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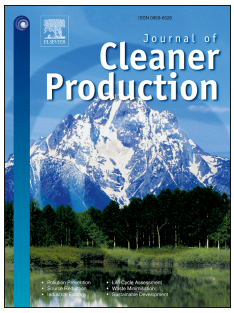

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Supply chain sustainability practices and governance for mitigating sustainability risk and improving market performance: A Dynamic capability Perspective

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Abstract

There is a genuine lack of a theoretically justified and empirically validated integrative scale for supply chain sustainability (SCS) in the extant literature. Further, literature is also void on the study of the interaction effect of SCS and governance in affecting SC performance through reducing risk. This research addresses these two significant research gaps. Drawing on dynamic capability view (DCV) and taking mixed methods research design approach this study develops and validates an instrument for measuring supply chain sustainability (SCS) in the context of apparel industry of a developing country. It then investigates the conditional direct and indirect effect of supply chain sustainability on performance through reducing sustainability risks at different levels of sustainability governance. Our findings suggest that SCS is a multidimensional construct consisting of four dimensions: social, environmental, economic (financial) and economic (production). The measurement instrument of SCS also satisfactorily correlates to the "technical" and "evolutionary" criteria of DCV. The findings also affirms that the conditional indirect effect of SCS on market performance via reducing sustainability risk is significant at higher levels of sustainability governance. This study contributes significantly to the body of knowledge by developing and validating a multidimensional scale of supply chain sustainability (SCS) and investigating its impact on market performance through a mediated-moderated modelling approach. In practice, the supply chain managers will be able to adopt appropriate SCS practices and governance mechanism to reduce sustainability risks and improve market performance. Implications of the study are highlighted.

Key words: *Supply chain sustainability, scale development, sustainability governance, sustainability risk, market performance, dynamic capability view*.

1. Introduction

Recent changes in stakeholder sustainability requirements, coupled with mounting interest in the area of supply chain sustainability (SCS) research, offer the promise of better SCS practices (Taticchi et al. 2015). Supply chain sustainability has been defined and

conceptualised in many different ways. Seuring and Muller (2008) (one of the highly cited publications) conducted a comprehensive literature review of sustainable supply chain and developed conceptual framework. Ahi and Searcy (2013) compared various definitions of SCS and offered their own comprehensive definition of SCS. Recently Ansari and Kant (2017) conducted a comprehensive literature review on sustainable supply chain management and expounded various research gaps in SCS area, primarily on the methodological aspect of SCS analysis. These and other relevant literature suggest that SCS comprises both measurement and performance aspects. Thus in line with the extant literature (Seuring and Muller 2008, Ahi and Searcy 2013, Ansari and Kant 2017; among others), in this paper we define SCS as "managing the supply chain functions aligned with the social, environmental, and economic sustainability requirements of the stakeholders to reduce sustainability risks in supply chain and improve market performance".

Freeman (1984) advocates that organisations must manage requirements of multiple stakeholders to achieve long-term success. However, stakeholder requirements change over time. As a result, organisations need dynamic capabilities to identify and meet changing stakeholder requirements (Beske 2012). Failure to comply with stakeholder sustainability requirements may trigger sustainability risks including consumer boycotts, reputational damage, labour disputes, financial loss, or expensive legal action (Busse et al. 2016; Foerstl et al. 2010; Boyd et al. 2007). Sustainability risks may damage the market and financial performance of companies and their supply chains (Giannakis and Papadopoulos 2016; Foerstl et al. 2010; Campbell 2007). Therefore, managing sustainability practices to mitigate sustainability risks is vital for supply chains (Kuosmanen and Kuosmanen 2009; Markley and Davis 2007). However, a comprehensive measurement scale for SCS that integrates multiple dimensions (and hence requirements of stakeholders) remains under-researched. For example, Gimenz and Sierra (2013) in studying the effects of governance mechanism dealt

with only environmental dimension of supply chain sustainability (SCS). The authors also acknowledged the limitation of supply chain environmental sustainability measurements and suggested future research in dealing with "triple bottom line" (both its measurements and effects of governance mechanisms). Morali and Searcy (2013) found that most of the studies on SCS dealt with either environmental or social dimension, but very few dealt with all three dimensions (environmental, social and economic) of SCS. The authors suggested an "integrative" (rather than separate) approach to SCS measurement. Most of the studies on SCS (Svensson et al. 2018; Mani et al. 2016; Tachizawa and Wong 2015; Shafiq et al. 2014; Klassen and Vereecke 2012; Ageron et al. 2012; Zhu et al. 2008; among others) have dealt with environmental sustainability, green supply chain management or social sustainability issues without focusing on an integrated measurement of stakeholder sustainability requirements. Amid this theoretical and empirical lacuna and grounded in DCV (Teece et al. 1997), this paper aims to:

(i) develop, test and validate a multidimensional supply chain sustainability measurement scale in an integrative manner in the context of apparel industry in a developing country.

In a recent study Paulraj et al. (2017) considered only environmental aspect of SCS in the study of motives and outcomes of SCS. The authors, however, acknowledged that measurements of SCS are "contextually and culturally dependent" and suggested future research on SCS should be conducted in the Asian context where manufacturers are "making profound impact on global ecological system". Our study on SCS is conducted on the apparel industry of Bangladesh, which has the second largest apparel industry in the world (https://www.thedailystar.net/business/export/bangladesh-remains-the-second-biggest-apparel-exporter-1614856; accessed on November 27, 2019). However, apparel industry in Bangladesh are also beset with numerous challenges and problems. For example Chowdhury and Quaddus (2015) identified a number of challenges as labour unrest, poor wages, unsafe

working environment, political instability, problem of utility supply, inefficient port and customs, volatile exchange rate, problem of on time supply of supply of fabrics and accessories, intensive competition, inefficient operations, strict compliance on sustainability standards, among others. Apparel supply chain is global in nature as supply side is mostly occupied by the emerging and low production cost countries. Thus global apparel supply chains are facing numerous challenges which are presented by many authors in the existing literature. Chowdhury et al. (2018) analysed the supply side challenges and identified the major challenges related to inbound supply problem, lack of institutional support, suppliers' disruptions, management inefficiency, production workers' inefficiency and different incidental disruptions. In Indian context Venkatesh et al. (2015) found that Globalization, labor issues and security and safety of resources are the major challenges of global apparel supply chain. Fontana, E., & Egels-Zandén, (2019) focused on challenges relating to human rights violation and CSR engagement at upstream supply chain. Boström and Micheletti, M. (2016) identified challenges such as lack of policy and legal framework of the sourcing countries to govern sustainability issues in a complex supply chain which makes supply chain governance difficult. Many studies (e.g. Akbar and Ahsan 2019; Chowdhury et al. 2019; Yadlapalli et al 2018; Chowdhury and Hossain 2015) identified that the problems relating to violation of social and environmental standard and consequential reputation loss as major challenges in global apparel supply chain. Our current research focusses on the governance issues of SCS in the context of Bangladesh apparel industry, which will mitigate many of the challenges expounded above. This study will thus make significant contribution to the extant literature.

