



Sub-supplier's sustainability management in multi-tier supply chains: A systematic literature review on the contingency variables, and a conceptual framework

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ABSTRACT

Sub-suppliers may violate sustainability standards for a variety of motivations, and focal firms' neglecting of sub-suppliers' sustainability violation despite stakeholder pressures to establish sustainability compliance at sub-supplier level can bring several tangible and intangible risks to focal firms. Focal firms apply sub-supplier's sustainability management (SSM) approaches to extend sustainability to sub-suppliers. As sustainable supply chain management is fundamentally context-dependent, a set of contingency variables are expected to impact the effectiveness of the SSM approaches. Through an up-to-date, comprehensive review of the literature on multi-tier, sustainable supply chain management (MT-SSCM), 37 contingency variables influencing the effectiveness of the SSM approaches in multi-tier supply chain are identified. These variables are then clustered in two stages based on their similarity in terms of their common themes/points for more efficient analysis. Propositions are formulated to explain the way variation in the contingency variables impacts the effectiveness of each SSM approach, when each SSM approach is an effective approach with regard to the contingency variables, the sub-supplier's motivations in not complying with sustainability requirements and the risks of ignoring sub-supplier's noncompliance with sustainability requirements for focal firm. A conceptual framework is built according to the results and findings of the study. Detailed practical implications are also presented to provide managerial insights for supply chain managers. Finally, possible future research directions, that are linked to identified research gaps, are discussed.

1. Introduction

Instead of studying the dyadic buyer-supplier and supplier-supplier relationships in the context of supply chain management, multi-tier supply chain management is interested in studying the interrelationships between supply chain partners in a triadic relationship such as buyer-supplier-supplier's supplier to truly reflect the dynamics of the relationships within supply chains (Choi and Wu, 2009; Mena et al., 2013).

Both academia and business are paying considerable attention to sustainable supply chain management (Seuring and Müller, 2008b;

Wilhelm et al., 2016a; Fattahi et al., 2021). However, the past research on sustainable supply chain management has mostly studied the management of sustainability at direct supplier level, and the research dedicated to managing the sustainability of sub-suppliers in multi-tier supply chains has been emerging in recent few years (Grimm et al., 2014; Gong et al., 2018a; Tachizawa and Wong, 2014; Wilhelm et al., 2016a; Kannan, 2021). Sub-suppliers are defined as suppliers' suppliers or tier "n" suppliers, upstream in the supply chain with whom the focal firm has no contractual relationship (Grimm et al., 2018; Sharma et al., 2022).

Opposed to the firms closer to the end customer that tend to have

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better sustainability performance (Ghadge et al., 2019), many suppliers at lower tiers do not actively address their social and environmental issues for different motivations (Nath et al., 2020; Soundararajan and Brammer, 2018), and can become the riskiest suppliers in a supply chain (Villena and Gioia, 2018). Lower-tier suppliers' noncompliance with sustainability standards carries the risk of negative reputation for buying firms and consumers' boycotting of these firms' products, and they can be held responsible for the sustainability nonadherence that occurs in their supply chains (Hofmann et al., 2014; Wilhelm et al., 2016a; Reuter et al., 2010). For example, Ferrero, as a confectionery giant, was seriously criticised by the media because of sub-supplier's sustainability noncompliance. The sub-contractors (suppliers) of a first-tier supplier paid very low wages to the workers, sometimes aged six, that made toys which were used in Ferrero's products, and the working environment lacked very basic hygiene (Parker, 2016).

Different sub-supplier's sustainability management (SSM) approaches, such as "direct", "indirect", "work with third parties" and "don't bother" (Tachizawa and Wong, 2014), have been proposed in the literature to extend sustainability to sub-suppliers in multi-tier supply chain. Since sustainable supply chain management is essentially a context-driven practice, specific contingency variables/factors can be determinant of the effectiveness of the SSM approaches (Wilhelm et al., 2016a; Tachizawa and Wong, 2014). For instance, *the power asymmetry between focal firm and direct supplier in favour of focal firm* which arises from *the buyer-power of focal firm over direct supplier* and *focal firm size* gives an advantage to the focal firm to request the direct supplier to become involved in SSM plans (i.e. the focal firm applies the indirect approach); or *focal firm's knowledge capability for the sustainability management of sub-supplier* which is composed of *the sustainability knowledge of focal firm* and *the supply knowhow of focal firm* would enable the focal firm to directly design and implement the initiatives for establishing sustainability compliance at sub-supplier level (i.e. the direct approach is applied by the focal firm).

The existing literature lacks an up-to-date, comprehensive literature review study regarding the motivations for sub-supplier's violation of focal firm's sustainability requirements, the risks of neglecting sub-supplier's noncompliance with sustainability requirements for a focal firm, the contingency variables that influence the effectiveness of SSM approaches in multi-tier supply chain, the way variation in these contingency variables impacts the degree of effectiveness of each SSM approach and when each SSM approach is an effective approach with regard to the contingency variables.

In response to these research gaps, this study carries out a systematic literature review, which identifies the contingency variables that have an impact on the effectiveness of SSM approaches in multi-tier supply chain. Regarding the relatively large number of the identified contingency variables, for more efficient analysis of the influence of these variables on the effectiveness of the relevant SSM approaches, they are clustered in two stages based on their similar aspects. Then, how variation in these contingency variables impacts the effectiveness of each SSM approach, when each SSM approach should be applied with regard to the contingency variables, the possible motivations for sub-supplier's noncompliance with sustainability standards and what kind of risks a focal firm would face as a result of ignoring sub-supplier's sustainability noncompliance are determined by synthesising the information extracted from the literature. Finally, a conceptual framework is made, which integrates the results and findings of the literature review study. Detailed practical implications are also provided, which presents managerial insights for practitioners.

We thus pose the research questions as follows:

RQ1. What are the motivations for sub-supplier's sustainability noncompliance?

RQ2. What are the risks of neglecting sub-supplier's sustainability noncompliance for focal firm?

RQ3. What are the contingency variables that influence the effectiveness of each SSM approach?

RQ4. How does variation in the contingency variables influence the effectiveness of each SSM approach?

RQ5. When is each SSM approach an effective approach with regard to the contingency variables?

The organisation of the remainder of the paper is as follows. In Section 2, the literature on multi-tier, sustainable supply chain management (MT-SSCM) is reviewed to find research gaps. The theoretical foundation of this research is presented in Section 3. Section 4 respectively presents the systematic literature review method and the descriptive analysis of the publications selected for review. In Section 5, the sub-suppliers' motivations for sustainability noncompliance and the risks of neglecting this sustainability noncompliance for a focal firm are discussed. In Section 6, the contingency variables are presented, and how their variation influences the effectiveness of each SSM approach and when to use each SSM approach with regard to the contingency variables are discussed. The developed conceptual framework and the practical implications are also presented in Section 6. In Section 7, conclusions are drawn and directions for future research are provided.

2. Background

2.1. MT-SSCM: the relevant literature

In general, the literature on MT-SSCM can be divided into two broad categories: (i) quantitative, model-based research in the area of MT-SSCM which applies management science techniques such as mathematical programming, simulation and multi-criteria decision-making (MCDM) methods, and (ii) the research on MT-SSCM that applies various research methods other than quantitative, model-based research method, such as case study, survey, hypothesis testing, Delphi method and literature review.

Five subcategories from the latter category, the literature on (i) the motivations for sub-supplier's sustainability noncompliance, (ii) the risks of neglecting sub-supplier's sustainability noncompliance for focal firm, (iii) the contingency variables/factors influencing the effectiveness of SSM approaches, (iv) the drivers and barriers in extending sustainability to multi-tier suppliers, and (v) traceability of sustainability in multi-tier supply chains, are reviewed generally in this subsection as the relevant body of the research to present study. The first three subcategories are the main focus of this research, and the last two subcategories are relevant to the contingency (contextual) variables impacting the effectiveness of SSM approaches and the motivations for sub-supplier's sustainability noncompliance respectively.

A relatively new research strand in the area of MT-SSCM has investigated the motivations of suppliers at lower tiers for not complying with the sustainability requirements set by focal firm. These research studies have also investigated how sub-suppliers implement their sustainability noncompliance plans (Nath et al., 2020; Nath and Eweje, 2021; Soundararajan and Brammer, 2018).

Risks of sub-supplier's sustainability noncompliance for focal firm have been explored by a group of research works on MT-SSCM. This group of research works identify different types of stakeholder reactions to sustainability violations upstream supply chain aimed at focal firm if the focal firm takes no or little action to establish sustainability compliance upstream supply chain (Hofmann et al., 2014; Foerstl et al., 2010; Seuring and Müller, 2008b; Nath and Eweje, 2021; Meixell and Luoma, 2015).

A large portion of the research on MT-SSCM studies the contingency (contextual) variables that have an impact on the effectiveness of SSM approaches. As MT-SSCM practices are not implemented in vacuum, this category of the literature seeks to identify the context (environment)-related variables affecting the success of SSM plans and determine how variation in these variables' states impacts the degree of effectiveness of

SSM plans (Wilhelm et al., 2016a, 2016b; Grimm et al., 2014, 2016; Meinschmidt et al., 2018; Dou et al., 2018; Tachizawa and Wong, 2014; Gong et al., 2018a; Villena and Gioia, 2018, 2020).

Drivers (enablers, antecedents) and barriers (challenges, tensions, bottlenecks) related to implementing sustainability along multiple tiers of suppliers have also been explored by the literature on MT-SSCM. This body of research on MT-SSCM has studied drivers and barriers in extending sustainability to upstream members of the supply chain (i) with regard to social sustainability (Venkatesh et al., 2020a; Govindan et al., 2021; Mathiyazhagan et al., 2021; Khan et al., 2021a), environmental sustainability (Jæger et al., 2021; Agyemang et al., 2018) and the triple bottom line (Kannan, 2021; Chand and Tarei, 2021; Feng et al., 2021), and (ii) in emerging economy/developing country context (Venkatesh et al., 2020a; Mathiyazhagan et al., 2021; Khan et al., 2021a, 2021b; Jæger et al., 2021). A limited number of research studies have investigated the drivers/enablers and barriers of adopting Industry 4.0 technologies as facilitators of extending sustainability to lower-tier suppliers (Sharma et al., 2021; Yadav et al., 2021).

Tracing sustainability violations upstream supply chain, especially with regard to social sustainability which relatively demands more transparency, has been a relatively new stream of the research on MT-SSCM (Hastig and Sodhi, 2020; Venkatesh et al., 2020b; Fraser et al., 2020; Mejías et al., 2019). The more recent literature about the traceability of sustainability in multi-tier supply chain has also studied the application of Industry 4.0 technologies such as Blockchain, Internet of Things (IoT) and Big Data analytics to assist focal firms trace back the sustainability noncompliance at sub-supplier level (Hastig and Sodhi, 2020; Wang et al., 2022; Venkatesh et al., 2020b; Agrawal et al., 2021).

2.2. The literature reviews on MT-SSCM and research gaps

The existing literature reviews in the area of MT-SSCM are Wang et al. (2022); Dawande and Qi (2021); Govindan et al. (2021); Senyo and Osabutey (2021); Garcia-Torres et al. (2019); Jabbour et al. (2019); Sauer and Seuring (2018); Sodhi and Tang (2018); Tachizawa and Wong (2014); Seuring and Müller (2008b).

A Blockchain-based, system architecture for MT-SSCM in personal protective equipment industry was developed by Wang et al. (2022) through a comprehensive literature review, in order to identify and coordinate sustainability standards throughout the supply chain. The literature on supplier/sub-supplier auditing, and the inspection and/or testing of products for possible socially responsibility noncompliance is examined in Dawande and Qi (2021) to summarise the main insights. Through reviewing the relevant literature, Govindan et al. (2021) identified social sustainability-related drivers, barriers, issues, tensions, practices and performances in multi-tier supply chains. By linking these factors, a conceptual framework of social sustainability is proposed in their research. A systematic literature review approach from trans-disciplinary perspective was employed by Senyo and Osabutey (2021). They identified the main streams of the research in the area of MT-SSCM regarding the triple bottom line, developed a framework for multi-tier, sustainable supply chains and provided avenues for the future research.

Garcia-Torres et al. (2019) examined the literature at the intersection of traceability and sustainability in global, multi-tier apparel supply chains. The aim was to find out how companies implement traceability for sustainability in their global supply chains and how it can contribute to sustainable supply chain management. Jabbour et al. (2019) reviewed selected literature which has applied quantitative approaches for modelling multi-tier, sustainable supply chains, and identified research gaps, provided lessons for both managers and practitioners on how to deal with sustainability issues in multi-tier supply chains and developed an integrative framework which synthesises the identified research gaps and lessons learned.

To propose various arrays of the application of MT-SSCM, a conceptual framework is built in Sauer and Seuring (2018), which includes three dimensions: supply uncertainty, demand uncertainty and pressure

from the environment on sub-suppliers to adhere to sustainability standards. Sodhi and Tang (2018) performed a thematic analysis of the literature that investigates the efforts of large companies to incorporate social sustainability in their supply chain operations, and mapped out the identified research themes.

In Tachizawa and Wong (2014), four approaches for extending sustainability to sub-suppliers, i.e. direct, indirect, work with third parties and don't bother, and the contingency variables that affect these approaches are identified from the literature. A conceptual framework is built in their study, which incorporates these four approaches and the contingency variables. Seuring and Müller (2008b) conducted a systematic literature review and constructed a conceptual framework which included three parts: triggers (pressures and incentives) for considering sustainability issues in supply chain management, supplier management with regard to sustainability risks and performance, and managing supply chain for sustainable products.

The individual, non-literature review studies in MT-SSCM context, each identify various contingency variables influencing the effectiveness of SSM strategies together with the way variation in the states of these variables influences the degree of effectiveness of SSM strategies. This literature has also individually determined a number of motivations of lower-tier suppliers for not complying with sustainability standards and a set of risks related to focal firm ignoring sub-supplier's sustainability noncompliance. A need for a comprehensive, systematic literature review study is sensed in order to provide a holistic picture in this regard by bringing together and integrating the findings from the literature review and therefore making inferences drawn on the basis of multiple research studies.

The most recent and the only published literature review on MT-SSCM which has discussed the contingency variables that influence the effectiveness of SSM approaches was conducted by Tachizawa and Wong (2014). They identified 7 contingency variables that could influence focal companies' approaches for managing lower-tier supplier's sustainability: *stakeholder pressure, power, material criticality, dependency, distance, industry, and knowledge resources*.

However, we have identified the following research gaps in the literature review studies on MT-SSCM, including Tachizawa and Wong (2014):

First, as it is presented later in Subsection 4.2, the descriptive analysis of the reviewed literature, 57 out of the 83 (68.67%) papers selected for review in present study have been published from 2014 onwards, which indicates that the amount of research in the area of MT-SSCM has been growing fast. These recently published research papers have presented a new set of contingency variables together with new insights on their impact on the effectiveness of SSM approaches in multi-tier supply chain, which demands an up-to-date systematic literature review study to identify these new contingency variables and determine their influence on the success of SSM plans.