Extant Studies (Keetinger et al. 1994; Dauvergne and Lister 2012) posit that proper management of SCS practices has an influence on mitigating the risks arising from non-compliance with stakeholder sustainability requirements. Dauvergne and Lister (2012)

propose that sustainability governance may reduce supply chain sustainability risks. However, there is a dearth of empirical research on the role of sustainability governance in managing sustainability and performance (Tachizawa and Wong 2015). For example, Vurro et al. (2009) proposed theoretical models of SCS governance based on supply chain network density and centrality of focal organizations. The authors suggested empirical testing of the SCS governance models. In a recent qualitative study Huq et al. (2018) identify factors contributing to the decoupling from the social sustainability practices by the apparel industry suppliers. Addressing suppliers' decoupling is in fact a supply chain governance issue (Boxenbaum and Jonsson 2017). Huq et al (2018) offers various propositions for proper governance of the decoupling factors and suggest future (empirical) "social sustainability-relationship studies".

Sustainability practices in supply chains do not always ensure performance unless focal firms establish appropriate governance mechanisms (Dauvergne and Lister 2012). Excellent sustainability practices among some supply chain members may become ineffective because of the risk arising from poor sustainability practices among other supply chain members (Faruk et al. 2001). It is argued herein that SCS governance has the potential to reduce such risks, improving supply chain performance. For example, since the Rana Plaza building collapse in 2013, the governance mechanism of the Alliance for Bangladesh Worker Safety has played an important role in improving work conditions, reducing sustainability risks (Alliance for Bangladesh Worker Safety 2017). Most of the SCS governance literature deals with (or propose) how governance affects SCS which in turn influences performance (Vurro et al. 2009, Gimenz and Sierra 2013, Paulraj et al. 2017, Ehrgott et al. 2011, Yadlapalli et al. 2018; among others). To the best of authors' knowledge literature is void on the study of the interaction effect of SCS and governance in affecting SC performance through reducing risk. Hence second aim of this research is to:

(ii) Investigate the conditional direct and indirect effect of supply chain sustainability on performance through reducing sustainability risks at different levels of sustainability governance.

This study is grounded in dynamic capability view (DCV) (Teece et al. 1997, Teece 2007). We argue that dynamic capability is needed to identify dynamic stakeholder requirements and translate those requirements to sustainability practices (Beske 2012;Hong et al. 2018). In the existing literature (for example, Morali and Searcy 2013; Ageron et al. 2012; Ashby et al. 2012 and others), sustainability practices mainly are categorised as economic, social or environmental. We envisage that components of SCS practices are dynamic in nature, heavily dependent on the requirements of diverse stakeholders and changing market scenarios. Capabilities needed to meet dynamic stakeholder requirements around sustainability or to mitigate risk arising from non-compliance of sustainability practices are not adequately addressed in relevant theories (Foerstl et al. 2010). Aligned with DCV (Teece et al. 1997, Eisenhardt and Martin 2000), we argue that SCS practices require dedicated processes and reconfiguration of resources based on changing stakeholder sustainability requirements. We assert that development and use of "contextually and culturally dependent" measurement scale of SCS (Paulraj et al. 2017) and corresponding governance mechanisms are the dynamic capabilities (Beske 2012) needed to support the dynamic stakeholder sustainability requirements. Teece (2007) proposes two yardsticks for assessing dynamic capability: 'technical' and 'evolutionary' fitness. Technical fitness refers to "how effectively a capability performs its function", while evolutionary (or external) fitness refers to "how well the capability enables a firm to make a living" (Teece 2007). The "contextually and culturally dependent" measurement scale of SCS (Paulraj et al. 2017) that we develop in this paper conforms to the concepts of "technical" and "evolutionary" fitness criteria of DCV (Teece 2007). The SCS governance, on the other hand, is an important microfoundation of dynamic

capability as Teece (2007) states "the development of governance mechanisms ….are foundation to dynamic capability".

Above discussions highlight how our current study operationally adapts the foundations of DCV in terms of developing a contextual SCS scale and governance mechanism. This study thus makes several contributions to SCS theory and practice. First, relying on DCV, this study develops and validates a multi-dimensional measurement scale for SCS, which primarily consists of social, environmental, and economic dimensions. Second, this study examines the interactions of SCS and sustainability governance via investigating the conditional direct and indirect effect of SCS on market performance through reducing sustainability risks at different levels of sustainability governance. Third, supply chain managers will benefit from the findings of our research, which will help them to adopt appropriate SCS practices to reduce sustainability risks and improve market performance. Our research will also help managers analyse the role of sustainability governance in reducing sustainability risk.

The remaining sections of this paper are structured as follows: literature review, research instrument development process, instrument testing, confirmatory study, discussion and implications, and limitations and directions for future research.

2. Background Literature and Hypotheses

Sustainability has expanded beyond organisational boundaries in the business world, as stakeholders exert pressure towards implementation of sustainability practices across the entire supply chain (Gold et al. 2010). Therefore, sustainability in supply chain management has become an issue of focus in academic and corporate settings (Seuring and Muller 2008). Nevertheless, fundamental issues still need to be addressed to achieve supply chain

sustainability (Pagell and WU 2009). In the following subsections we critically review relevant extant literature and present the hypotheses.

2.1 Dimensions of supply chain sustainability

The existing literature on SCS mainly focuses on the concept of the triple bottom line put forward by Elkington (1999) and thus concentrates on social, environmental and economic dimensions of SCS (Carter and Rogers 2008; Carter and Easton 2011). However, stakeholder sustainability requirements are dynamic as well as idiosyncratic to industry and market requirements. The triple bottom line of social, environmental and economic dimensions is the foundation of numerous sustainability standards in business, including the Global Reporting Initiative (GRI 2011), International Standard Organizations (ISO) 14001, and Dow Jones Sustainability Index (Delai and Takahashi 2011). However implementing these sustainability standards could be costly and they also suffer from lack of "harmonization and equivalence", and "transparent governance" mechanism (UNFSS 2013). Relying on the typology of products, services and operations, conceptual frameworks of sustainability measurement have been discussed in different contexts (Hutchins and Sutherland 2008; Labuschagne et al. 2005; Vasileiou and Morris 2006).

From an organisational standpoint, **social sustainability** influences the effects of organisational activity on stakeholders (Delai and Takahashi 2011). In sum, social sustainability can be measured by indicators including fair wages, safe work environments, other health and safety factors, the presence of child or forced labour, and employee satisfaction; among many others (Carter 2004; de Brito et al. 2008; GRI 2011; Shafiq et al. 2014). Table 1 lists factors associated with social sustainability. It is noted from Table 1 that

indicators of social sustainability varies from donation to charity to child labour to customer satisfaction, hence quite broad in nature. To make social sustainability "contextually and culturally dependent" (Paulraj 2017) and identify relevant sub-factors/indicators we shall conduct a qualitative field study.

The **environmental dimension of sustainability** revolves around the environmental friendliness of corporations and their operations (Chien and Shih 2007; de Brito et al. 2008; Tan et al. 2002). For the purpose of this research, the environmental dimension considers environmental stakeholder requirements such as pollution prevention, waste disposal, recycling, environmental audits and environmental performance evaluation of suppliers (Zhu et al. 2005; Chien and Shih 2007; de Brito et al. 2008; GRI 2011). Table 1 also lists factors associated with environmental sustainability. The range of factors reveal that environmental dimension is indeed a multidimensional factor. Again, to explicate "contextually dependent" environmental sustainability dimension this study conducts a qualitative filed study.

The **economic dimension of sustainability** refers to the short- and long-term economic value of organisational activities (Delai and Takahashi 2011). The primary focus is on the long-term economic prosperity of an organisation. In measuring economic sustainability practices, while maintaining social and environmental responsibilities, indicators such as share value, profitability, sales growth and debt-equity responsibilities, among others, are evaluated (Delai and Takahashi 2011). Table 1 lists factors associated with economic sustainability. As mentioned earlier the specific economic dimension in the context of SCS will be explicated via qualitative field study following some guiding principles from the extant literature (Sethi et al. 2011, Choi and Ng 2011).