Second, Tachizawa and Wong (2014) incline to discuss the identified contingency variables as a whole and do not break them into their constituent variables to unravel their influence on the effectiveness of the SSM approaches. For example, the contingency variable *power* can be broken into the related contingency variables such as *the buyer-power of direct supplier over sub-supplier, the buyer-power of focal firm over direct supplier, focal firm size and power asymmetry between direct supplier and sub-supplier in favour of direct supplier* for thorough analysis of the role of this contingency variable in the effectiveness of SSM strategies.

Third, the contingency variables identified in Tachizawa and Wong (2014) are analysed mostly at focal firm level, while these variables could be relevant at direct supplier and sub-supplier levels as well.

Fourth, the existing literature reviews in the area of MT-SSCM lack a systematic investigation of the motivations behind lower-tier suppliers' sustainability noncompliance.

Fifth, identifying the risks related to neglecting sub-supplier's sustainability noncompliance for focal firm in a systematic way is absent in the existing literature reviews on MT-SSCM.

3. Theoretical foundation

As the main body of this research studies the contingency variables influencing the effectiveness of SSM strategies in multi-tier supply chain, contingency theory and MT-SSCM perspective are considered as its theoretical underpinning. The contingency theory provides a basis for the justification of the need for studying the contextual (contingency) variables that influence the effectiveness of SSM approaches in multi-tier supply chain. MT-SSCM perspective relates to the multi-tier nature of the supply chains in which SSM approaches are applied.

3.1. Contingency theory

Contingency theory states that organisations should adapt their structure and strategies to internal and external environment (context) in order to survive or improve their performance. According to contingency theory, there is no single best organisational structure and management style, and contextual factors determine the appropriate organisational structure and management style (Lawrence and Lorsch, 1967; Drazin and Van De Ven, 1985; Tosi and Slocum, 1984; Donaldson, 2001). Building upon contingency theory, sustainable supply chain management and implementation are context-specific issues, and it is difficult to achieve a generalised best set of practices which is suitable for all sustainable supply chain management situations. Hence, utilising a contingency approach would be useful for the understanding and management of sustainable supply chains (Silvestre, 2015; Yu et al., 2020).

Contingency theory has been applied to different sustainable supply chain management practices, including climate change and low-carbon operations management (Alves et al., 2017), green human resource management and environmental cooperation (Yu et al., 2020), environmental management accounting (Christ and Burritt, 2013), green supply chain management and the circular economy (Liu et al., 2018a) and supply chain social sustainability in a global setting (Golicic et al., 2020). The central point in the research works that have studied sustainable supply chain management from contingency theory perspective is that a set of contingency (contextual) factors/variables play significant roles in determining the appropriate strategies and tactics (Silvestre, 2015; Christ and Burritt, 2013; Yu et al., 2020; Alves et al., 2017).

More specifically, in the context of MT-SSCM as well, a specific set of contingency (contextual) variables/factors can determine the degree of effectiveness of the SSM approaches. Considering the inherent complexity of multi-tier supply chains, identifying these contingency variables/factors and analysing the way these variables influence the effectiveness of each SSM approach can help the focal firms to employ the most effective SSM approach to extend sustainability to sub-suppliers with regard to the context in which they operate instead of applying a general SSM strategy in all situations (Wilhelm et al., 2016a; Tachizawa and Wong, 2014).

3.2. MT-SSCM perspective

MT-SSCM is not only concerned with sustainability compliance at direct supplier level. As many lower-tier suppliers are less known to the public and are less visible, they frequently commit unsustainable actions, which can lead to negative outcomes for focal firms. Therefore, focal firms are required to find ways to extend sustainability to their lower-tier suppliers (Wilhelm et al., 2016a; Meinschmidt et al., 2018; Gong et al., 2018a).

In the literature on MT-SSCM, several SSM approaches/mechanisms have been proposed to ensure the lower-tier suppliers incorporate sustainability into their operations, including “open triad”, “closed triad” and “transitional triad” (Mena et al., 2013); “direct”, “indirect”, “work with third parties” and “don’t bother” (Tachizawa and Wong, 2014); “direct-holistic”, “direct: product-specific”, “direct: region-specific”, “direct: event-specific”, “indirect: multiplier-based”, “indirect:

alliance-based”, “indirect: compliance-based” and “neglect: tier-1-based” (Meinschmidt et al., 2018); “hierarchical”, “compliance”, “support services”, “partnership” and “promotion of voluntary change” (Alexander, 2020). The brief description of these SSM approaches is presented in Table 1.

From Table 1, it can be stated that the open triad and closed triad mechanisms proposed by Mena et al. (2013) are respectively equivalent to the indirect and direct approaches in Tachizawa and Wong (2014). As it is stated in Table 1, the transitional triad in Mena et al. (2013) is a middle structure and it is expected to make a transition towards the closed triad. Different types of the direct and indirect SSM approaches suggested by Meinschmidt et al. (2018), e.g. direct-holistic, direct: product-specific and indirect: multiplier-based, are the elaborated versions of the direct and indirect approaches proposed by Tachizawa and Wong (2014), except that the indirect: alliance-based approach is essentially similar to the work with third parties plan. The neglect: tier-1-based approach in Meinschmidt et al. (2018) is equivalent to the don’t bother approach in Tachizawa and Wong (2014). The SSM approaches proposed in Alexander (2020) can be considered as different practical forms of the direct, indirect and work with third parties approaches in Tachizawa and Wong (2014), depending on whether the focal firm is directly involved in extending sustainability to lower-tier suppliers or carries out this task with the help of direct suppliers and other partners (as third parties).

In addition, from the reviewed literature, we observed that the four SSM approaches proposed by Tachizawa and Wong (2014) have been applied extensively in the literature, possibly because they proposed these SSM approaches based on a literature review study.

Therefore, we have considered the SSM approaches proposed by Tachizawa and Wong (2014) in current systematic literature review to better reflect the literature on MT-SSCM.

4. Research method and descriptive analysis

4.1. Research method

We follow the steps proposed by Denyer and Tranfield (2009) for the systematic literature review as a well-established procedure in the literature for systematic literature review study.

In the first step, the research questions were formulated, as was presented in Introduction section.

In the second step, the relevant studies were found through searching keywords in academic research databases. For this purpose, possible combinations of the keywords, which are presented in Fig. 1, were searched for in Scopus and Web of Science (WoS) research databases.

In the third step, the study selection and evaluation was performed. Only English-language, journal papers from 1990 to May 2022 were considered. The initial search resulted in 6844 and 6129 papers at Scopus and WoS respectively. The search results were filtered by reviewing the title, abstract, keywords and if necessary the full-text according to the inclusion and exclusion criteria which have been presented in Fig. 1. The snowball approach (reviewing the references section of the remaining publications) was also used to find more relevant studies to the current research. 83 papers were finally selected for review. Supplementary Table 1 in Appendix A provides more details about the selected papers for review. The screening process of the search results is summarised in Fig. 1.

In the fourth step, the analysis and synthesis of the reviewed literature was conducted. Two authors separately reviewed the selected literature and identified a group of contingency variables that could influence the effectiveness of each SSM approach, which summed up to over 50 contingency variables. As there were overlaps between these contingency variables, they were screened by the authors to minimise the overlaps so that each contingency variable would be regarded as a distinct variable. After a closer evaluation of the remaining contingency variables, we found out that a number of these variables are essentially

Table 1
The brief description of SSM approaches in multi-tier supply chain.

| | The SSM approach/mechanism | Description |
|---------------------------|----------------------------|--|
| Mena et al. (2013) | Open triad | Open triad structure is representative of a conventional supply chain with straight physical (material/product) and information flows, where direct link between focal company and sub-supplier is absent. This requires direct supplier to play a mediating role. |
| | Closed triad | Unlike the open triad, in closed triad, there is a formal, direct connection between focal firm and sub-supplier. Regular contact, information sharing and formal or informal, mutual relationship exist between both firms. |
| | Transitional triad | This structure lies between open and closed triads. Under this structure, focal firm and sub-supplier initiate building a link to reach out to each other, and manage a transition towards a closed triad. |
| Tachizawa and Wong (2014) | Direct | In direct approach, focal firms have a direct access to sub-suppliers and can manage their mutual relationship with sub-suppliers in formal and informal ways. They can disintermediate direct suppliers and directly communicate with sub-suppliers to monitor their sustainability compliance, train them to comply with sustainability requirements and provide assistance to them to improve their social and environmental performance. |
| | Indirect | The indirect approach is characterised by the indirect evaluation, selection and development of sub-suppliers by direct suppliers with regard to sustainability standards. For example, focal companies may utilise their power over direct suppliers to persuade them to monitor the sub-suppliers' sustainability compliance or collaborate with them to improve their sustainability performance. |
| | Work with third parties | According to the work with third parties strategy, the focal firms' responsibilities of elaborating sustainability standards for sub-suppliers, implementing industry's voluntary sustainability standards at sub-supplier level and monitoring sub-suppliers' sustainability compliance are delegated to other organisations such as government, non-governmental organisations (NGOs), competitors, industry alliances and standards institutes. |
| | Don't bother | When don't bother approach is applied, focal firm does not engage in SSM practices and focuses on direct suppliers since it lacks information about sub-suppliers and has no intention of extending sustainability to sub-suppliers. |
| Meinschmidt et al. (2018) | Direct-holistic | The main characteristic of this approach is the regular management of the lower-tier suppliers by focal firm which requires the highest resource allocation. Focal firms that employ this proactive sustainability strategy, assess the costs and benefits of implementing the sustainability initiatives to their direct suppliers and sub-suppliers up to tier <i>n</i> in order to allocate the required resources. |

Table 1 (continued)

| | The SSM approach/mechanism | Description |
|------------------|-------------------------------|--|
| Alexander (2020) | Direct: product-specific | Focal firms normally monitor their first-tier suppliers, but they evaluate and develop certain lower-tier suppliers for critical products made up of ingredients that are suspected to have been produced under environmentally harmful conditions. |
| | Direct: region-specific | This approach is applied by focal firms to selected sub-suppliers that are based in regions where unsustainable social and environmental practices are expected. |
| | Direct: event-specific | The event-specific strategy is essentially a reactive approach. Focal firms react to specific critical and urgent, sustainability-related events, such as social or environmental misconduct, upstream in their supply chain by utilising their own resources to resolve the issue. |
| | Indirect: multiplier-based | Focal firms apply their sustainability standards to assess, train and promote direct suppliers, and in turn, direct suppliers are expected to proactively manage their suppliers with the same sustainability standards. |
| | Indirect: alliance-based | Under this approach, focal firms join the sustainability-driven alliances and industry associations/consortia, so that these alliances can perform sub-supplier sustainability audits, award sub-supplier sustainability certification and share information regarding lower-tier supplier sustainability assessment with their members. |
| | Indirect: compliance-based | Direct suppliers are required to apply the sustainability standards of focal firm to sub-suppliers, according to the focal firm's supplier codes of conduct. |
| | Neglect: tier-1-based | Focal firms only manage sustainability compliance at direct supplier level, and do not engage in plans for evaluating, training and selecting sub-suppliers with regard to sustainability requirements. |
| | Hierarchical | Focal firms vertically integrate several tiers of suppliers to ensure complete control over lower-tier suppliers. |
| | Compliance | Focal firms set sustainability standards and monitors the lower-tier suppliers through incentives or sanctions to ensure their compliance. |
| | Support services | Through this mechanism, focal firms encourage direct suppliers and sub-suppliers to employ more sustainable operational processes by providing assistance such as sustainability training programmes for managers and workers and financial support for upgrading the equipment and facilities. |
| Partnership | Partnership | This approach is also collaborative, in which focal firms cooperate with first-tier suppliers and sub-suppliers to collaboratively tackle sustainability challenges upstream in their supply chain by taking into account the priorities of each other and finding shared values. |
| | Promotion of voluntary change | Focal firms promote new or modified sustainable operational practices to suppliers at any tier in different ways, including direct interaction with suppliers, promotion of new practices by partners or launching public |

(continued on next page)

Table 1 (continued)

| The SSM approach/mechanism | Description |
|----------------------------|--|
| | campaigns. Multi-tier suppliers can choose to incorporate these practices into their operations. |

the drivers and barriers of general sustainable supply chain management without implicit or explicit impact on the effectiveness of SSM approaches. These variables were removed from further consideration. Similar procedure was followed by the authors in identifying different motivations behind lower-tier suppliers' sustainability noncompliance and the risks that neglecting this sustainability noncompliance carries for focal firm from the reviewed literature and screening the set of identified motivations and risks to minimise the overlaps.

Then, different pieces of information derived from the literature were put together to figure out how variation in the contingency variables affects the usefulness/effectiveness of each SSM approach and when each SSM approach is an effective approach with regard to the contingency variables. The pieces of information drawn from the literature were also associated with each other to make a conceptual framework.

4.2. The descriptive analysis of the reviewed literature

The descriptive analysis of the selected papers for review is presented in Fig. 2a–b and Supplementary Table 1 in Appendix A.

57 out of the 83 (68.67%) selected papers for review are from 2014 onwards which is indicator of the relatively fast growing amount of research in the area under study. As can be seen from the trend line in Fig. 2a, the number of the reviewed papers has been growing with the positive slope of 0.3089.

Case study (case study as the single research method or case study combined with literature review or multiple-criteria decision-making

(MCDM) techniques), literature review (literature review as the single research method or literature review combined with case study or survey) and hypothesis testing are the three most frequently used research methodologies by the reviewed literature.

5. Sustainability noncompliance at sub-supplier level: the motivations and risks

5.1. The motivations for sub-supplier's sustainability noncompliance

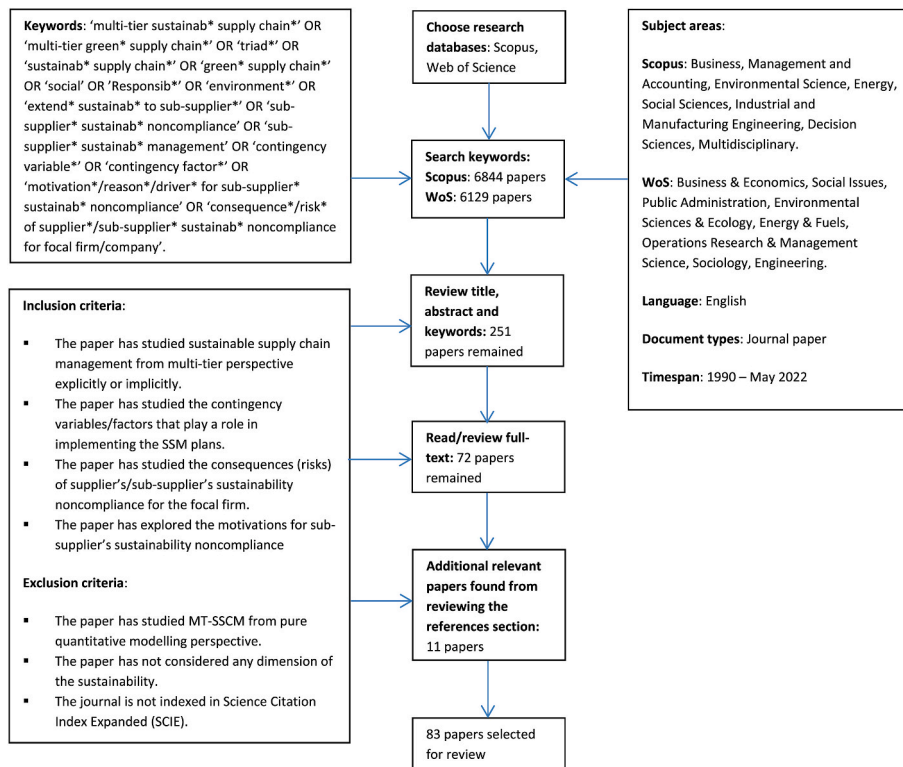
Sub-suppliers may decide to commit unsustainable actions for a variety of reasons.

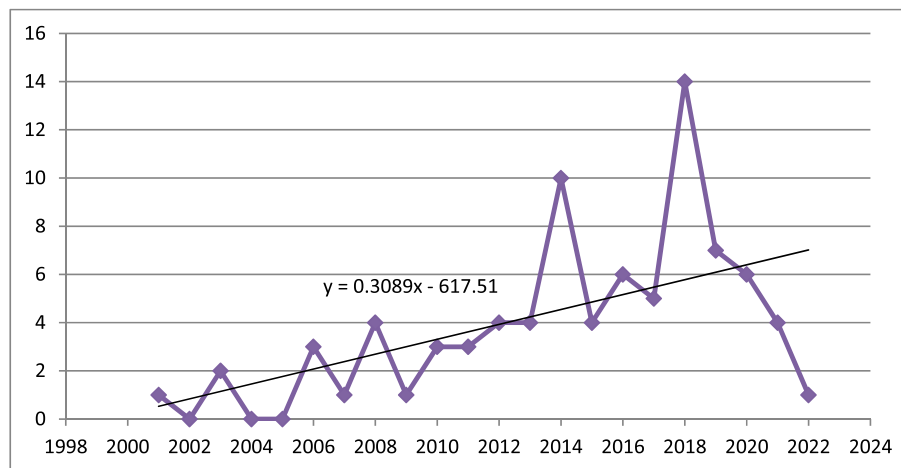
As suppliers upstream supply chain (beyond first-tier suppliers) are generally less visible and less known to the public, they can frequently violate sustainability standards without being noticed (Wilhelm et al., 2016b; Meinschmidt et al., 2018; Gong et al., 2018a).

Sometimes sub-suppliers are willing to follow the sustainability requirements set by focal firm but they lack the capability/expertise to do so (Dou et al., 2018; Grimm et al., 2014). Also, sub-suppliers may perceive no direct or indirect benefits, e.g. increased purchase volume or price premiums, in return to their normally costly compliance with sustainability standards (Grimm et al., 2014; Villena, 2019).

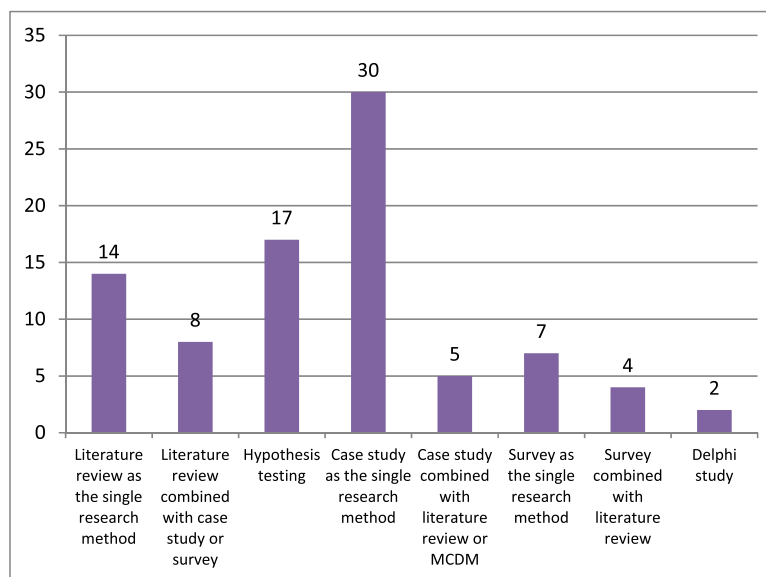
The simultaneous existence of conflicting institutional logics could lead to decoupling responses from sub-suppliers to institutional pressures related to sustainable supply management practices. Conflict in institutional logics that permits sub-suppliers' decoupling of the implementation of sustainability practices in supply chains includes the following (Nath et al., 2020; Nath and Eweje, 2021):

- social and economic logics are in conflict (such as high implementation costs for workplace safety regulations and the financial burden of paying the minimum wage);
- environmental and economic logics are in conflict (such as expensiveness of implementing the environmental improvement plans and





a: The number of the reviewed papers per year



b: The frequency of the most widely used research methodologies by the reviewed literature

Fig. 2. (a) The number of the reviewed papers per year.
(b) The frequency of the most widely used research methodologies by the reviewed literature.

uncertainty about return on investment for environment improvement initiatives);

- there are gaps in factory management’s normative logic (such as the factory management and workers’ lack of awareness and knowledge, and the factory management’s/owners’ lack of commitment); and
- there is a complexity of the legitimacy logic of various institutional actors (such as lack of government support and enforcement of law, and inconsistency in buyers’ sustainability requirements).

When intermediaries (sourcing agents for focal firms) frame social sustainability requirements as opportunities (e.g. as a way for gaining more resources, increasing productivity and improving worker skills) and participate in various procedures that sub-suppliers perceive as procedurally fair, such as supportive procedures that enable sub-suppliers in meeting their sustainability requirements, sub-suppliers tend to reciprocate positively, e.g. by lowering the number of contract employees and raising the wages. Conversely, when the social sustainability requirements are framed as insulation by intermediaries, i.e. it is framed as a mechanism for averting risks, and they participate in various

procedures that sub-suppliers perceive as procedurally unfair, such as adopting a hostile approach and engaging in minimum dialogue and knowledge sharing, sub-suppliers reciprocate negatively. The negative reciprocity from sub-suppliers is expressed in the form of hostility, distrust and deception (Soundararajan and Brammer, 2018).

To summarise the motives for sub-suppliers’ unsustainable actions, the following proposition is made:

P1. *There are different motivations behind sub-supplier’s sustainability noncompliance, such as lack of visibility at lower tiers, sub-supplier is less known to the public, sub-supplier’s lack of sustainability-related capabilities, sub-supplier perceives no benefit for sustainability compliance, the simultaneous existence of conflicting institutional logics and intermediaries’ framing of social sustainability requirements as insulation and their engagement in procedures perceived to be procedurally unfair by sub-suppliers.*

5.2. The risks of neglecting sub-supplier’s sustainability noncompliance

Suppliers especially at lower tiers frequently violate social norms and environmental regulations, which carries several negative consequences

for focal firms (Govindan et al., 2021; Seuring and Müller, 2008b; Wilhelm et al., 2016a). Sub-suppliers may employ two strategies to decouple sustainable supply management practices: (i) consensual strategy to lower the sustainability criteria, and (ii) concealment strategy to hide their involvement in illegal and unethical practices from institutional actors (Nath et al., 2020).

Examples of unsustainable actions by sub-suppliers in the literature are tainting milk for infant formula with melamine as a toxic industrial chemical, farm's animal health risks because of poor animal husbandry (Gong et al., 2018a, 2018b), use of pesticides, excessive water consumption, child labour, and low wages for farm labour (Gong et al., 2018b, 2019; Wilhelm et al., 2016a).

Unsustainable actions from suppliers/sub-suppliers can have serious social and environmental consequences. For example, in 2013, the collapse of illegally-constructed garment factories within the Rana Plaza building in Dhaka, Bangladesh, killed 1134 people and injured at least 2500 (Jeppesen, 2013); or according to United Nations Environment Programme (2004), each year, 70 million tons of mine tailings and waste rock are discharged from Ok Tedi Mine in Papua New Guinea in an uncontrolled way, which has spread along over a 1000 km distance through the Ok Tedi and Fly rivers. This has raised river beds due to sediment deposition, and has caused flooding, forest damage and a significant decrease in the region's biodiversity including fish counts.

Suppliers'/sub-suppliers' sustainability noncompliance leads to different types of stakeholder reactions (Hofmann et al., 2014). Stakeholder pressure, internal and external, positively influences the firms' sustainability awareness, adoption and implementation in their supply chains (Meixell and Luoma, 2015; Tachizawa et al., 2015; Grimm et al., 2022; Roy et al., 2020; Sauer and Seuring, 2019). External stakeholders include government, NGOs, customers, media, local communities, financiers, consumer advocate groups, human rights organisations, environmental protection agencies and competitors (Freeman et al., 2010; Sodhi and Tang, 2018; Grosvold et al., 2014; Nath and Eweje, 2021; Jakhar, 2017). Major internal stakeholders mentioned in the literature are employees (including top and midlevel managers) and shareholders (Grosvold et al., 2014; Ehrigott et al., 2011; Foerstl et al., 2010; Ayuso et al., 2014).

Stakeholders can influence the focal firm through "coercive", "normative" and "mimetic" pressures, as drivers of isomorphic change, to adopt sustainable supply chain management policies in the following ways:

Coercive pressures: government and other regulatory bodies legislation on environmental and social sustainability (Zhu and Sarkis, 2006; Mont and Leire, 2009; Carter and Dresner, 2001; Varsei et al., 2014), investors may define specific environmental and social requirements for their investment (Hofmann et al., 2014; Mont and Leire, 2009; Trowbridge, 2006), consumers take part in boycott campaigns of the firm's products (Hofmann et al., 2014; Mont and Leire, 2009; Busse et al., 2017; Glover et al., 2014), social movements organised by environment and human rights groups, such as NGOs, against the firm (Mont and Leire, 2009; Meixell and Luoma, 2015), local communities may protest, invade or sabotage the firm's facilities (Hofmann et al., 2014; Meixell and Luoma, 2015).

Mimetic pressures: mimicking the strategies and practices of the successful competitors and peers in sustainable supply chain management (Sayed et al., 2017; Zhu and Geng, 2013; Chu et al., 2017; Glover et al., 2014).

Normative pressures: norms and code of conducts developed by industry associations and fair trade organisations, focal company's set of values, traditions and business practices, educational bodies that train employees, auditors and retailers on sustainability, and the influence coming from the public opinion shaped by media (Kauppi and Hannibal, 2017; Hofmann et al., 2014; Mont and Leire, 2009; Glover et al., 2014; Grimm et al., 2022).

Focal firm's failure to meet the stakeholders' expectation to establish sustainability compliance at sub-supplier sites carries significant risks,

including (Hofmann et al., 2014; Nath and Eweje, 2021; Foerstl et al., 2010; Meixell and Luoma, 2015; Sajjad et al., 2015; Kumar and Rahman, 2016; Seuring and Müller, 2008b):

- sales (revenue) decline;
- negative media exposure;
- damaged corporate reputation;
- the loss of customer credibility;
- fines related to legal action against the focal firm; and
- increase in total costs because of the extra costs incurred to establish supplier sustainability compliance compared with the situation that the focal firm pro-actively addresses this issue.

Thus, the following proposition is formulated:

P2. *Sub-supplier's sustainability noncompliance leads to stakeholder reaction, which comes into practice through coercive, mimetic and normative pressures, and focal firm's failure to accommodate stakeholder expectations could result in sub-supplier's sustainability noncompliance risks for focal firm.*

6. Contingency variables and their influence on the effectiveness of SSM approaches

6.1. Clustering the contingency variables

In applying the four different approaches to manage sustainability in sub-suppliers' activities in multi-tier supply chain and determining the effectiveness of these approaches, specific contingency variables can play a critical role.

The 37 contingency variables which were identified from the reviewed literature on MT-SSCM are presented in Table 2.

Due to the rather large number of the contingency variables, for a more efficient analysis, they are then clustered in two stages, called first-order and second-order constructs, according to their similarity in terms of common themes/points among each group of the contingency variables. For example, the *sustainability knowledge of focal firm* and the *supply knowhow of focal firm*, as primary contingency variables, have similarities as (i) they both indicate the focal firm's knowledge of supply chain-related issues, (ii) they are interconnected because the focal firm's robust understanding of its supply base including its upstream supply chain members and their characteristics, fundamental processes and procured products can help the focal firm more easily develop the knowledge on how to make its supply base sustainable, and (iii) increase in these two contingency variables would make the focal firm more knowledge-capable to get directly involved in plans for extending sustainability to sub-suppliers. Thus, these two primary contingency variables are clustered under the first-order construct "Focal firm's knowledge capability for the sustainability management of sub-supplier". The first-order constructs "Focal firm's knowledge capability for the sustainability management of sub-supplier" and "Focal firm's facilitated monitoring of sustainability compliance at sub-supplier level" would enable the focal firm to become directly involved in initiatives for the management of sustainability at sub-supplier level, and therefore they are clustered under the second-order construct "The enablers of direct engagement of focal firm in SSM initiatives". Table 2 shows the two-stage clustering of the primary contingency variables together with the common themes/points among each group of contingency variables.

Fig. 3 maps the way variation in the primary contingency variables impacts the first-order constructs and the way variation in the first-order constructs impacts the second-order constructs.