Studies of sustainable development and corporate social responsibility have outlined conceptual frameworks for sustainability measurement. However, sustainability measurement lacks a cohesive focus for measuring economic, social and environmental dimensions in an

integrated fashion in the context of supply chain (Adams and Frost 2008; Labuschagne et al. 2005; Singh et al. 2009). More significantly, empirically tested measurement scales of SCS that incorporate social, environmental and economic issues are rare and thus have become the foremost concern of supply chain management research.

[Insert Table 1]

2.2 Sustainability Risk and Mitigation

While the term "Risk" is widely used across various disciplines, its concept is "heterogeneous and inconsistent" as its definition and use is contextually dependent (Heckman et al. 2015). In studying the evolution of "Risk" Heckman et al. (2015) mention strong connection between probability theory and risk. This notion of probability in risk assessment is highly relevant in the supply chain context. In supply chain setting two other concepts deserve attention: disruption and vulnerability. Supply chain disruption is triggered by various events (eg. political unrest, demand fluctuation, natural disaster, infrastructure inadequacy, quality issues; among many others). However these are characterized by probability of occurrence and degree of severity (Wagner and Bode 2008, Heckman et al. 2015). Heckman et al. (2015) further state that these disruptive events are the major determining factors of supply chain risk. Vulnerability, on the other hand, is the "susceptibility of the supply chain to the consequences of disruptive events" (Chowdhury and Quaddus 2015, Heckman et al. 2015). Hence, in short, supply chain risk is a function of supply chain disruption and its vulnerability (Risk = f(disruption, vulnerability)).

In this paper we define sustainability risk as the risk instigated by various sustainability issues in the supply chain (economic, social and environmental) (Xu et al. 2019, Hofmann et al. 2014). Hence, various disruptions will be due to supply chain sustainability issues, primarily

lack of compliance of various sustainability measures, which may result in bad media publicity resulting in consumer boycott of products (Hofmann et al 2014), in other words "adverse reactions by various stakeholders" (eg. customers, suppliers, government agencies, industry partners, investors; among others). There are limited literature in explicating sustainability supply chain risk. For example see Giannakis and Papadopoulos (2016), Foerstl et al. (2010), Xu et al. (2019), Hofmann et al. (2014); among others. We adapt some of the relevant sustainability supply chain risk in our case, which is further contextualized via qualitative field study.

In the context of existing supply chain sustainability challenges in global apparel supply chain following studies offer various models to mitigate the sustainability risks. For example, considering an emerging economic context Chowdhury et al. (2018) suggested an AHP integrated QFD based model to select best strategies to mitigate supply side challenges. Similarly, Chowdhury and Quaddus (2015) developed a multi-objective optimization model for building a resilient supply chain. Further, using Interpretative Structural Modelling (ISM) and Fuzzy MICMAC methodology, Venkatesh et al. (2015) offers a model for the Risk Priority Number (RPN) calculation. On the other hand, from developed countries' context, Roos et al. (2016) suggested a life cycle assessment (LCA)-based approach to guide Swedish apparel industry for achieving sustainability and mitigating sustainability risks. Börjeson et al. (2015) suggested strategies for knowledge gathering and use to mitigate knowledge challenges for responsible supply chain management of chemicals in textiles. To mitigate environmental sustainability challenges, Oxborrow and Claxton (2016) offers strategies to ensure design for Clothing Longevity. In the context of luxury clothing supply chains Robinson and Hsieh (2016) find reshoring strategy to mitigate the brand crisis challenge.

As will be discussed later we surmise that proper governance of supply chain sustainability practices will help reduce the sustainability risks and improve market performance. To this end we adopt an analytical approach to substantiate our conjecture.

2.3 Supply chain sustainability through the lens of dynamic capability

Supply chain sustainability practices are essential for organisations to achieve social, environmental and economic goals that arise from customer and stakeholder requirements (Seuring and Muller 2008). According to Freeman (1984), as time passes, organisations face different types of changes and challenges from internal and external stakeholders, such as customers, suppliers, governments, competitors, pressure groups and others. In such conditions, organisations must develop capabilities (as well as design strategies) to respond to environmental change (Freeman, 1984). Beske (2012) defines such capabilities as dynamic abilities to respond to the external environment and to changing stakeholder requirements. The dynamic capability view (DCV) develops appropriate resources and capabilities so that organisations can respond to situation-specific changes (Teece et al. 1997; Eisenhardt and Martin 2000) and adapt to the idiosyncrasies of dynamic markets. Further, DCV explains how companies can achieve a competitive advantage in a dynamic market environment (Teece et al. 1997; Eisenhardt and Martin 2000). Chowdhury and Quaduus (2017) also find that identifying changes and uncertainties in the environment, along with selecting appropriate capabilities to mitigate the risks arising from an uncertain environment, are dynamic capabilities. Along this line and relying on DCV, we argue that firms need dynamic

capabilities to identify, adapt and respond to dynamic stakeholder sustainability requirements. In turn, dynamic capabilities help to mitigate vulnerabilities arising from sustainability risks.

Capabilities as discussed above are organizational (firm) capabilities as per dynamic capabilities view (DCV). However firm level capabilities are a combination of various resources as physical, human, various firm assets, including 'competencies' of human resources (Eisenhardt and Martin 2000). Hence the term 'combination capabilities' is also used to describe dynamics capabilities (Kogut and Zander 1992, Eisenmhardt and Martin 2000). Helfat and Peteraf (2015) state that along with physical capabilities managers should also possess cognitive capabilities to effectively produce the microfoundations of dynamic capability. Hence human capabilities (along with other appropriate resources) are essential component of producing dynamic capabilities of organizations.

Failure to select and implement appropriate sustainability practices may lead to risk factors for organisations, such as reputation loss, costly law suits and consumer boycotts. For example, branded apparel retail chains including Levi Strauss, Nike, Benetton, Adidas, Disney and C & A have faced consumer boycotts and close scrutiny from stakeholders as a result of revelations about sweatshop labour in their upstream supply chains (Busse et al. 2016; Seuring and Muller 2008; Preuss 2001). On the other hand, meeting stakeholder sustainability related expectations creates positive value for firms (Islam and Deegan 2008; de-Brito et al. 2008). Further, reducing environmental impact and ensuring fair treatment of employees improves firms' reputational image, enhancing their market value (Giannakis, and Papadopoulos 2016; 2001).

Foerstl et al. (2010) posit that selecting effective sustainability practices to mitigate sustainability risks is also a dynamic capability for organisations to enhance their competitive

advantage. We hence argue that sustainability practices may reduce firms' risk of reputational loss, improving the market performance of firms and their supply chains. As proposed by DCV, selecting appropriate sustainability practices to reduce sustainability risks can be attributed to defining the path of competencies during changing market scenarios (Teece et al. 1997; 2007). Such competencies will improve firms' market performance. Therefore, drawing on the DCV and above discussion we propose the following hypotheses:

H1: Supply chain sustainability practices are positively associated with market performance.

H2: Sustainability practices improve market performance through reducing sustainability risks in the supply chain.