Signs \rightarrow^+ and \rightarrow^- in Fig. 3 respectively indicate the positive and negative relationship between the cause and effect. For example, when the contingency variable "Information asymmetry between focal firm and sub-supplier" decreases, its corresponding clustered contingency variable "Ease of persuading direct supplier to participate in the

Table 2
The contingency variables and their two-stage clustering.

| The relevant SSM approach | The primary contingency variables | Related references | The first-order constructs | Common themes/points among each group of the contingency variables | The second-order constructs | Common themes/points among each group of the contingency variables |
|---------------------------|--|---|---|--|--|---|
| The direct approach | A-I. The sustainability knowledge of focal firm | Villena and Gioia (2018); Tachizawa and Wong (2014); Wilhelm et al. (2016a); Wilhelm et al. (2016b) | I. Focal firm's knowledge capability for the sustainability management of sub-supplier (cluster of A-I and A-II) | These contingency variables are indicator of the knowledge-related capability of the focal firm to directly extend sustainability to sub-suppliers. | The enablers of direct engagement of focal firm in SSM initiatives (cluster of I and II) | These contingency variables describe the factors that enable a focal firm to become directly involved in management of sustainability at sub-supplier level. |
| | A-II. The supply knowhow of focal firm | Grimm et al. (2014); Dou et al. (2018); Hall (2000); Reuter et al. (2010) | | | | |
| | B-I. Direct supplier's willingness to reveal sub-suppliers' sustainability violation to focal firm | Grimm et al. (2014); Dou et al. (2018); Vachon and Klassen (2006) | II. Focal firm's facilitated monitoring of sustainability compliance at sub-supplier level by direct supplier (cluster of B-I, B-II, B-III, B-IV and B-V) | The contingency variables under this category describe how direct suppliers can facilitate focal firm's direct involvement in monitoring sub-suppliers' sustainability compliance. | | |
| | B-II. The perceived risk by direct supplier that it could be bypassed by focal firm | Grimm et al.(2014); Dou et al. (2018); Choi and Linton (2011) | | | | |
| | B-III. Direct supplier's involvement in the sustainability management of sub-supplier | Grimm et al. (2014); Grimm (2013) | | | | |
| | B-IV. Trustful relationship between direct supplier and focal firm | Grimm et al. (2014); Dou et al. (2018); Sjoerdsma and Weele (2015); Grimm (2013) | | | | |
| | B-V. The buyer-power of direct supplier over sub-supplier | Grimm et al. (2014); Dou et al. (2018); Grimm (2013) | | | | |
| | C-I. The criticality of the material sourced from sub-supplier to focal firm | Sauer and Seuring (2018); Yawar and Kauppi (2018); Tachizawa and Wong (2014); Mena et al. (2013) | III. The difficulty of switching the sub-supplier due to the criticality and specificity of the sourced material (cluster of C-I and C-II) | According to these two contingency variables, the criticality and specificity of the material sourced from sub-supplier to focal firm would mean the difficulty of switching the sub-supplier when required. | Focal firm's perceived necessity to take direct action for the management of sub-supplier's sustainability (cluster of III and IV) | Focal firm would regard it as highly necessary to directly engage in the sustainability management of sub-supplier if changing the sub-supplier is difficult and focal firm has perceived a high sustainability risk at sub-supplier level. |
| | C-II. The specificity of the material sourced from sub-supplier | Meinlschmidt et al. (2018); Sauer and Seuring (2018) | | | | |
| | D-I. Stakeholder salience | Meinlschmidt et al. (2018); Mitchell et al. (1997) | IV. Sustainability risk perceived by focal firm (cluster of D-I, D-II, D-III, D-IV, D-V and D-VI) | This group of contingency variables describe the situation that focal firm perceives a high level of sustainability violation risk at sub-supplier level and decides to take direct action to establish sustainability compliance. | | |
| | D-II. Product and industry salience | Meinlschmidt et al. (2018); Castka and Balzarova (2008); Simpson et al. (2012); Hajmohammad and Vachon (2016); Schneider and Wallenburg (2012); Hartmann and Moeller (2014) | | | | |
| | D-III. Past sustainability-related incidents in the supply chain of focal firm or competitors | Meinlschmidt et al. (2018); Hajmohammad and Vachon (2016); Grimm et al. (2016); Groetsch et al. (2013) | | | | |
| | D-IV. The complexity of learning sustainability knowledge for multi-tier suppliers | Gong et al. (2018a); Jia et al. (2019) | | | | |

(continued on next page)

Table 2 (continued)

| The relevant SSM approach | The primary contingency variables | Related references | The first-order constructs | Common themes/points among each group of the contingency variables | The second-order constructs | Common themes/points among each group of the contingency variables |
|---------------------------|--|--|--|---|---|---|
| | D-V. The social aspect of sustainability is to be monitored | Wilhelm et al. (2016a) | | | | |
| | D-VI. Public attention on direct supplier | Grimm et al. (2016); Lechler et al. (2020) | | | | |
| The relevant SSM approach | The primary contingency variables | Related references | The first-order constructs | Common themes/points among each group of the contingency variables | The second-order constructs | Common themes/points among each group of the contingency variables |
| The indirect approach | E-I. Information asymmetry between focal firm and sub-supplier | Wilhelm et al. (2016a); Wilhelm et al. (2016b) | V. Ease of persuading direct supplier to participate in the sustainability management of sub-supplier (cluster of E-I, E-II, E-III and E-IV) | The common point among this set of contingency variables is how easy it is to urge direct suppliers to take part in SSM activities according to the level of difficulty of this task and the benefits they receive in return. | The facilitators of delegating the SSM responsibility to direct supplier (cluster of V, VI, VII, VII, IX and X) | The focal point in common among these contingency variables is the facilitation of delegating the responsibility for the management of sub-supplier's sustainability to direct suppliers. |
| | E-II. Internal coordination between purchasing and sustainability functions at focal firm's organisation | Wilhelm et al. (2016b); Villena (2019) | | | | |
| | E-III. Benefits for direct supplier for the sustainability management of sub-supplier | Grimm et al. (2014); Villena (2019); Villena and Gioia (2020); Grimm (2013) | | | | |
| | E-IV. The environmental aspect of sustainability is to be monitored | Wilhelm et al. (2016a) | | | | |
| | F-I. The buyer-power of focal firm over direct supplier | Grimm et al. (2014); Dou et al. (2018); Wilhelm et al. (2016a); Wilhelm and Villena (2021) | VI. The power asymmetry between focal firm and direct supplier in favour of focal firm (cluster of F-I and F-II) | These contingency variables reflect the power inequality in focal firm-direct supplier relationship which arises from the high purchasing volume of the focal firm or its size. | | |
| | F-II. Focal firm size | Bourlakis et al. (2014a); Bourlakis et al. (2014b); Hartmann and Moeller (2014); Melnyk et al. (2003); Dou et al. (2018); Grimm et al. (2016); Mena et al. (2013) | | | | |
| | G-I. The sustainability trainings of direct supplier | Gong et al. (2018a); Jia et al. (2019); Gong et al. (2018b); Gong et al. (2019); Villena and Gioia (2018); Villena (2019); Villena and Gioia (2020); Wilhelm et al. (2016a); Alexander (2020); Klassen and Vachon (2003) | VII. Direct supplier's capability for the sustainability management of sub-supplier (cluster of G-I, G-II and G-III) | The contingency variables in this group consider factors such as sustainability trainings, resource availability and power that make direct suppliers capable of managing sub-supplier's sustainability. | | |
| | G-II. Direct supplier's internal resource availability | Wilhelm et al. (2016b) | | | | |
| | G-III. Power asymmetry between direct supplier and sub-supplier in favour of direct supplier | Wilhelm et al. (2016a); Wilhelm et al. (2016b) | VIII. The enablers of sub-supplier's sustainability compliance (cluster of H-I and H-II) | These contingency variables are related to the enablers of sub-suppliers in terms of the capability and benefits to comply with the sustainability requirements of focal firm. | | |
| | H-I. The capability of sub-supplier to meet focal firm's sustainability requirements | Grimm et al. (2014); Dou et al. (2018); Grimm (2013) | | | | |
| | Grimm et al. (2014); Villena (2019); Grimm (2013) | | | | | |

Table 2 (continued)

| The relevant SSM approach | The primary contingency variables | Related references | The first-order constructs | Common themes/points among each group of the contingency variables | The second-order constructs | Common themes/points among each group of the contingency variables |
|--------------------------------------|---|--|---|---|--|---|
| | H-II. Benefits for sub-supplier for sustainability compliance | | | | | |
| | I-I. Geographical distance between supply chain members | Grimm et al. (2014); Dou et al. (2018); Awaysheh and Klassen (2010); Busse et al. (2016); Simpson et al. (2007); Grimm (2013) | IX. Ease of communication between supply chain members (cluster of I-I, I-II and I-III) | Low geographical and cultural distances combined with decreased horizontal complexity (number of suppliers) at direct supplier level can make communication between supply chain partners easier. | | |
| | I-II. Cultural distance between supply chain members | Grimm et al. (2014); Tachizawa and Wong (2014); Awaysheh and Klassen (2010); Busse et al. (2016); Sarkis (2012); Wilhelm et al. (2016a) | | | | |
| | I-III. Horizontal complexity at direct supplier level | Wilhelm et al. (2016a); Meinschmidt et al. (2018); Choi and Hong (2002) | | | | |
| | J-I. Trustful relationship between sub-supplier and direct supplier | Grimm et al. (2014); Grimm (2013); Dou et al. (2018) | X. Cooperation and trust between sub-supplier and direct supplier (cluster of J-I and J-II) | These two contingency variables are indicator of the atmosphere of partnership, trust and commitment in relationship between sub-supplier and direct supplier. | | |
| | J-II. Long-term, committed relationship between sub-supplier and direct supplier | Grimm et al. (2014); Dou et al. (2018); Walker et al.(2008); Carter and Dresner (2001); Castka and Balzarova (2008); Grimm (2013) | | | | |
| The relevant SSM approach | The primary contingency variables | Related references | The first-order constructs | Common themes/points among each group of the contingency variables | The second-order constructs | Common themes/points among each group of the contingency variables |
| The work with third parties approach | K-I. Collaboration with external stakeholders in management of suppliers' sustainability | Gong et al. (2018a); Jia et al. (2019); Gong et al. (2018b); Gong et al. (2019); Peters et al. (2011); Hannibal and Kauppi (2019); Lechler et al. (2019); Villena and Gioia (2020); Grimm et al. (2022); Formentini and Paolo (2016); Alexander (2020) | XI. Drivers for engaging external stakeholders in initiatives for extending sustainability to sub-suppliers (cluster of K-I and K-II) | These contingency variables drive focal firm towards inviting external stakeholders to take part in SSM initiatives. | The expected degree of participation from external stakeholders in SSM plans (cluster of XI) | When drivers for engaging external stakeholders in plans for extend sustainability to lower-tier suppliers exist, the higher participation of external stakeholders in these plans can be expected. |
| | K-II. Horizontal complexity at sub-supplier level | Wilhelm et al. (2016a); Choi and Hong (2002) | | | | |
| The don't bother approach | L-I. Focal firm's reluctance to invest in the sustainability management of sub-supplier | Dou et al. (2018); Ageron et al. (2012); Walker et al. (2008); Zhu and Geng (2013); Orsato (2006) | XII. Financial barriers faced by focal firm in the sustainability management of sub-supplier (cluster of L-I and L-II) | These contingency variables indicate the financial barriers, such as possibly low return on investment for sustainability and insufficient financial resources and physical assets, faced by focal firm in management of sustainability at the lower tiers of supply chain. | Focal firm's lack of financial resources and motivation to take action to establish sub-supplier's sustainability compliance (cluster of XII and XIII) | Barriers related to focal firm's lack of financial resources and motivation which can hinder the initiatives for extending sustainability to sub-suppliers. |
| | L-II. Focal firm's lack of financial resources and physical assets required for the sustainability management of sub-supplier | Hofmann et al. (2018); Dou et al. (2018); Gavronski et al. (2011); Walker et al. (2008) | | | | |
| | M-I. Stakeholder pressure on focal firm | Hofmann et al. (2014); Tachizawa et al. (2015); Liu et al. (2018b); Roy et al. (2020); Seuring and Müller (2008a); Mont and Leire (2009); Ayuso et al. (2014); Jakhar (2017) | XIII. Focal firm's motivation for the sustainability management of sub-supplier (cluster of M-I and M-II) | Internal and external stakeholder pressures on focal firm together with top management commitment motivate the focal firm to extend sustainability to lower-tier suppliers. | | |
| | M-II. Focal firm's top management support | Dou et al. (2018); Sajjad et al. (2015); Kumar and Rahman (2016); Tachizawa et al. (2015); Shibin et al. (2020); Zhu and Geng (2013); Gavronski et al. (2011); Hajmohammad et al. (2013); Taylor and Vachon (2018) | | | | |

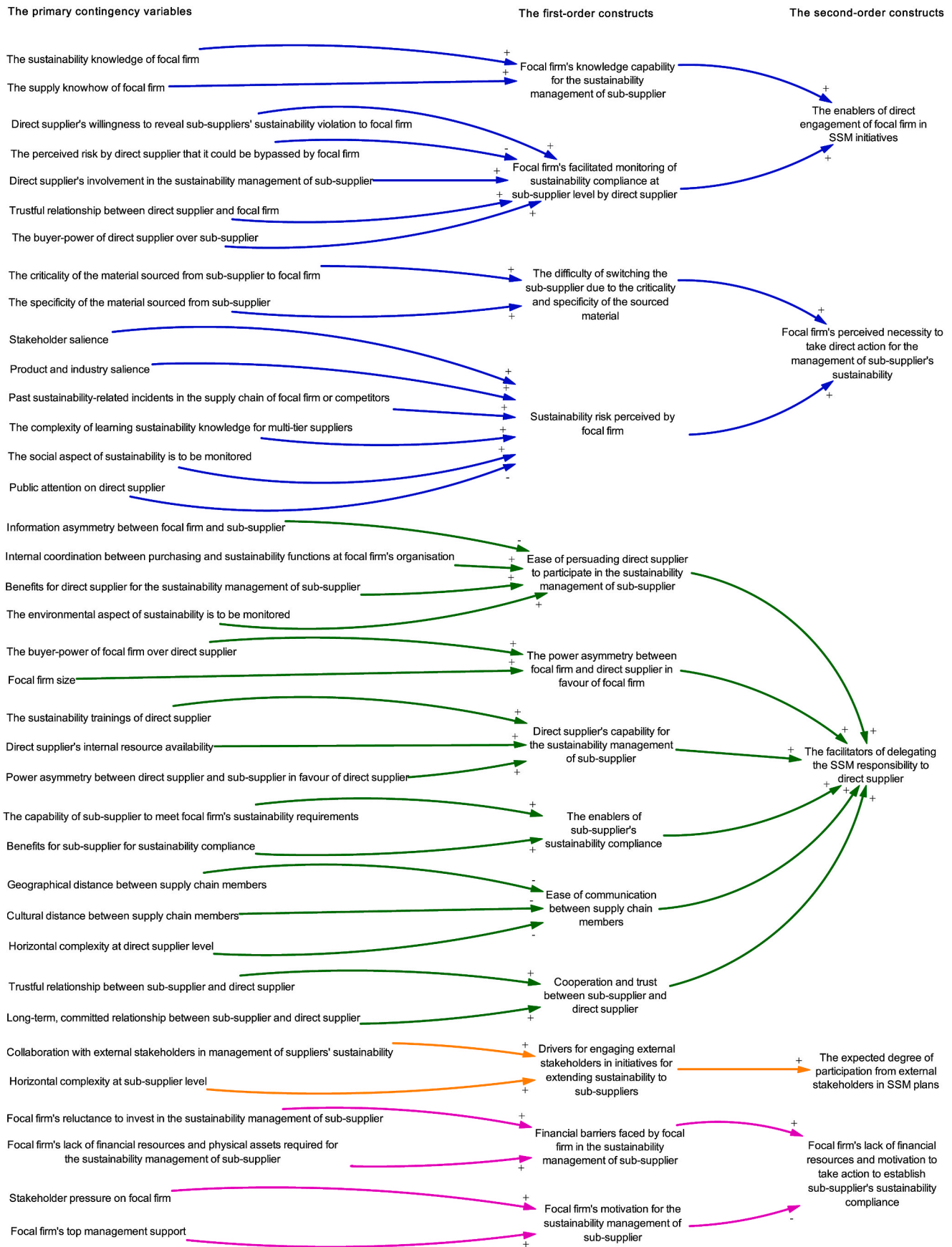


Fig. 3. The relationships between the contingency variables and their clusters.

sustainability management of sub-supplier'' increases, and thus they are connected through a \rightarrow arrow. In this figure, the contingency variables related to the direct, indirect, work with third parties and don't bother approaches are distinguished with blue, green, orange and rose pink colours respectively.