2.4 Sustainability governance and its impact on performance

Organisations need to manage sustainability practices effectively to reduce the losses arising from non-compliance of sustainability standards of supply chain partners and thus enhance performance. Tachizawa and Wong (2015) describe the importance of sustainability governance in managing sustainability and improving performance. An absence of proper sustainability governance may result in poor sustainability practices among supply chain partners, posing risks to the entire supply chain (Faruk et al. 2001). As a result, focal companies have also implemented governance approaches to sustainability in addition to implementing sustainability-related actions (Maignan et al. 2002). Vurro et al. (2009) found that, along with monitoring and auditing, the adoption of collaborative and incentives-based governance mechanisms among supply chain members were needed to achieve sustainability in the supply chain. Bhattacharya et al. (2009) and Tencati and Zsolnai (2008) found that buyer-supplier relational and collaborative approaches to governance were effective in achieving sustainability in the supply chain. Further, sustainability governance based on high

levels of cooperation and integration among supply chain partners accelerates the pace of sustainability through increased trust and commitment among supply chain partners (Jiang 2009). Such governance approaches may assist supply chain members to adopt sustainability practices, reduce sustainability risks in the supply chain and improve performance (Dauvergne and Lister 2012). Based on the above arguments it can be hypothesised that:

H3a: Sustainability practices directly enhance market performance at higher levels of sustainability governance.

H3b: Sustainability practices indirectly enhance market performance through reducing sustainability risks at higher levels of sustainability governance.

3. Instrument Development Process

In order to develop and validate an instrument for measuring SCS, in line with Chowdhury and Quaddus (2017) and Rosenzweig and Roth (2007), we followed the systematic procedure shown in Table 2. It is noted that the procedure outlined in table 2 essentially follows the principles of mixed method research (a combination of qualitative and quantitative method) (Creswell and Clark 2017). Molina-Azorin (2012) mentions that "a key feature of mixed methods research is its methodological pluralism, which frequently results in superior research compared with that of monomethod designs". Mixed method approach has the advantages of "triangulating" of the findings, "using results of one method to inform the other", "yielding enriched and elaborated understanding of the research phenomenon"; among many others (Molina-Azorin 2012). Our research involves developing an instrument for supply chain sustainability in the context of Bangladesh apparel industry. This calls for developing a "contextually and culturally dependent" instrument (Paulraj et al. 2017). Hence,

mixed method design (qualitative followed by quantitative method) is an appropriate research approach in our case.

This study commenced with examining commonly cited items for different dimensions of SCS, as outlined in the previous section. Through this process, three key dimensions of SCS were identified: social, environmental and economic sustainability (see Table 1 for lists of measurement items in each of the sustainability dimensions). Our literature review found the consensus that sustainability is multidimensional in nature. However, sustainability dimensions and practices may vary in different contexts based on changes in stakeholder requirements and hence "contextually and culturally dependent" measurement scale of SCS (Paulraj et al. 2017) needs to be developed. We, therefore, conducted a field study to reveal the dimensions and affirm the contextual appropriateness of the dimensions identified in the literature. Findings from the qualitative study were then justified based on existing literature. Item creation and item sorting for scale development followed this.

[Insert Table 2]

3.1 Qualitative study

The apparel industry of Bangladesh, one of the leading exporters of apparels in the world, was the study context. Bangladesh's apparel industry accounts for 78.6% of the country's total export earnings and employs over four million people, of whom 80 per cent are women. Bangladeshi apparel exports were valued at $19.90 billion USD in 2011, making Bangladesh the second largest apparel exporter in the world (BGMEA 2012). In spite of the Bangladeshi textile industry's projected growth supply chain challenges have hindered its sustainability. These include human rights violations, poor wages and working environments, pollution, unstable political environments, interrupted utility supply, inefficient customs and port

operations, a fluctuating exchange. rate, long lead. times, intense competition, and poor quality fabric and accessory supplies (Chowdhury. and Quaddus 2017; 2015; Haider 2007; Islam and Deegan 2008; Nuruzzaman. 2009). In light of these challenges and the textile industry's economic significance for Bangladesh, attaining SCS is an important goal for Bangladeshi companies.

In the qualitative part of this study, data were obtained through 15 in-depth interviews from apparel manufacturing supply chain decision makers and their suppliers. Table 3 shows the profiles of interview participants. It is noted that all interviewees hold high level managerial positions in their respective companies, thus justifying their suitability to take part in this phase of the study. There was a mix of garments manufacturers and accessory suppliers and by number of employees the participating companies were medium to large size. Interviews lasted approximately 45 to 60 minutes. Interviewees were selected based on convenience sampling. to ensure data quality. Participants were asked questions regarding sustainability practices, risks and sustainability governance issues of their organisation and supply chain. Interview responses were recorded and then transcripts were produced. Based on qualitative content analysis (Hsieh and Shannon 2005) the interview transcripts were analysed to derive various SCS dimensions. The analysis showed that the SCS dimensions are about social issues (e.g., "We satisfy the health and safety requirements"), environmental sustainability issues (e.g., "we take measures to reduce environmental pollution") or economic factors (e.g., "we need more sales to continue business") which reflected the multi-dimensional nature of SCS. Table 4 shows some samples of actual quotes which justify the derived sustainability dimensions (themes).

(Insert Tables 3 and 4 here)

The economic dimension in table 4 shows a mix bag of issues. The full analyses revealed that some of the quotes are related to "financial" aspect of the economic dimension ("profit",

"cost", "market share"), while others deal with "quality", "conformance", "reliability" (e.g., "we need to meet quality, design, specifications, lead time, on time supply..."). In line with existing literature (Delai and Takahashi 2011, Varsei and Polyakovskiy 2017, Kusi-Sarpong et al. 2019, Choi and Ng 2011) we have labelled them "production" aspect of economic dimension. In articulating the economic sustainability Seth et al. (2011) propose two dimensions of economic sustainability: one is firm centric (financial aspects of the firm) and the other is stakeholder centric (satisfying the stakeholders' requirements). This justifies our second economic dimension (production aspect of economic sustainability) which satisfies various stakeholders' requirements (in terms of quality, lead time etc.). Kusi-Sarpong et al. (2019) consider product cost reduction, enhanced value to customers and reduction in material consumption as sub-dimensions of economic sustainability. In designing sustainable supply chain network Varsei and Polyakovskiy (2017) consider optimized production cost as one of the main criteria of economic sustainability. All these extant literature support our two prone economic sustainability dimension: economic (finance) and economic (production). This is further analytically validated through exploratory factor analysis which is shown later in the paper.

Table 5 presents the full list of factors and variables derived from the field study, which contextualise sustainability factors for the apparel supply chain in Bangladesh. The dimensions identified from the filed study were justified based on existing literature and theory. Thus items in Table 5 conform to items shown earlier in Table 1. During the research process for this study, some items from Table 1 were omitted because of their limited relevance to our context. On the other hand, new items of sustainability measurement were introduced (e.g., economics (production) sustainability items) as the field study produced strong support for those items.

[Insert Table 5]

Based on findings from the qualitative phase of this study and the hypotheses presented earlier, we propose a research. model (see Figure 1). It is revealed that contextually dependent supply chain sustainability (SCS) and sustainability governance (SG) are the dynamic capabilities (as argued earlier) of the firm. The sustainability dimensions of SCS (social, environmental, economic (financial) and economic (production)) are also shown in the research model. In line with previous studies (e.g., Shafiq et al. 2014; Zhu et al. 2005; Khan et al. 2016) and following the guidelines of Jarvis et al. (2003) we operationalise SCS measurement scales as a reflective model. It is noted that SCS is the independent variable and market performance (MP) is the dependent variable, while sustainability risk (SR) is the mediating variable. SG is the moderating variable, which moderates the relationship between SCS → MP and SCS → SR. The control variables are firm size and age. The relationships among the variables in the model have been hypothesized earlier in H1 to H3b.