6.2. The influence of variation in the contingency variables on the effectiveness of each SSM approach

How variation in the second-order constructs and their constituent first-order constructs and the primary contingency variables impacts the effectiveness of each SSM strategy is detailed as follows.

6.2.1. The enablers of direct engagement of focal firm in SSM initiatives

6.2.1.1. Focal firm's knowledge capability for the sustainability management of sub-supplier. The sustainability knowledge of focal firm would enable the focal firm to train the sub-suppliers on how to integrate the sustainability into their operations and monitor their sustainability compliance more efficiently (Wilhelm et al., 2016a, 2016b; Villena and Gioia, 2018). Focal firms' lack of sustainability knowledge drives them towards collaborating with third parties to implement sustainability in their supply chains (Tachizawa and Wong, 2014; Plambeck and Denend, 2011).

The supply knowhow of focal firm comes from the focal firm's robust understanding of its supply base including its upstream supply chain members and their characteristics, fundamental process and procured products (Grimm et al., 2014; Grimm, 2013; Dou et al., 2018; Hall, 2000). To purposefully and efficiently deal with the sustainability issues that arise within its supply chain, the focal firm requires deep understanding of its supply chain; otherwise its dependence on external business partners such as consultants, auditors and NGOs for this purpose would be inevitable (Grimm et al., 2014; Grimm, 2013; Dou et al., 2018; Reuter et al., 2010).

6.2.1.2. Focal firm's facilitated monitoring of sustainability compliance at sub-supplier level by direct supplier. In particular situations, it would become more convenient for the focal firm to directly monitor the sub-suppliers for sustainability compliance.

Direct supplier's willingness to reveal sub-suppliers' sustainability violation to focal firm is a concept related to information sharing in supply chains and represents a key factor for sub-supplier adoption of sustainability practices (Grimm et al., 2014; Grimm, 2013; Dou et al., 2018; Vachon and Klassen, 2006). Direct supplier's willingness to share sub-suppliers' information with the focal company would be especially important when there is so many sub-suppliers and the focal company does not have enough resources to directly search and collect relevant information on their sustainability performance (Dou et al., 2018).

The perceived risk by direct supplier that it could be bypassed by focal firm, or the risk of disintermediation, is the risk that focal company terminates the business relationship with direct supplier and sources products and services directly from sub-supplier (Grimm et al., 2014; Grimm, 2013; Dou et al., 2018; Choi and Linton, 2011). Direct suppliers would be more reluctant to disclose sub-suppliers to focal firm and enable access to them, if it threatens their business relationship with the focal firm. Committed long term relationship between focal firm and direct supplier and a high level of trust between them would ease this concern (Grimm et al., 2014; Grimm, 2013; Dou et al., 2018).

Direct supplier's involvement in the sustainability management of sub-supplier shows a direct supplier's active mediating role in initiatives by focal firm to ensure sub-supplier's sustainability compliance. The direct supplier involvement brings the focal firm closer to the sub-supplier, helps the focal firm to more quickly become familiar with the characteristics of the sub-supplier and facilitates activities such as site visits and audits for the focal firm (Grimm et al., 2014; Grimm, 2013).

Trustful relationship between direct supplier and focal firm exists when each party perceives the other party in the relationship as not acting opportunistically and not exploiting its vulnerabilities even when such exploitation would not be detected (Stuart et al., 2012; Ring and Van de Ven, 1992; Barney and Hansen, 1994), and can result in more information sharing regarding the sub-suppliers (Dou et al., 2018; Sjoerdsma and Weele, 2015). When trustful relationship between direct supplier and focal firm exists, the direct supplier supports the sustainability management of sub-suppliers by the focal firm and enables the focal firm to approach sub-suppliers directly (Grimm et al., 2014; Grimm, 2013; Dou et al., 2018).

The buyer-power of direct supplier over sub-supplier facilitates easier access of focal firm to sub-supplier for direct interactions (Grimm et al., 2014; Grimm, 2013; Dou et al., 2018).

The description of the enablers of direct engagement of focal firm in SSM initiatives in terms of its constituent first-order constructs leads to the following proposition:

P3a. The enablers of direct engagement of focal firm in SSM initiatives exist if the focal firm has high capability for the sustainability management of sub-supplier, and the focal firm's monitoring of the sustainability compliance at sub-supplier level is facilitated by direct supplier.

6.2.2. Focal firm's perceived necessity to take direct action for the management of sub-supplier's sustainability

6.2.2.1. The difficulty of switching the sub-supplier due to the criticality and specificity of the sourced material. The criticality of the material sourced from sub-supplier to focal firm means that the material sourced from sub-supplier by direct supplier has significant impact on focal firm's product quality or sustainability (Tachizawa and Wong, 2014; Mena et al., 2013; Williamson, 2008). The higher the criticality of the material, the more the dependence of the focal firm on the correct delivery of the material and the more likely it is that the focal firm will employ the direct approach to establish a direct link with sub-suppliers. Otherwise, it may apply other SSM strategies (Tachizawa and Wong, 2014; Sauer and Seuring, 2018; Choi and Hong, 2002; Yawar and Kauppi, 2018).

The specificity of the material sourced from sub-supplier makes it hard or even impossible for both focal firm and direct supplier to turn to other suppliers (Meinlschmidt et al., 2018; Sauer and Seuring, 2018; Williamson, 2008).

The above two contingency variables describe the dependency of the focal firm on its sub-suppliers, and therefore the difficulty of replacing them. In such a case, the focal firm would evaluate the sub-supplier's sustainability noncompliance as a highly risky event, which can justify its direct involvement in lower-tier supplier's sustainability management (Meinlschmidt et al., 2018; Sauer and Seuring, 2018; Williamson, 2008).

6.2.2.2. Sustainability risk perceived by focal firm. If the focal firm perceives high sustainability risks at sub-supplier level, it would more likely take direct action to establish sub-supplier's sustainability compliance (Meinlschmidt et al., 2018; Grimm et al., 2016).

Stakeholder salience perceived by supply chain managers is influenced by stakeholders' power, the legitimacy of their claims and the urgency attached to these claims (Mitchell et al., 1997; Meinlschmidt et al., 2018). The higher the stakeholder salience in terms of power, legitimacy and urgency, the higher the focal firm's perceived sustainability risk (Meinlschmidt et al., 2018).

Product and industry salience describes products and industries that are highly visible to customers such as pharmaceutical, chemical and clothing and firms with publicly known brand names (Castka and Balzarova, 2008; Meinlschmidt et al., 2018; Simpson et al., 2012). The public attention to sustainability performance of a firm is related to visibility of its products, the size of the firm and producing publicly known brand names (Schneider and Wallenburg, 2012; Hartmann and

Moeller, 2014; Simpson et al., 2012). Higher product and industry salience would mean higher perceived sustainability risk by focal firm (Meinschmidt et al., 2018; Hajmohammad and Vachon, 2016).

Past sustainability-related incidents in the supply chain of focal firm or competitors increases the perceived sustainability risk of the focal firm (Meinschmidt et al., 2018; Hajmohammad and Vachon, 2016; Groetsch et al., 2013). In addition, buying firms that have experienced sustainability-related supplier misconduct or disruption in their own supply chain or in competitors' supply chain may analyse and reflect on these problems. This in turn creates promoted awareness and risk perception with regard to the similar types of problems in future (Meinschmidt et al., 2018; Grimm et al., 2016).

The complexity of learning sustainability knowledge for multi-tier suppliers describes the complexity level of the sustainability knowledge-related content for first-tier and lower-tier suppliers (Jia et al., 2019). The complexity of learning sustainability knowledge for suppliers decreases over time as result of their efforts and supports provided by the focal firms. When the complexity of learning the sustainability-related content is high for the multi-tier suppliers, the "proactive" focal companies tend to apply the direct approach on sub-suppliers regardless of their knowledge resources. Otherwise, they are likely to use the indirect or work with third parties approaches even if they have sufficient knowledge resources (Gong et al., 2018a).

If the social aspect of sustainability is to be monitored, sub-supplier's noncompliance with regard to this aspect of sustainability such as child labour, wage discrimination and sexual abuse is relatively harder to detect compared with the environmental sustainability. Therefore, the higher perceived sustainability risk leads the focal firm towards direct monitoring of the sub-suppliers for social sustainability compliance (Wilhelm et al., 2016a).

Little public attention on direct supplier puts little pressure on the direct supplier to be involved in the SSM programmes and thus can increase the focal firm's perceived risk of sub-supplier's sustainability noncompliance. This drives the focal firm to directly take on the responsibility of approaching the sub-suppliers and ensuring their sustainability compliance (Grimm et al., 2016). Stakeholder groups such as NGOs, governments, original equipment manufacturers (OEMs) and employees can influence direct suppliers in integrating sustainability into their supplier selection process (Lechler et al., 2020).

The relationship between focal firm's perceived necessity to take direct action for the management of sub-supplier's sustainability and its constituent first-order constructs is described by the following proposition:

P3b. Focal firm's perceived necessity to take direct action for the management of sub-supplier's sustainability is high when the sustainability risk perceived by the focal firm is high and it is difficult to switch the sub-supplier.

6.2.3. The facilitators of delegating the SSM responsibility to direct supplier

6.2.3.1. *Ease of persuading direct supplier to participate in the sustainability management of sub-supplier.* If there is high information asymmetry between focal firm and sub-supplier, the focal firm has little information about sub-suppliers' processes and how these processes can become sustainable socially and environmentally. Under this condition, it would become more difficult to persuade the direct suppliers to take part in the sustainability management of sub-supplier since they may find it hard to prove their success in managing sub-supplier's sustainability to the focal firm (Wilhelm et al., 2016a, 2016b).

Low degree of internal coordination between purchasing and sustainability functions at focal firm's organisation could increase the information asymmetry between focal firm and sub-supplier. To reduce the information asymmetry between focal firm and sub-supplier, the purchasing function at focal firm's organisation needs to have closer interaction with the sustainability function and share the information regarding sub-supplier's sustainability performance with the sustainability function (Wilhelm et al., 2016b; Villena, 2019).

Benefits for direct supplier for the sustainability management of sub-supplier are the direct supplier's perceived value for engagement in SSM activities. The trade-off between benefits and sacrifices determines the value, and it can be monetary and nonmonetary (Grimm et al., 2014; Grimm, 2013; Walter et al., 2001; Walter and Ritter, 2003). As high amount of effort is required for direct suppliers to be involved in practices related to the management of sub-supplier's sustainability, they will be willing to support these activities if they perceive benefits such as sustainability awards and long-term contracts from their efforts (Grimm et al., 2014; Grimm, 2013; Villena, 2019; Villena and Gioia, 2020).

If the environmental aspect of sustainability is to be monitored, sub-supplier's noncompliance with respect to this aspect of sustainability such as pesticides misuse or high level of CO2 emissions is relatively easier to detect compared with the social sustainability. Thus, it would be easier to encourage direct supplier to take on the responsibility of managing environmental sustainability compliance at sub-supplier level (Wilhelm et al., 2016a).

6.2.3.2. *Power asymmetry between focal firm and direct supplier in favour of focal firm.* Focal firm can have power over direct supplier in several ways which leads to the power asymmetry.

The buyer-power of focal firm over direct supplier is directly linked to the purchase/demand volume of the focal firm from its direct supplier (Grimm et al., 2014; Grimm, 2013; Wilhelm et al., 2016a). If the direct supplier is dependent on the focal firm because of focal firm's demand volume, it would more likely respond to the focal firm's request to take action for a noncompliance at sub-supplier sites (Grimm et al., 2014; Grimm, 2013; Dou et al., 2018; Wilhelm and Villena, 2021).

Focal firm size which can be measured based on the number of employees or annual income/turnover is associated with the ability to buy higher quantities of goods and services (buyer-power) and possessing more human, financial and technological resources (Bourlakis et al., 2014a, 2014b; Hartmann and Moeller, 2014; Melnyk et al., 2003). From the resource dependence theory viewpoint, a company that lacks the required resources is likely to be dependent on other partners to acquire the resources, and the dependent actor is more likely to respond to the requirements of the partners who provide its required resources (Dou et al., 2018; Grimm et al., 2016; Pfeffer and Salancik, 2003). Dependence of direct supplier on focal firm for its higher purchase volume or critical resources which arises from the focal firm size gives the focal firm the "channel power" which describes the ability to influence the supply chain partners of a firm directly or indirectly (Grimm et al., 2016; Mena et al., 2013).

6.2.3.3. *Direct supplier's capability for the sustainability management of sub-supplier.* Direct supplier's capability for the sustainability management of sub-supplier is related to direct supplier's ability to extend sustainability to sub-suppliers' activities through collaboration and assessment (Wilhelm et al., 2016a).

Focal firms can manage to provide the sustainability trainings of direct supplier in a number of ways to build the direct suppliers' sustainability capabilities. They (i) build up their own sustainability team to exchange the best practices regarding the environment, health, safety and sustainability (EHS&S) during the direct supplier visits or events such as supplier training week/sessions (Villena and Gioia, 2018, 2020; Villena, 2019; Klassen and Vachon, 2003; Gong et al., 2018a, 2018b, 2019; Jia et al., 2019; Wilhelm et al., 2016a), (ii) facilitate direct supplier peer learning on sustainability, e.g. by creating a supplier sustainability panel which consists of direct suppliers that are sustainability leaders to promote supplier to supplier sustainability learning through the members discussion (Villena and Gioia, 2018; Villena, 2019), and (iii) provide sustainability trainings to direct suppliers through their industry organisations/alliances (Villena and Gioia, 2018; Villena, 2019; Gong et al., 2018a, 2018b, 2019; Jia et al., 2019; Wilhelm et al., 2016a).

Direct supplier's internal resource availability enables the direct

supplier to implement sustainability upstream in the supply chain since it possesses sufficient resources to assign to the management of sustainability at the second-tier supplier level. Otherwise, the cost burden of extending sustainability to lower tiers may discourage the direct suppliers from engagement in SSM plans (Wilhelm et al., 2016b).

Decreasing *power asymmetry between direct supplier and sub-supplier in favour of direct supplier* can be the result of the relatively larger size of the sub-supplier or the difficulty of replacing the sub-supplier for the direct supplier. This would significantly weaken the direct supplier's position to enforce the sustainability requirements on sub-suppliers (Wilhelm et al., 2016a, 2016b).