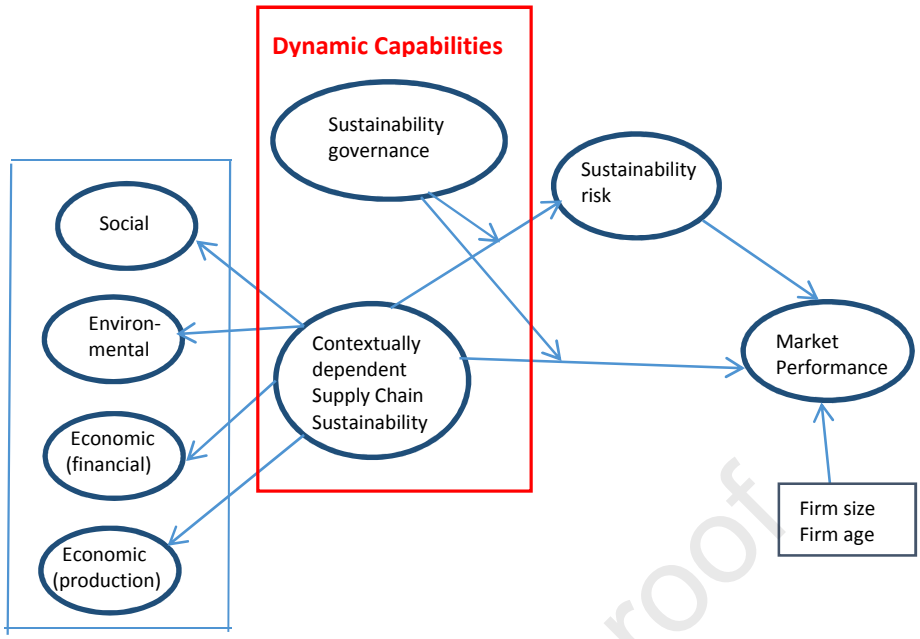

Figure 1: Supply chain sustainability model.

3.2 Scale development

In the process of developing scales for dimensions of SCS (i.e. social, environmental, economic (financial) and economic (production)), items were created, and data were sorted and refined. Creation of items and the process of sorting and refining data were undertaken to ensure content validity by determining the convergence and divergence of items under each dimension (Chowdhury and Quaddus 2017).

3.2.1 Item creation and sorting

To create the initial pool of items under each construct, we reviewed the existing literature on supply chain sustainability, green supply chains, environmental sustainability in supply chains, as well as social sustainability in supply chains. Items were identified and adopted from existing studies (see Table 1). Additional items were created through qualitative study (see Table 5). To develop scales for SCS, most items were adapted from existing studies as shown in Table 1. However, items for economic (production) sustainability were mainly

developed from field study findings. Theoretical justification was established to confirm the content validity of the constructs.

Once the scale items were summarised based on literature and field study support, five experts were invited to justify the SCS measurement items in the context of the Bangladeshi apparel industry. One expert was an academic in the field of supply chain sustainability, one was an industry leader from the Bangladesh Garment Manufacturers and Exporters Association, and three were supply chain management professionals from a leading apparel manufacturing company in Bangladesh. In the first round, the experts were asked individually to judge whether the measurement items were relevant to SCS and to classify the items based on sustainability. In the second round, the experts were asked to classify the randomised items into first-order factors or constructs of SCS. From this round, we retained items which matched more than 80% of the cases in classification schema. In this process, three items were excluded (SCS10, SCS21 and SCS30) from Table 5, leaving 27 items.

3.2.2 Drafting the questionnaire and item purification

A primary version of our questionnaire was prepared using a 6-point Likert scale (ranging from ‘strongly disagree’ to ‘strongly agree’), to negate neutral responses and bias (Blumberg, Cooper and Schindler 2008). The questionnaire was given to four supply chain managers from apparel manufacturing companies, three managers from accessory producing companies and three supply chain academics. Based on the initial responses it was noted that some statements. of the questionnaire needed further clarification. For example, one respondent queried the intention of the statement “different specification of the buyers”. The initial feedback assisted in the development of the final questionnaire. which was then administered for the pilot study to test the instrument.

4. Instrument Testing

4.1 Pilot study

Based on the feedback from the pre-test, a pilot survey was conducted to ensure the applicability. of the questionnaire with real respondents (see supplementary materials for survey questionnaire). Using the convenience sampling method, respondents were selected from the list of apparel manufacturers and accessories producers in the Bangladesh Garment Manufacturers and Exporters Association (BGMEA) members list (http://www.bgmea.com.bd/member/memberlist). Supply chain decision makers were initially approached via phone and informed about the aim of our research. 79 managers greed to participate in the study of which 54 managers were from apparel manufacturers and 25 from accessory supply companies. Questionnaires were distributed and a total of 73 usable responses were obtained for the pilot study. To assess the initial measurement scale, we conducted an exploratory factor analysis (based on the pilot study data) using varimax rotation (see table 6). We evaluated the appropriateness of the factor analyses by implementing Kaiser Meyer Olkin (KMO) and Bartlett's tests. The KMO test affirmed the measure of sampling. adequacy as it was 0.90 (>0.50). Bartlett's test of sphericity provided evidence for the validity of the instrument as it was 1450.125 (df = 312, significant at p = 0.000). Four factors with eigenvalue >1 were extracted, and after rotation, they were 3.368, 2.725, 1.896, and 1.564, respectively. The sum of squared loading from the components had a cumulative. value of 72.3% in explaining the total variance in data. Table 6 shows four distinct factors. Factor 1 reflects social sustainability. Factor 2 is environmental sustainability. While factors 3 and 4 are economic - production and economic – financial sustainability dimensions respectively. It is noted that exploratory factors analysis (table 6)

empirically validates dual dimensions of economic sustainability (finance and production) which was initially derived in the field study and theoretically supported.

In evaluating the result of factor analysis, items were deleted that had a loading of <0.50 or had cross loadings (>.5) with other factors (see Table 6). In this process, SCS4, SCS6, SCS9, SCS10, SCS18, SCS19, and SCS24 were deleted from the items of Table 6. The remaining 20 items (out of 27) were retained for the next round of factor analysis. Items under different dimensions of supply chain sustainability were selected using a Cronbach's alpha coefficient and composite reliability with minimum threshold value of 0.60 and 0.7, respectively, to ensure the reliability of the psychometric properties (Straub et al. 2004) (see Table 7). Finally, item pools were created for the four supply chain sustainability dimensions following a thorough examination of the existing items and elimination of redundant items.

[Insert Table 6]

[Insert Table 7]

4.2 Confirmatory study

We ran confirmatory factor analysis (CFA) to assess the refined instrument thoroughly over a larger group of samples to further justify validity of the instrument. We sent survey questionnaire by email and postal mail to 655 supply chain professionals of apparel companies. We received responses from 289 respondents comprising 236 early respondents and 53 late respondents. However, 262 were usable responses consisting of 179 apparel manufacturers and 83 suppliers (accessory producers) (see supplementary materials for profiles of respondents). This study deployed partial least square (PLS) based structural equation modelling, as PLS helps to achieve more efficient models in assessing a multidimensional and hierarchical model (Akter et al. 2013; Chowdhury and Quaddus 2017). To estimate the higher order construct of SCS, this study used the repeated indicator

approach so that the whole nomological network could be employed in the lower order and higher order levels (Becker et al. 2012; Wetzels et al. 2009). This study also used the nonparametric bootstrapping technique (Efron and Tibshirani 1993; Wetzels et al. 2009) to find the standard errors of the estimates. A non-response bias test was conducted on the early and late respondents (Armstrong and Overton 1977). Table 8 shows that response bias was not a problem in this research.

[Insert Table 8]

In order to reduce the problem of common method bias *ex-ante*, following Podsakoff et al. (2003), several initiatives were undertaken. First, data was collected from relevant knowledgeable respondents. Second, questionnaire was designed using simple plain English language to avoid ambiguity. Third, questions related to independent and dependent variables were addressed separately in the questionnaire. An observatory approach and statistical approach were also engaged (Chen et al. 2013) as *ex-post* measures. In the observatory approach, we found that the inter-correlations among the constructs (Table 10) posed no problem as high correlation did not exist among the construct. In the statistical approach, we found that construct correlation was low with the marker variables ("transportation in Chittagong is better than other cities in Bangladesh"). Therefore, based on multiple techniques of testing the common method variance, we found that our results were not influenced by common method variance.

4.2.1 Assessment of the first-order construct

The results of the CFA using PLS (Table 9) show that item loadings for first-order. constructs were > 0.5 and significant at $p < 0.01$. In addition, all average. variance. extracted (AVE) and composite reliability (CR) values surpassed the minimum. thresholds of 0.5 and 0.8,

respectively (Fornell and Larcker 1981; Hair et al. 2011). Further, item loadings of the corresponding construct were greater than the loading with any other constructs. The square root of AVE was greater than off-diagonal. elements. across the row and down. the column (Table 10), establishing the discriminant validity of the measurement model. Thus, the measurement model was satisfactory in light of the evidence for the adequacy of its psychometric properties (convergent validity and discriminant validity). It is noted that all these statistically justify the reliability and validly of the SCS instrument. However as our instrument development process involved qualitative field study it also reflects the opinion of the professionals from the apparel industry in Bangladesh. Hence the SCS instrument also has the real world industry validation.

[Insert Table 9]

[Insert Table 10]

4.2.3 Hypothesis testing and assessing predictive validity

An assessment of the predictive validity of SCS was conducted by examining its direct and indirect relationship with the outcome construct of market performance through reducing sustainability risks at different levels of sustainability governance practices (SCS-governance interaction). In the process of hypothesis testing, we controlled for firm size (number of employees), and firm age (number of years in business) based on our assumption that larger firms and firms with long time experience would have better market performance. Results of hypothesis testing are shown in Table 11.

[Insert Table 11]

We found a standardised beta coefficient of the link between supply chain sustainability and market performance (without mediation) of 0.868 *(t* = 28.75, R^2 = 0.754, see Model 1 in

Table 9). This finding was significant, leading to the acceptance of Hypothesis 1 (*H1*) that supply chain sustainability has a positive impact on market performance. In addition, this finding established the predictive validity of our model (Akter et al. 2013). We also tested the impact of SCS on market performance while sustainability risk mediated this relationship. The results satisfied the condition of mediation suggested by Hayes (2013) as the direct effect was 0.865, which is significant *(t* = 14.205, see Model 4 in Table 11). The indirect effect was 0.2036, which was also significant (LLCI = 0.1055 and ULCI = 0.3057, see Model 4 in Table 11). Thus, Hypothesis 2 was accepted. The conditional direct effect of sustainability practices on market performance and indirect effect through reducing sustainability risk at different levels of sustainability governance were tested. Our results showed that the conditional direct effect was insignificant in Model 3 (β = 0.0403, *t* = 1.028) which did not support our Hypothesis 3a. However, when we ran Model 6, our result showed that our indirect effect was significant (effect = .0708 at LLCI = 0.0239 and ULCI = 0.1669), supporting our Hypothesis 3b.

We conducted post hoc analysis in order to explore these findings more deeply. Our post hoc analysis showed that a conditional direct effect of 0.5564 at mean -1 standard deviation of SG, LLCI = 0.3938 and ULCI = 0.7190. The conditional direct effect was 0.6977 at mean +1 standard deviation, LLCI = 0.5087 and ULCI = 0.8866. Further, the conditional indirect effect at mean -1 standard deviation was 0.0334, LLCI = 0.0005 and ULCI = 0.1175. On the other hand, the conditional indirect effect at mean +1 standard deviation was = 0.1082, LLCI = 0.0379 and ULCI = 0.2171. Therefore, the mediation of sustainability risk mitigation will be more effective when supply chain sustainability governance is high. This highlights the significant interaction of effect of SCS and governance in improving market performance through reducing the supply chain risk.

Based on above findings and tests of hypotheses figure 2 below shows the final model (model 6 of table 11). The β and t values in the figure clearly shows the acceptance and rejection of various hypotheses.

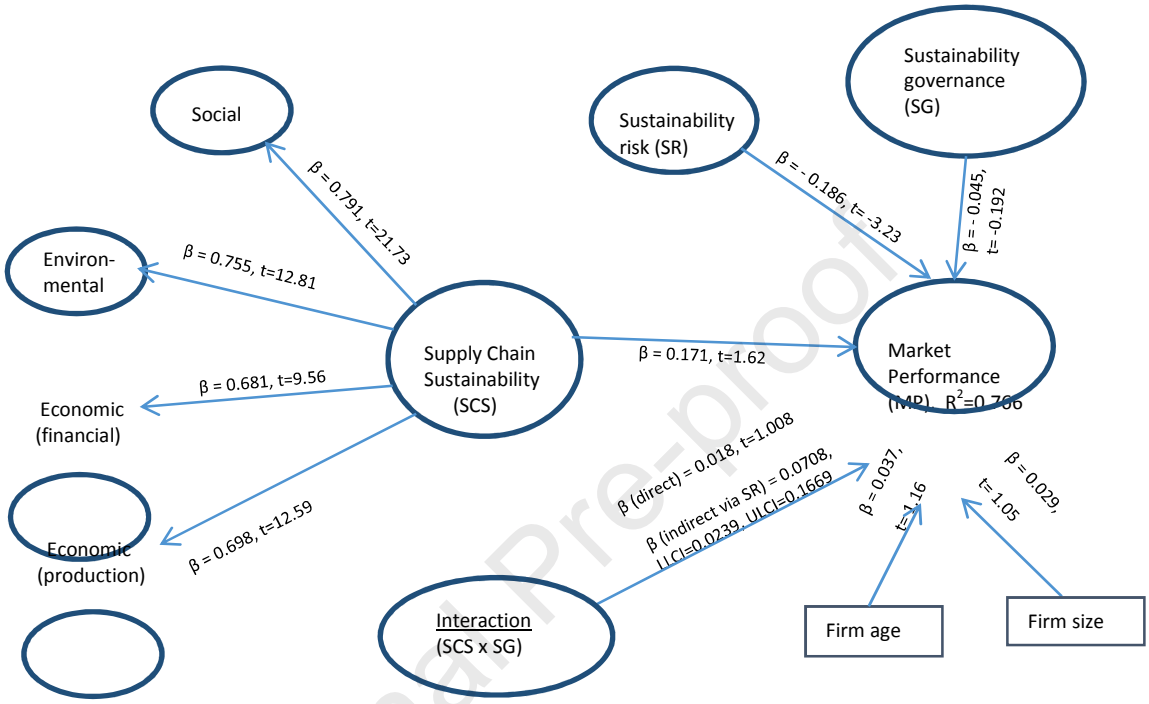

Figure 2: Final model (model 6 of table 11)

5 Discussion and Implications

5.1 Summary of findings

The existing literature suggests that organisations should ensure SCS to reduce sustainability risks and to enhance market performance. However, there are no theoretically justified and empirically validated scale for measuring SCS which is also "contextually and culturally dependent" (Paulraj et al. 2017). Developing a reliable and valid scale to fill this gap in the existing SCS literature was a prime goal of this study. Our study makes a significant contribution to SCS theory, method and practice through the development of a multi-

dimensional supply chain sustainability measurement instrument. A number of systematic processes were developed to empirically validate the measurement instrument and support our multi-dimensional supply chain sustainability scale.