6.2.3.4. The enablers of sub-supplier's sustainability compliance. The capability of sub-supplier to meet focal firm's sustainability requirements positively impacts the willingness of direct supplier to take part in SSM initiatives. If the direct supplier perceives a sub-supplier as incapable of fulfilling focal company's sustainability standards, it would become more reluctant to support SSM activities because of the worry about not meeting the focal company's sustainability-related expectations and losing business (Grimm et al., 2014; Grimm, 2013; Dou et al., 2018).

Benefits for sub-supplier for sustainability compliance are of high importance as sub-suppliers' compliance with focal company's sustainability requirements entails costs and extra efforts (Grimm et al., 2014; Grimm, 2013; Villena, 2019). Therefore, the sub-suppliers expect increased sales volumes or price premiums as a reward for their sustainability compliance (Grimm et al., 2014; Grimm, 2013).

6.2.3.5. Ease of communication between supply chain members. Both *geographical* and *cultural* distances between supply chain partners can act as barriers against effective communication and lead to information asymmetry (Grimm et al., 2014; Grimm, 2013; Simpson et al., 2007; Busse et al., 2016).

Geographical distance between supply chain members is important since for instance the increased geographical distance between direct supplier and sub-supplier makes sub-supplier sustainability training, periodic monitoring, auditing and collaboration difficult and costly for the direct supplier (Gopalakrishnan et al., 2012; Grimm et al., 2014; Grimm, 2013; Alwaysheh and Klassen, 2010). Close proximity between the supply chain partners facilitates it for focal firm and particularly the first-tier suppliers to supervise sub-suppliers' sustainability compliance (Dou et al., 2018).

In general, the probability that the focal firm employs the indirect approach is negatively associated with the *geographical distance between supply chain members* (Tachizawa and Wong, 2014). When *geographical distance between supply chain members* increases, the focal company applies more diversified sustainability governance mechanisms such as direct approach and/or relying on third parties, e.g. auditing firms, to extend sustainability to sub-suppliers (Alwaysheh and Klassen, 2010).

Cultural distance between supply chain members reflects the differences that exist between the social norms, values and the cultures of the societies in which the firms are based (Alwaysheh and Klassen, 2010; Wilhelm et al., 2016a). The culture and societies in which the supply chain members are based can play a role in determining the suitable strategy to extend sustainability to sub-suppliers (Alwaysheh and Klassen, 2010; Busse et al., 2016; Sarkis, 2012).

Generally, the *cultural distance* goes along with the *geographical distance*. Likewise, when the *cultural distance between supply chain members* decreases, the focal firm tends to apply the indirect approach since due to the cultural similarities the sub-supplier would more likely take sustainability requirements from the direct supplier seriously (Grimm et al., 2014; Grimm, 2013; Tachizawa and Wong, 2014). In the opposite case, the focal firm may apply diversity of sustainability governance mechanisms (Alwaysheh and Klassen, 2010).

Horizontal complexity at direct supplier level simply refers to the number of suppliers at direct supplier level (Choi and Hong, 2002). Low

horizontal complexity at the first-tier supplier level facilitates delegating the tasks for sustainability management of sub-supplier to first-tier suppliers given that there is low institutional distance between focal firm and its supply base (Wilhelm et al., 2016a). Institutional distance can be defined as the distance between the home country institutions of buyer and supplier firms in terms of voice and accountability, political stability and government effectiveness, absence of violence, regulatory quality, rule of law and control of corruption (Wilhelm et al., 2016a; Kostova, 1996).

6.2.3.6. Cooperation and trust between sub-supplier and direct supplier. *Trustful relationship between sub-supplier and direct supplier* is defined the same way as in *trustful relationship between direct supplier and focal firm*. In a *trustful relationship between sub-supplier and direct supplier*, instead of fear of retribution, the sub-supplier expects support from the direct supplier to overcome the deficiencies regarding the sustainability compliance. Accordingly, more involvement of the sub-supplier in sustainability management initiatives is expected (Grimm et al., 2014; Grimm, 2013; Dou et al., 2018).

Long-term, committed relationship between sub-supplier and direct supplier eases the implementation of SSM initiatives (Grimm et al., 2014; Grimm, 2013; Dou et al., 2018), and sub-suppliers pay more attention to sustainability requirements from direct suppliers if their relationship is of long-term focus (Carter and Dresner, 2001; Walker et al., 2008; Castka and Balzarova, 2008).

With regard to the above description of *the facilitators of delegating the SSM responsibility to direct supplier*, the following proposition is formulated:

P3c. *The facilitators of delegating the SSM responsibility to direct supplier exist when it is easy to persuade direct supplier to participate in the sustainability management of sub-supplier, high power asymmetry exists between focal firm and direct supplier in favour of focal firm, direct supplier has high capability for the sustainability management of sub-supplier, the enablers of sub-supplier's sustainability compliance exist, communication between supply chain members is easy and there is high cooperation and trust between sub-supplier and direct supplier.*

6.2.4. The expected degree of participation from external stakeholders in SSM plans

6.2.4.1. Drivers for engaging external stakeholders in initiatives for extending sustainability to sub-suppliers. *Collaboration with external stakeholders in management of suppliers' sustainability* includes partnership with strategic stakeholders such as NGOs, governments, auditors, industry alliances and suppliers for sourcing sustainability knowledge, training suppliers the sustainability issues, developing sustainability certifications and assessing suppliers' sustainability performance (Peters et al., 2011; Gong et al., 2018a; Gong et al., 2018b; Gong et al., 2019; Hannibal and Kauppi, 2019; Jia et al., 2019; Grimm et al., 2022; Formentini and Paolo, 2016). Companies may also collaborate to form strategic alliances as a means to share supplier sustainability assessment with each other especially within multi-tier supply chains (Lechler et al., 2019; Villena and Gioia, 2020).

Horizontal complexity at sub-supplier level is directly related to the number of suppliers at sub-supplier level (Choi and Hong, 2002). The increased level of *horizontal complexity at sub-supplier level* together with high institutional distance between supply chain members necessitates engaging the external parties, leading to the application of the work with third parties approach (Wilhelm et al., 2016a).

The above-presented description of *the expected degree of participation from external stakeholders in SSM plans* leads to the following proposition:

P3d. *The expected degree of participation from external stakeholders in SSM plans is high when the drivers for engaging external stakeholders in initiatives for extending sustainability to sub-suppliers exist.*

6.2.5. Focal firm's lack of financial resources and motivation to take action to establish sub-supplier's sustainability compliance

6.2.5.1. *Financial barriers faced by focal firm in the sustainability management of sub-supplier.* Focal firm's reluctance to invest in the sustainability management of sub-supplier can arise from a number of finance-related concerns: the difficulty of determining the amount to invest in supply chain sustainability and the return on investment, and possibly difficult task of distributing costs and benefits of invest in supply chain sustainability between supply chain members (Ageron et al., 2012; Zhu and Geng, 2013). Another reason could be the companies' desire to reduce the product/service price to remain competitive in the market (Orsato, 2006; Walker et al., 2008). Financial support provided for second tier suppliers indicates that the focal firm is serious about the green multi-tier supplier management programme (Dou et al., 2018).

Focal firm's lack of financial resources and physical assets required for the sustainability management of sub-supplier is a major factor that can impede MT-SSCM initiatives (Hofmann et al., 2018; Dou et al., 2018). Costs related to SSM plans can even be of greater significance for small and medium-sized enterprises (SMEs) which generally have less financial resources available and thus are more vulnerable (Walker et al., 2008; Hervani and Helms, 2005; Wycherley, 1999). Providing suppliers with physical assets such as pollution treatment devices and facilities could help them develop green capabilities and improve their environmental performance (Dou et al., 2018; Gavronski et al., 2011). Focal firm's physical assets support would be seen as a strong signal that it attaches high importance to the green multi-tier supplier management plans (Dou et al., 2018).

6.2.5.2. *Focal firm's motivation for the sustainability management of sub-supplier.* Stakeholder pressure on focal firm for incorporating sustainability in supply chain management can come from both external and internal stakeholders (Roy et al., 2020; Hofmann et al., 2014; Seuring and Müller, 2008a; Liu et al., 2018b). The "environmental drivers", as the factors that can be internal or external to a firm, motivate the firm to adopt green supply chain management initiatives (Tachizawa et al., 2015).

Actions such as promoting public awareness of the low sustainability performance of the firm's supply chain, boycotting its products, taking legal actions against its unsustainable performance and penalising it, taken by external stakeholders like government, NGOs, media, consumer organisations, competitors and the local community can drive the firm towards adopting policies for sustainable supply chain management (Roy et al., 2020; Hofmann et al., 2014; Mont and Leire, 2009; Liu et al., 2018b).

Internal stakeholders such as shareholders and employees are capable of shaping the form and nature of the firm's policy for sustainable supply chain management (Ayuso et al., 2014; Jakhar, 2017; Roy et al., 2020).

Focal firm's top management support is directly related to the incorporation of supplier selection, supplier development and supplier performance review in buyer-supplier relationship for improving the sustainability of supply chain (Kumar and Rahman, 2016) and is positively associated with sustainable supply chain management practices (Tachizawa et al., 2015; Sajjad et al., 2015; Zhu and Geng, 2013; Gavronski et al., 2011). Shibin et al. (2020) found out the positive impact of coercive pressures on top management participation which in turn has positive influence on supply chain connectivity and information sharing in supply chains which ultimately influence the environmental performance of supply chains to a great extent.

With *focal firm's top management support*, direct suppliers would become more interested in green multi-tier supplier management and are motivated for active involvement. Sub-suppliers interpret the focal company's top management support as willingness to invest resources in green multi-tier supplier management plans (Dou et al., 2018;

Hajmohammad et al., 2013; Taylor and Vachon, 2018).

We formulate the following proposition to describe *focal firm's lack of financial resources and motivation to take action to establish sub-supplier's sustainability compliance* with respect to its constituent first-order constructs:

P3e. *Focal firm would lack financial resources and motivation to take action to establish sub-supplier's sustainability compliance, if it has faced financial barriers in the sustainability management of sub-supplier because of cost reduction desire, uncertain return on investment in sustainability and lack of required physical assets and its motivation for the sustainability management of sub-supplier is low due to low stakeholder pressure and lack of top management support.*

How variation in the primary contingency variables and the clustered contingency variables influence the effectiveness of each SSM approach is summarised in Tables 3a–3c according to what was presented in Subsection 6.2.1–6.2.5. For instance, in Table 3a, if the *sustainability knowledge of focal firm* is "High", the direct approach would be "Effective", and if the *sustainability knowledge of focal firm* is "Low", the direct approach would be "Not effective". These scores are directly inferred from the descriptions that have been provided for each contingency variable in Subsection 6.2.1–6.2.5 based on the reviewed literature.

As the don't bother approach is a passive strategy in essence, it is hard to determine whether applying this approach will be beneficial in extending sustainability to sub-suppliers. Therefore, in Tables 3a–3c, for this SSM approach, instead of "The effectiveness of the relevant SSM approach", "Effective" and "Not effective", we have used "The likelihood of choosing the don't bother approach", "More likely" and "Less likely" respectively.

6.3. When is each SSM approach an effective approach?

Based on Table 3c, the following propositions describe the conditions in which each SSM approach can be effective with regard to the second-order constructs:

P4a. *The direct approach is an effective approach when the enablers of direct engagement of focal firm in SSM initiatives exist and focal firm's perceived necessity to take direct action for the management of sub-supplier's sustainability is high, otherwise this approach would not be effective.*

P4b. *The indirect approach is an effective approach when the facilitators of delegating the SSM responsibility to direct supplier exist, otherwise this approach would not be effective.*

P4c. *The work with third parties approach is an effective approach when the expected degree of participation from external stakeholders in SSM plans is high because of the existence of the drivers for engaging external stakeholders in initiatives for extending sustainability to sub-suppliers, otherwise this approach would not be effective.*

P4d. *The don't bother approach would more likely be applied if focal firm lacks financial resources and motivation to take action to establish sub-supplier's sustainability compliance, otherwise other SSM approaches would more likely be applied.*

6.4. The conceptual framework

A conceptual framework, which is shown in Fig. 4, is built by integrating the above-presented propositions to summarise the results and findings of the study.

According to this conceptual framework, the motivations for sub-supplier's sustainability noncompliance would instigate sub-supplier's sustainability noncompliance. A set of contingency variables impact the effectiveness of each SSM approach, where these contingency variables are clustered in two stages based on their similarities. The effectiveness of a given SSM approach is expected to reduce sub-supplier's

Table 3a
The influence of variation in the primary contingency variables on the effectiveness of each SSM approach.

| The relevant SSM approach | The primary contingency variables | The effectiveness of the relevant SSM approach | | |
|--|---|--|----------------|------|
| | | Effective | Not effective | |
| The direct approach | The sustainability knowledge of focal firm | High | Low | |
| | The supply knowhow of focal firm | High | Low | |
| | Direct supplier's willingness to reveal sub-suppliers' sustainability violation to focal firm | High | Low | |
| | The perceived risk by direct supplier that it could be bypassed by focal firm | Low | High | |
| | Direct supplier's involvement in the sustainability management of sub-supplier | High | Low | |
| | Trustful relationship between direct supplier and focal firm | Exists | Does not exist | |
| | The buyer-power of direct supplier over sub-supplier | High | Low | |
| | The criticality of the material sourced from sub-supplier to focal firm | High | Low | |
| | The specificity of the material sourced from sub-supplier | High | Low | |
| | Stakeholder salience | High | Low | |
| | Product and industry salience | High | Low | |
| | Past sustainability-related incidents in the supply chain of focal firm or competitors | Frequent | Not frequent | |
| | The complexity of learning sustainability knowledge for multi-tier suppliers | High | Low | |
| | The social aspect of sustainability is to be monitored | True | False | |
| | Public attention on direct supplier | Low | High | |
| | The indirect approach | Information asymmetry between focal firm and sub-supplier | Low | High |
| | | Internal coordination between purchasing and sustainability functions at focal firm's organisation | High | Low |
| Benefits for direct supplier for the sustainability management of sub-supplier | | High | Low | |
| The environmental aspect of sustainability is to be monitored | | True | False | |

Table 3a (continued)

| | | | | | |
|--------------------------------------|---|--------|----------------|---|--------------------|
| | The buyer-power of focal firm over direct supplier | High | Low | | |
| | Focal firm size | Large | Small | | |
| | The sustainability trainings of direct supplier | High | Low | | |
| | Direct supplier's internal resource availability | High | Low | | |
| | Power asymmetry between direct supplier and sub-supplier in favour of direct supplier | High | Low | | |
| | The capability of sub-supplier to meet focal firm's sustainability requirements | High | Low | | |
| | Benefits for sub-supplier for sustainability compliance | High | Low | | |
| | Geographical distance between supply chain members | Low | High | | |
| | Cultural distance between supply chain members | Low | High | | |
| | Horizontal complexity at direct supplier level | Low | High | | |
| | Trustful relationship between sub-supplier and direct supplier | Exists | Does not exist | | |
| | Long-term, committed relationship between sub-supplier and direct supplier | Exists | Does not exist | | |
| The work with third parties approach | Collaboration with external stakeholders in management of suppliers' sustainability | High | Low | The likelihood of choosing the don't bother approach | |
| | Horizontal complexity at sub-supplier level | High | Low | | More likely |
| The don't bother approach | Focal firm's reluctance to invest in the sustainability management of sub-supplier | N/A | N/A | True | False |
| | Focal firm's lack of financial resources and physical assets required for the sustainability management of sub-supplier | N/A | N/A | True | False |
| | Stakeholder pressure on focal firm | N/A | N/A | Low | High |
| | Focal firm's top management support | N/A | N/A | Low | High |

noncompliance with sustainability standards which itself brings about stakeholder pressure on focal firm. Stakeholder pressure on focal firm to extend sustainability to sub-suppliers is normally realised through coercive, mimetic and normative pressures. If focal firm ignore stakeholders' demand for the sustainability management of sub-supplier, it could face several risks such as extra costs to establish sustainability at sub-supplier level, corporate reputational damage and decline in sales/revenue.