Our findings suggest that the apparel supply chain in Bangladesh adopts sustainability practices on four fronts (social, environmental, economic (financial) and economic (production)) to meet the requirements of internal and external stakeholders. One unique finding of this study is its exploration of dual dimensions of economic sustainability—that is, economic (financial) and economic (production) within the apparel supply chains in Bangladesh. Previous studies (Stank et al. 2003; Bateman and David 2002) have supported the relevance of various production economic issues for organisations. and their supply chains. Most SCS studies have focused on social, environmental and mono-economic features of sustainability; exploration of dual economic sustainability of our study is thus very unique. Our findings also support the well-known customer (stakeholder) centric approach to sustainability of Seth et al. (2011) thus adding new knowledge to the extant literature.

To compare our findings with extant studies we present a snapshot of similar studies in countries surrounding Bangladesh. Zailani et al. (2012) studied the performance of sustainable supply chain (SSC) in the context of Malaysian industries. The authors derived four dimensions of SSC as environmental, economic, social and operational. In their 'operational' SSC dimension the items of measurements were *"ability to reduce manufacturing operating cost"*, *"ability to fulfill perfect order"* among others. Hence their 'operational' dimension of SSC is very similar to our economic (production) dimension. This further validates our findings of supply chain sustainability dimensions in the context of apparel industry in Bangladesh. In developing a theoretical framework for sustainable supply

chain management (SSCM) in the context of Indonesian coal industries Wu et al. (2017) came up with four dimensions as "operational, economic, environmental and social". The operational dimension of Wu et al. (2017) dealt with *"cost savings"*, *"reduction in lead time"* among others. Hence it is very similar to economic (production) dimension of SCS in our case. In studying the supply chain sustainability (SCS) issues in Indian automotive industry Kumar and Rahman (2016) developed measurement framework for SCS in terms of environmental, social and economic. However their economic dimension included items related to *"cost reduction"*, *"late delivery"*, which are similar to our economic (production) dimension of SCS. It is noted that above studies are in different industries compared to ours, this however justifies the external validly of our findings (Calder et al. 1982).

In testing predictive validity, related to Hypothesis 1, we found that SCS enhanced market performance. This study also revealed that SCS enhanced market performance indirectly by reducing sustainability risks, thus supporting Hypothesis 2. Therefore, it can be deduced that SCS practices ought to be strategized to meet dynamic stakeholder requirements. Studies (e.g., Foerstl et al. 2010) based on dynamic capability theory have argued that SCS is a dynamic capability of organisations. Supply chain managers should design sustainability practices to meet dynamic stakeholder sustainability requirements, reducing sustainability risks that arise from non-compliance of requirements. Failure to mitigate sustainability risk factors may influence the perceptions of customers and stakeholders, with negative effects on market performance. Therefore, consistent with the dynamic capability view (Teece et al. 1997), firms must reconfigure their resources and processes to meet stakeholder sustainability requirements and to mitigate sustainability risks to ensure their long term performance.

Regarding Hypothesis 3, we found that sustainability practices improve market performance directly. Further, the indirect effect of sustainability practices on market performance is

significant and occurs through reducing sustainability risks. One important finding in our research was that the direct interaction effect of sustainability practices and sustainability governance (Model 3 in Table 9) is not significant. This finding rejects our Hypothesis 3a. However, when sustainability risk is operationalised as a mediating factor in our model (Model 6 in Table 9) we find that the conditional indirect effect was significant. These findings suggest that organisations that practice sustainability, including through careful monitoring of supply chain partners' (mainly suppliers) sustainability practices to manage sustainability risk factors, improve their performance. From our post hoc analysis, we found that the effectiveness of sustainability practices on market performance through improving sustainability is increased at higher levels of sustainability governance (SCS-governance interaction). This finding suggests that, in order to enhance market performance through reducing sustainability risk, supply chain managers need to strengthen sustainability governance throughout the supply chain. As discussed earlier this also verifies the governance as an important micro foundation of DCV (Teece 2007). If supply chain sustainability governance is high, managers can reduce the chances of reputational risks and improve performance. On the other hand, weak governance may create sustainability risks, damage the overall reputation of an organisation's supply chain, and diminish performance.

Our SCS measurement scale is a dynamic. capability. tool (Beske 2012; Eisenhardt and Martin 2000, p. 1108) which organisations can use to improve SCS, reduce sustainability risks and increase market performance through designing effective governance mechanisms. As per Eisenhardt. and Martin. (2000, p. 1108), the SCS model has "communalities" and "idiosyncrasies". For example, the two basic dimensions of sustainability (social and environmental) are communalities of the SCS model. However, the dual-economic dimension of sustainability is contextual and idiosyncratic.

As argued earlier our SCS scale conforms to the "technical" and "evolutionary" fitness criteria of the dynamic. capability. view (Teece 2007). Technical fitness refers to "how effectively a capability performs its intended function" (Helfat et al. 2007, Leiblein 2011). As the psychometric properties of the SCS scale satisfy all the requirements, it aligns with the technical fitness criterion of the DCV. Evolutionary. fitness refers to "how well a dynamic capability enables an organisation to sustain by developing, extending, or modifying its resources" (Helfat et al. 2007; Teece 2007, Leiblein 2011). We argue that organisations must govern the sustainability practices of supply chain members to ensure that supply chain members are complying with stakeholder requirements over time. Pohjola and Stenholm (2012) state that much recent literature has used "performance" as the measure of the evolutionary. fitness of organisations' dynamic capability. In line with this view, we propose "market performance" as another measure. Our results support that sustainability practices improve market performance through reducing SCS risk and improving sustainability governance. Thus, our proposed SCS measurement scale satisfies. the evolutionary. fitness criterion significantly. Hence, we conclude that the "contextually and culturally dependent" (Paulraj et al. 2017) measurement scale of SCS that we developed in this study is a dynamic capability, which must be practised by the apparel manufacturing organizations to maintain the social, economic (financial), economic (production) and environmental sustainabilities of the supply chain.

5.2 Implications for theory

Building on the dynamic capability view, relying on previous studies and filling gaps in the existing literature, this research has offered. novel. insights by developing a scale for SCS and a research model to establish the relationship between SCS and market performance. The model developed through this research was contextualised. through a qualitative. field study. The final research. model. developed addressed the sustainability practices of apparel supply

chain actors in Bangladesh. In addition, the model showcased the importance of sustainability governance in the supply chain to reduce sustainability risk and enhance performance. This study has made a novel contribution. to the existing literature on supply chain management by developing. a theoretically justified and empirically validated multi-dimensional scale for supply chain sustainability practices on four dimensions of sustainability (social, environmental, economic (financial) and economic (production)).