Table 3b
The influence of variation in the first-order constructs on the effectiveness of each SSM approach.

| The relevant SSM approach | The first-order constructs | The effectiveness of the relevant SSM approach | | | |
|--------------------------------------|---|--|---------------|---|--------------------|
| | | Effective | Not effective | | |
| The direct approach | Focal firm's knowledge capability for the sustainability management of sub-supplier | High | Low | | |
| | Focal firm's facilitated monitoring of sustainability compliance at sub-supplier level by direct supplier | True | False | | |
| | The difficulty of switching the sub-supplier due to the criticality and specificity of the sourced material | High | Low | | |
| | Sustainability risk perceived by focal firm | High | Low | | |
| | Ease of persuading direct supplier to participate in the sustainability management of sub-supplier | High | Low | | |
| | The power asymmetry between focal firm and direct supplier in favour of focal firm | High | Low | | |
| The indirect approach | Direct supplier's capability for the sustainability management of sub-supplier | High | Low | | |
| | The enablers of sub-supplier's sustainability compliance | Exist | Do not exist | | |
| | Ease of communication between supply chain members | High | Low | | |
| | Cooperation and trust between sub-supplier and direct supplier | High | Low | The likelihood of choosing the don't bother approach | More likely |
| The work with third parties approach | Drivers for engaging external stakeholders in initiatives for extending sustainability to sub-suppliers | Exist | Do not exist | | |
| The don't bother approach | Financial barriers faced by focal firm in the sustainability management of sub-supplier | N/A | N/A | High | Low |
| | Focal firm's motivation for the sustainability management of sub-supplier | N/A | N/A | Low | High |

Table 3c
The influence of variation in the second-order constructs on the effectiveness of each SSM approach.

| The relevant SSM approach | The second-order constructs | The effectiveness of the relevant SSM approach | | | |
|--------------------------------------|--|--|---------------|---|--------------------|
| | | Effective | Not effective | | |
| The direct approach | The enablers of direct engagement of focal firm in SSM initiatives | Exist | Do not exist | | |
| | Focal firm's perceived necessity to take direct action for the management of sub-supplier's sustainability | High | Low | | |
| The indirect approach | The facilitators of delegating the SSM responsibility to direct suppliers | Exist | Do not exist | The likelihood of choosing the don't bother approach | |
| The work with third parties approach | The expected degree of participation from external stakeholders in SSM plans | High | Low | More likely | Less likely |
| The don't bother approach | Focal firm's lack of financial resources and motivation to take action to establish sub-supplier's sustainability compliance | N/A | N/A | True | False |

6.5. Practical implications

Several practical considerations (especially with regard to the contingency variables) need to be taken into account when applying the SSM approaches:

In firm level, the early adopters of social and environmental sustainability are expected to achieve better economic/financial performance (Yang et al., 2021; Zhu and Sarkis, 2004). In supply chain level, timing issue can also be an important factor in determining the level of successfulness of SSM approaches. In other words, if SSM initiatives are applied earlier, they can be more effective. As it was stated in Subsection 5.2, one of the risks related to sub-supplier's sustainability noncompliance is that the focal firm would incur extra costs to establish sustainability compliance at sub-supplier level compared with the situation that it pro-actively addresses this issue. Therefore, delayed action to extend sustainability to sub-suppliers can be more costly for the focal firm.

In addition, the states of the contingency variables can change over time. This means that a SSM approach that is the most effective approach at present with regard to the current states of the contingency variables may no longer be the most effective approach in future because of variation in the states of the pertinent contingency variables. As such, the supply chain managers are advised to regularly monitor the states of the relevant contingency variables to ensure that the SSM approach that is currently used is still the most effective approach.

Furthermore, the capability of emerging Industry 4.0 technologies to monitor sustainability compliance and trace back sustainability violations to lower-tiers needs to be considered by supply chain managers at all tiers of the supply chain, especially with regard to more complex and hard-to-detect social sustainability issues.

The decentralised architecture of the Blockchain allows members of the supply chain, including the direct suppliers and sub-suppliers, to record and distribute their sustainability compliance data, such as wages, overtime hours and workplace safety, on a network which is accessible to all members (Venkatesh et al., 2020b; Agrawal et al.,

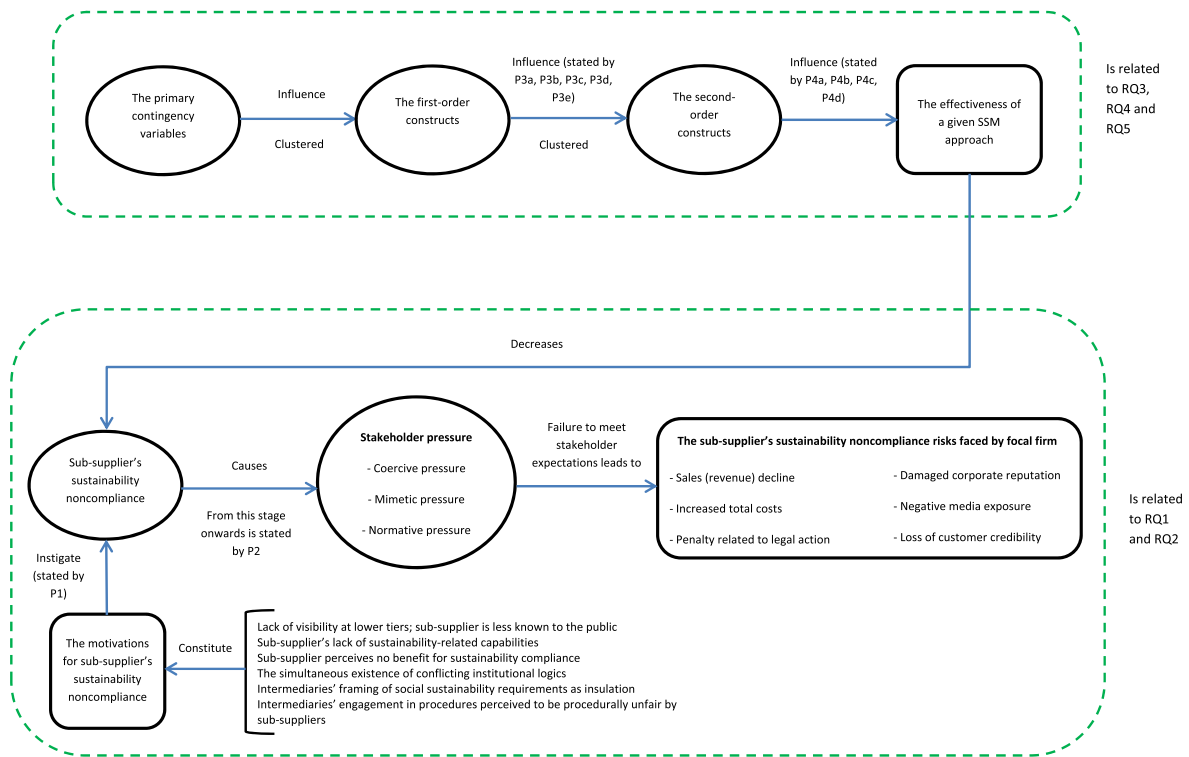


Fig. 4. The conceptual framework.

2021). IoT can be used to remotely monitor environmental and social sustainability compliance. For example embedded IoT microchips can remotely record and transmit the amount of fertilisers and pesticides used by the farmers in the field, or embedded IoT sensors can remotely record, process and transmit the amount of light, heat, noise and harmful chemical fumes (Olsen and Tomlin, 2020; Venkatesh et al., 2020b). The Big Data analysis tools can be used for collecting and processing the relevant data on the social media, e.g. Twitter, Facebook and Instagram, to obtain information about possible sub-supplier sustainability noncompliance (Stieglitz et al., 2018; Choi et al., 2017).

Thus, the above-mentioned Industry 4.0 technologies can be employed in parallel with SSM approaches. Moreover, as it will also be discussed in Subsection 7.2, applying each of these technologies can have an impact on a specific set of the contingency variables, and therefore on the effectiveness degree of the related SSM approach. For instance, the above-described application of Blockchain to MT-SSCM would decrease the information asymmetry between focal firm and sub-supplier and make the direct supplier's willingness to reveal sub-suppliers' sustainability violation to focal firm matter less, and this would, in turn, influence the degree of effectiveness of the indirect and direct approaches respectively.

Finally, the literature is mostly silent about how the contingency variables impact the effectiveness of the mixed approach/strategy (i.e. applying more than one SSM approach simultaneously). Hence, in this study, to base the literature analysis on the relevant literature on MT-SSCM, the analysis of how variation of the contingency variables impacts the effectiveness of the SSM approaches are only done for the pure approach/strategy (i.e. applying a single SSM approach at a time).

However, many situations in the real-world may demand applying a combination of the SSM approaches since none of the SSM approaches may prove effective if they are applied as pure/single approach (Wilhelm et al., 2016a; Gong et al., 2021). In such cases, the supply chain managers need to decide about the best mix of SSM approaches regarding the states of the contingency variables.

7. Conclusions and future research

7.1. Concluding summary

Each of the individual research studies in the area of MT-SSCM, in limited sense, has shed a light on the motivations for sub-supplier's sustainability violations, the risks of sub-supplier's sustainability violations for a focal firm, the contingency variables influencing the effectiveness of SSM approaches and how variation in these variables' states impacts the effectiveness of SSM approaches. Thus, a thorough, systematic literature review, which synthesises different pieces of information extracted from the reviewed literature, is required in order to provide a deeper understanding of these aspects.

In response to the research gaps that were identified from reviewing the literature on MT-SSCM, this study conducted a systematic literature review on MT-SSCM literature to identify an up-to-date and comprehensive set of contingency variables that influence the effectiveness of SSM approaches in multi-tier supply chain. In order to have a deeper understanding of the impact of the contingency variables on the effectiveness of SSM approaches, the identified contingency variables are detailed and diverse and are pertinent to the roles of direct suppliers and sub-suppliers as well as the role of focal firm in SSM programmes. As the identified contingency variables are diverse and rather large, they were clustered in two stages according to their common grounds for more efficient analysis of the way their variation impacts the effectiveness of each SSM approach. The relevant information derived from the reviewed literature was synthesised to find out the way variation in these contingency variables influences the effectiveness of each SSM approach, when to apply each SSM approach with regard to the contingency variables, the motives that drive sub-suppliers towards committing unsustainable actions and type of risks a focal firm would face as a result of ignoring sub-supplier's sustainability noncompliance.

According to the reviewed literature, there could be a variety of motives for sub-supplier's sustainability violation, ranging from lack of visibility at the lower tiers of supply chain and sub-supplier's lack of sustainability-related capabilities to intermediaries' framing of social

sustainability requirements as insulation and their engagement in procedures that are regarded as procedurally unfair by sub-suppliers. The literature review also showed that sub-supplier's sustainability noncompliance could bring about stakeholder reaction which is realised through coercive, mimetic and normative pressures, and focal firm's failure to accommodate the expectations of stakeholders could lead to sub-supplier's sustainability noncompliance risks. In-depth analysis of the first-order and second-order constructs and their constituent contingency variables helped determine the interrelationships, the mechanisms through which the variation in the contingency variables influences the effectiveness of each SSM strategy and when each SSM strategy should be applied with regard to the contingency variables. A conceptual framework was constructed to summarise the results and findings of the study.

However, this study also has limitations. The literature review research method could have limitations especially regarding the literature screening process, inclusion and exclusion criteria and the literature analysis (Denyer and Tranfield, 2009). In addition, further empirical research using industrial data is needed to test the propositions and refine and validate the conceptual framework which integrates the propositions.

7.2. Future research directions

The future research in the area of MT-SSCM can be extended in several directions as follows:

First, we observed that in MT-SSCM literature, the potential application of the recently developed Industry 4.0 technologies in extending sustainability to lower-tier suppliers is heavily under-researched. These technologies can complement the SSM plans, and can help the supply chain managers to more easily and efficiently monitor the sub-suppliers' compliance with sustainability standards. For example, IoT can be used for the remote monitoring of sub-suppliers' sustainability compliance; or the Big Data analysis techniques can be used for the social media data analysis to detect possible sub-suppliers' noncompliance. These Industry 4.0 technologies can even have an impact on deciding which SSM approach to apply. For instance, in presence of IoT and Big Data analysis tools, the contingency variables such as "Horizontal complexity at direct supplier level", "Horizontal complexity at sub-supplier level" and "Geographical distance between supply chain members" can become less influential in determining the effective SSM approach.

Further to the above, the contingency variables "The supply knowledge of focal firm" and "Information asymmetry between focal firm and sub-supplier" are closely related to traceability of sustainability in supply chain, which is a tangential topic to MT-SSCM. Supply chain traceability, especially with regard to sustainability, is a relatively new stream in supply chain management research (Sodhi and Tang, 2019; Hastig and Sodhi, 2020), and thus it is also largely under-researched by the literature on MT-SSCM. Again, the above-mentioned Industry 4.0 technologies especially Blockchain can be used efficiently to trace sustainability violations at lower tiers of a supply chain. Therefore, future research can study applying these newly emerged technologies impact on sustainability governance approaches and sustainability-related traceability in multi-tier supply chain.

Second, as it was already stated in Subsection 6.2.5.1, one of the main reasons for *focal firm's reluctance to invest in the sustainability*

management of sub-supplier is finance-related concerns. The literature on MT-SSCM lacks research on evaluating the SSM approaches from financial perspective. As extending sustainability to lower-tier suppliers normally involves costs in present and future, comparing the SSM approaches with regard to the financial criteria would be an interesting subject for future research.

Third, we observed that in the vast majority of the reviewed literature, focal firm and in several cases even direct suppliers and sub-suppliers were from developed countries. Studying multi-tier, sustainable supply chains where focal firm and its supply base are based in developing countries would also be insightful. This is particularly important as in the developing countries in comparison with the developed countries the stakeholder pressure on focal firms to extend sustainability to sub-supplier may be weaker in general, and sustainability violations such as child and forced labour, excessive overtime, delayed payments, manufacturing products that can be harmful for consumers' health, excessive use of pesticides and fertilizers, excessive water consumption and polluting the air, rivers and seas have been frequent (Govindan et al., 2016, 2021; Gong et al., 2018a, 2018b, 2019).

Fourth, as the supply chain of the individual firms is part of the supply network of their industry (Braziotis et al., 2013), firms in the real world do not just exist in supply chains, and in fact, they exist in supply networks as well (Borgatti and Li, 2009; Mills et al., 2004). Different firms at different tiers occupy different positions in the supply network (e.g. centrality, structural hole), and the structure of different supply network is also different. Hence, differences in the behaviours of the firms are expected, which will affect a series of operational, financial, and environmental outcomes. This may also serve as one of the perspectives for the future research's analysis of sub-suppliers' motivations for unsustainable practices, which was discussed in Subsection 5.1.

Fifth, there has been a paucity of research works on the quantitative modelling of decision problems in MT-SSCM (Jabbour et al., 2019), and therefore there are possible future research avenues in this area. For instance, future research can study the risk analysis of SSM approaches in multi-tier supply chain using business analytics methods particularly with regard to the sub-supplier's sustainability noncompliance risks mentioned in Subsection 5.2. Another quantitative, model-based future research topic can be studying cooperation mechanisms, e.g. information sharing and profit/cost sharing, using management science techniques such as game theory and simulation regarding the fact that several contingency variables related to different SSM approaches emphasise cooperation/partnership between supply chain partners.

Sixth, different sustainability governance/SSM approaches in multi-tier supply chain have been presented in the literature, which were mentioned in Subsection 3.2. Studying the commonalities and differences between these approaches and how they can complement each other to create synergy can be a subject for future research.

Seventh, in practice, there may not be one best SSM approach that the firms should follow, and the application of mixed SSM approaches can be more effective (Wilhelm et al., 2016a; Gong et al., 2021). Which bundles of contingency variables influence the focal firm's decision making in applying mixed SSM initiatives is worth further research.

Data availability

All the data is available in the paper

Appendix A

Supplementary Table 1

The details of the publications selected for review

| Study | Research methodology | The aspect of sustainability considered | Industry |
|---------------------------------|---|---|--|
| Carter and Dresner (2001) | Inductive, multiple case study | Environment | Minerals (mining), machine/machinery (defence contracting, high-technology), chemical industry (chemicals), food industry (food processing) |
| Klassen and Vachon (2003) | Hypothesis testing | Environment | N/A |
| Melnyk et al. (2003) | Hypothesis testing | Environment | Machine/Machinery (industrial and commercial machinery, computer equipment, transportation equipment, electronic and other electrical equipment and components except computer equipment, measuring, analysing and controlling instruments, photographic equipment), metal industry (fabricated metal products except machinery and transportation equipment), the healthcare industry (medical and optical goods), home appliances (watches and clocks) |
| Orsato (2006) | Literature review (conceptual framework development) | Environment | N/A |
| Vachon and Klassen (2006) | Hypothesis testing | Environment | Packaging industry (package printing) |
| Zhu and Sarkis (2006) | Multiple case study | Environment | Machine/Machinery (the automobile industry, the electronic/electrical industry), public sector (the thermal power plants) |
| Simpson et al. (2007) | Hypothesis testing | Environment | Machine/Machinery (automotive industry) |
| Castka and Balzarova (2008) | Literature review, single case study (International Organisation for Standardization (ISO)) | Social | International standard-setting body |
| Seuring and Müller (2008a) | Delphi study | Triple bottom line (TBL) | N/A |
| Seuring and Müller (2008b) | Literature review (conceptual framework development) | Triple bottom line (TBL) | N/A |
| Walker et al. (2008) | Literature review, multiple case study | Environment | Public sector (NHS trust, a government agency, a government authority procurement agency), cosmetics industry (cosmetics manufacturer), machine/machinery (electronic equipment manufacturer), retail (a high street food retailer) |
| Mont and Leire (2009) | Literature review, Survey | Social | Public sector |
| Awaysheh and Klassen (2010) | Literature review, survey | Social | Food industry, chemical industry (chemicals), transportation |
| Foerstl et al. (2010) | Multiple case study | Triple bottom line (TBL) | Chemical industry |
| Reuter et al. (2010) | Inductive multiple case study | Triple bottom line (TBL) | Chemical industry |
| Ehrgott et al. (2011) | Hypothesis testing | Social | German manufacturing industry, construction industry, retail (retail companies) |
| Gavronski et al. (2011) | Hypothesis testing | Environment | Metal industry (fabricated metal products), machine/machinery (machinery, electronics), home appliances (electrical appliances) |
| Peters et al. (2011) | Literature review, comparative case study (inductive, exploratory case study) | Triple bottom line (TBL) | Paper and wood industry (wood supply chains), food industry (palm oil, production of soy, seafood supply, agriculture) |
| Ageron et al. (2012) | Literature review, survey | Triple bottom line (TBL) | Public sector (power generation and distribution), the healthcare industry (medical and pharmaceutical), retail (sales and distribution), logistic services (third logistics service provider) |
| Sarkis (2012) | Literature review (conceptual framework development) | Environment | N/A |
| Schneider and Wallenburg (2012) | Literature review (proposition development) | Triple bottom line (TBL) | N/A |
| Simpson et al. (2012) | Literature review (proposition development) | Triple bottom line (TBL) | N/A |
| Groetsch et al. (2013) | Literature review (proposition development) | Triple bottom line (TBL) | N/A |
| Hajmohammad et al. (2013) | Hypothesis testing | Environment | Metal industry (fabricated metal products), machine/machinery (machinery manufacturing, electronics), home appliances (electric appliances) |
| Mena et al. (2013) | Inductive, multiple case study | Triple bottom line (TBL) | Food industry (beer, bread, pork) |
| Zhu and Geng (2013) | Hypothesis testing | Environment | Machine/Machinery (mechanical, electronic/electrical and automobile industry), chemical industry (chemical/petro-chemical industry), food industry (food/beverage), home appliances (furniture), construction industry |
| Ayuso et al. (2014) | Hypothesis testing | Social | N/A |
| Bourlakis et al. (2014a) | Survey | Triple bottom line (TBL) | Food industry (dairy industry) |
| Bourlakis et al. (2014b) | Survey | Triple bottom line (TBL) | Food industry (including dairy, fruit, meat and vegetable products) |
| Glover et al. (2014) | Survey | Triple bottom line (TBL) | Machine/Machinery (dairy) |
| Grimm et al. (2014) | Exploratory multiple case study | Triple bottom line (TBL) | Food industry (chocolate, fruit juice) |
| Grosvold et al. (2014) | Inductive, multiple case studies | Triple bottom line (TBL) | Public sector (utilities), food industry (food and drinks), the healthcare industry, retail, packaging industry, consulting, construction industry, finance |
| Hartmann and Moeller (2014) | Hypothesis testing | Triple bottom line (TBL) | N/A |

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Supplementary Table 1 (continued)

| Study | Research methodology | The aspect of sustainability considered | Industry |
|----------------------------------|--|---|--|
| Hofmann et al. (2014) | Transdisciplinary research | Triple bottom line (TBL) | Telecommunications, public sector (energy utility), logistic services, retail (nationally operating retailer), chemical industry (producer of specialty chemistry) |
| Tachizawa and Wong (2014) | Literature review (proposition development) | Triple bottom line (TBL) | N/A |
| Varsei et al. (2014) | Literature review (conceptual framework development) | Triple bottom line (TBL) | N/A |
| Formentini and Paolo (2016) | Multiple case study | Triple bottom line (TBL) | Food industry (coffee, pasta), construction industry (cement), apparel industry (fashion), machine/machinery (construction mechanical tools, mechanical components) |
| Meixell and Luoma (2015) | Literature review (proposition development) | Triple bottom line (TBL) | N/A |
| Sajjad et al. (2015) | Multiple (exploratory) case study | Triple bottom line (TBL) | Public sector (postal and communication), insurance, retail (food retail), banking |
| Tachizawa et al. (2015) | Survey | Environment | N/A |
| Busse et al. (2016) | Dyadic case study | Triple bottom line (TBL) | Packaging Industry (packaging producer) |
| Grimm et al. (2016) | Multiple case study | Triple bottom line (TBL) | Machine/Machinery (electronics and software (IT)), retail |
| Hajmohammad and Vachon (2016) | Literature review (proposition development) | Triple bottom line (TBL) | N/A |
| Kumar and Rahman (2016) | Hypothesis testing | Triple bottom line (TBL) | Machine/Machinery (automobile industry) |
| Wilhelm et al. (2016a) | Multiple case study | Triple bottom line (TBL) | Food industry (dairy, tea production, vegetables), packaging industry (product packaging), apparel industry (clothing, footwear), home appliances (consumer electronics) |
| Wilhelm et al. (2016b) | Multiple case study | Triple bottom line (TBL) | Food industry (dairy, tea production, vegetables), home appliances (consumer electronics) |
| Busse et al. (2017) | Design science approach | Triple bottom line (TBL) | Food industry (food supply chain) |
| Chu et al. (2017) | Hypothesis testing | Environment | Manufacturing industry in Korea |
| Jakhar (2017) | Hypothesis testing | Environment | Food industry (food and kindred products), apparel industry (textile mill products, apparel and other textile products, leather and leather products), machine/machinery (industrial machinery and equipment, electronic and other electric equipment, transportation equipment, instruments and related products), paper and wood industry (lumber and wood products, paper and allied products, printing and publishing), chemical industry (chemical and allied products, petroleum and coal products), home appliances (furniture and fixtures, rubber and miscellaneous plastics products), metal industry (fabricated metal products, primary metal industries), minerals (stone, clay and glass products), tobacco products |
| Kauppi and Hannibal (2017) | Literature review, survey | Social | N/A |
| Sayed et al. (2017) | Multiple case study | Triple bottom line (TBL) | Food industry (food and catering supply chains at UK Universities) |
| Dou et al. (2018) | DEMATEL-based case study (exploratory case study), action research | Environment | Machine/Machinery (automobile industry) |
| Ghadge et al. (2019) | Hypothesis testing | Triple bottom line (TBL) | Machine/Machinery (manufacturing and technology companies) |
| Gong et al. (2018a) | Exploratory, multiple case study | Triple bottom line (TBL) | Food industry (food processing and packaging, food and beverage), home appliances (home furnishing) |
| Gong et al. (2018b) | Case study | Triple bottom line (TBL) | Food industry (food and beverage) |
| Grimm et al. (2018) | Multiple case study, DEMATEL | Triple bottom line (TBL) | Machine/Machinery (electronics and software (IT)), retail |
| Hofmann et al. (2018) | Exploratory case study (multiple case study) | Social | Machine/Machinery (automotive, aerospace/defence, electronics, engineering), minerals (jewellery) |
| Liu et al. (2018b) | Multiple case study | Triple bottom line (TBL) | Chemical industry (chemicals), machine/machinery (electronics), home appliances (household appliances), metal industry (metal hardware), plastic hardware, apparel industry (textile and apparel), toys |
| Meinlschmidt et al. (2018) | Abductive, multiple case study | Triple bottom line (TBL) | Chemical industry (chemicals), the healthcare industry (pharmaceuticals), home appliances (furniture), apparel industry, packaging industry, machine/machinery (semi-conductors) |
| Sauer and Seuring (2018) | Literature review (conceptual framework development) | Triple bottom line (TBL) | N/A |
| Sodhi and Tang (2018) | Literature review (finding themes) | Triple bottom line (TBL) | N/A |
| Soundararajan and Brammer (2018) | Longitudinal multiple case study method | Triple bottom line (TBL) | Apparel industry (knitwear garment industry) |
| Taylor and Vachon (2018) | Literature review (finding research gaps) | Triple bottom line (TBL) | N/A |
| Villena and Gioia (2018) | Inductive, multiple case study | Triple bottom line (TBL) | Machine/Machinery (automotive, electronics), the healthcare industry |

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Supplementary Table 1 (continued)

| Study | Research methodology | The aspect of sustainability considered | Industry |
|----------------------------|--|---|---|
| Yawar and Kauppi (2018) | Multiple case study | Social | Food industry (dairy) |
| Gong et al. (2019) | Case study | Triple bottom line (TBL) | Home appliances (home furnishing) |
| Hannibal and Kauppi (2019) | Survey | Triple bottom line (TBL) | Apparel industry (textile, footwear), food industry (agriculture), home appliances (consumer electronics, handicrafts) |
| Jabbour et al. (2019) | Literature review (finding research gaps) | Triple bottom line (TBL) | N/A |
| Jia et al. (2019) | Multiple case study | Triple bottom line (TBL) | Food industry (food processing and packaging, food and beverage), home appliances (home furnishing) |
| Lechler et al. (2019) | Multiple case study | Triple bottom line (TBL) | Machine/Machinery (railway industry), telecommunications, the healthcare industry (pharmaceutical industry) |
| Sauer and Seuring (2019) | Delphi study | Triple bottom line (TBL) | Minerals (mineral supply chain) |
| Villena (2019) | Inductive, multiple case studies | Triple bottom line (TBL) | Machine/Machinery (automotive, electronics), the healthcare industry (pharmaceutical industry) |
| Alexander (2020) | Qualitative case study | Triple bottom line (TBL) | Apparel industry (garment retail) |
| Lechler et al. (2020) | Cross-case study | Triple bottom line (TBL) | Machine/Machinery (automotive industry) |
| Nath et al. (2020) | Survey (exploratory, qualitative research) | Triple bottom line (TBL) | Apparel industry |
| Roy et al. (2020) | Hypothesis testing | Triple bottom line (TBL) | Apparel industry |
| Shibin et al. (2020) | Hypothesis testing | Triple bottom line (TBL) | Machine/Machinery (auto components industry) |
| Villena and Gioia (2020) | Inductive, multiple case study | Triple bottom line (TBL) | Machine/Machinery (automotive, electronics), the healthcare industry |
| Gong et al. (2021) | Case study | Triple bottom line (TBL) | Home appliances (home furnishing) |
| Govindan et al. (2021) | Literature review (conceptual framework development) | Social | N/A |
| Nath and Eweje (2021) | Survey | Triple bottom line (TBL) | Apparel industry |
| Wilhelm and Villena (2021) | Hypothesis testing | Triple bottom line (TBL) | Machine/Machinery (electronics) |
| Grimm et al. (2022) | Exploratory multiple case study | Triple bottom line (TBL) | Retail (food retail), the paper industry (print media, packaging), the healthcare industry (medical textile), machine/machinery (electronics (IT hardware)) |

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