Based on DCV (Teece et al. 1997, Teece 2007) this research offers several contributions to SCS research. First, relying on the dynamic capability view, this research has identified and defined constructs for SCS and their associated measurement items in a developing country manufacturing context. Second, based on customer (stakeholder) centric approach to sustainability (Seth 2011) this study has developed dual dimensions of economic sustainability which is very unique in the extant literature. This study has validated market performance as a critical outcome of SCS through empirical data. This study has tested and validated that SCS practices influence market performance indirectly by reducing sustainability risk. This finding is another contribution of this research. Further, this study has demonstrated that the indirect effect of SCS and performance through reducing sustainability risk is more effective when sustainability governance is high.

Designing and practising effective sustainability governance mechanisms is a dynamic capability which is effective in reducing sustainability risk and enhancing market performance. This finding is novel in the existing literature on dynamic capability and supply chain sustainability. Finally, this paper contributes to the body of knowledge on the dynamic capability view by devolving the SCS model and assessing it through the technical and evolutionary fitness criteria of DCV.

5.3 Implications for practice

The implications of this study are significant. to supply chain managers, and specifically to apparel supply. chain managers in low cost manufacturing settings. Findings of this study suggest that supply chain managers can balance social, environmental, and economic sustainability practices to satisfy dynamic stakeholder requirements, promoting market performance by reducing risks of non-compliance with sustainability standards. This research equips apparel supply chain managers. with knowledge. of factors required to ensure sustainability in supply chains. The items under social, environmental, and economic and operational factors (see table 9) offer insights for managers to deal with the SCS issues effectively.

We hope that apparel supply chain members will use our proposed model to assist in addressing the problems associated with labour unrest, violation of social and environmental issues, and operational failures arising from non-compliance of sustainability requirements of stakeholders. Our proposed model also offers managers thought-provoking insights on the interaction of supply chain sustainability and sustainability governance practices in reducing sustainability risk and improving market performance. Such findings will motivate supply chain managers to consider supply chain sustainability implementation and administer effective governance to enhance their market performance and competitive advantage.

It is noted that our derived environmental SCS dimension has measurement items related to *water pollution, air pollution, soil pollution* (among others, see tables 6 and 7). Hence our model addresses these aspect of environmental sustainability. However, the measurement items of the sustainability dimensions can be made more focused depending on the organizational strategies and focus. For example, some apparel manufacturing companies have major issues with many other aspects of environmental sustainability (eg. microfiber pollution, wastes accumulation, too much water consumption; among others) (Leonas 2018,

https://www.sustainyourstyle.org/old-environmental-impacts; accessed on 7 December 2019). Through consultation with the company executives and various experts appropriate measurement items can be developed to include in the environmental dimension of SCS.

6. Conclusions

This study has made significant contributions to the existing literature on three fronts: (i) developing a valid and reliable scale for SCS, (ii) validating the mediating effect of sustainability risk in the relationship between supply chain sustainability and market performance, and (iii) affirming the conditional effect of supply chain sustainability on market performance through reducing sustainability risks in settings of higher level sustainability governance. The findings have significant managerial value, as it may assist apparel supply chain managers in developing their knowledge of factors required to ensure sustainability in the supply chain. This research may also provide apparel supply chain managers with a valid tool to measure their supply chain sustainability practices, helping managers to minimise sustainability risks and improve market performance.

However, this research also has certain limitations. The findings of this study is context-specific. Hence replicating this study in other countries and industries will help improve confidence in the model. Future research could also be conducted to investigate antecedent factors of supply chain sustainability. Lastly, the moderating. effect of supply chain design on the relationship. between supply chain sustainability and risk mitigation and market performance is yet to be explored.

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Table 1: SC Sustainability and other constructs of our research model in literature

Indicators and sub-indicators for SC Sustainability and governance	**Source**
Social factors	
Health and safety	Wang and Dai (2018); Khan et al. (2016); Marshall et al. (2015); Shafiq et al. (2014); Mani et al. (2016)
Remuneration	Wang and Dai (2018); Khan et al. (2016); Shafiq et al. (2014); GRI (2011).
No wage discrimination	Wang and Dai (2018); Khan et al. (2016); Shafiq et al. (2014).
Monitoring suppliers' performance	Wang and Dai (2018); Shafiq et al. (2014); Marshall et al. (2015).
Training and development	Wang and Dai (2018); GRI (2011)
Forced labour	Wang and Dai (2018), Khan et al. (2016), Shafiq et al. (2014).
Child labour	Wang and Dai (2018), Khan et al. (2016), Shafiq et al. (2014).
Donate to charity in the community	Shafiq et al. (2014); Mani et al. (2016); Delai and Takahashi (2011)
Health and safety	Wang and Dai (2018), Shafiq et al. 2014; Mani et al. 2016
People oriented organizational culture	Shafiq et al. 2014; Carter and Jenning 2004
Top management support	Shafiq et al. 2014; Carter and Jenning 2004
Employee satisfaction	Shafiq et al. 2014; Khan et al. (2016).
Personal and organizational learning and development	Wang and Dai (2018); Delai and Takahashi (2011)
Customer satisfaction	Wang and Dai (2018); Delai and Takahashi (2011)
Compliance with regulation	Wang and Dai (2018); Delai and Takahashi (2011)
Assessment of suppliers' social performance	Wang and Dai (2018); Mani et al. 2016; Shafiq et al. (2014); Delai and Takahashi (2011)
Compliance of health, safety and human rights by the suppliers	Shafiq et al. 2014; GRI 2011; Delai and Takahashi (2011)
Reward & punishment related to compliance performance	Shafiq et al. (2014)
Auditing and Monitoring suppliers social sustainability	Wang and Dai (2018); Mani et al. (2016); Shafiq et al. (2014); Delai and Takahashi (2011)
Support for supplier development	Shafiq et al. (2014); GRI (2011); Delai and Takahashi (2011)
Train suppliers in improving social performance	Shafiq et al. (2014)
Environmental factors	
Reduction of air pollution	Zhu et al. (2005); Khan et al. (2016); GRI (2011).

Reduction of water pollution	Zhu et al. (2005); Khan et al. (2016); GRI (2011).
Reduction of solid wastes	Zhu et al. (2005); Khan et al. (2016); GRI (2011).
Reduction of resource consumption (material, energy, water)	Zhu et al. (2005); GRI (2011)
Disposing of pollutants (chemical waste, solid waste)	Pagel and Wu (2009); Rao and Holt (2005); GRI (2011).
Waste recycled or reused	Zhu et al. (2005); Khan et al. (2016); Rao and Holt (2005); GRI (2011)
Using energy efficient technology	Zhu et al. (2005); Rao and Holt (2005);
Using environment friendly transportation	Rao and Holt (2005); Perotti et al. (2012)
Material used that poses health, safety or environmental hazard	Zhu et al. (2005); Khan et al. (2016).
Purchasing environmentally friendly materials	Zhu et al. (2005); Rao and Holt (2005)
Purchasing recycled packaging	Carter and Jenning (2004); Zhu et al. (2005)
Reducing idle capacity	Zhu et al. (2005); Pagel and Wu (2009)
Total quality environmental management	Zhu et al. (2005); Pagel and Wu (2009); Rao and Holt (2005)
Compliance of environmental legislation	GRI (2011); Zhu et al. (2005); Delai and Takahashi (2011)
Cross functional cooperation for environmental management	Zhu et al. (2005)
Commitment of management towards environmental management	Zhu et al. (2005); Pagel and Wu (2009)
Life cycle thinking of the product	Pagel and Wu (2009); Carter and Jenning (2004)
Evaluating environmental performance of suppliers	Zhu et al. (2005); GRI (2011); Pagel and Wu (2009)
Evaluating environmental performance of 2nd tier suppliers	Zhu et al. (2005)
Cooperation with customer for eco-design, production & packaging	Zhu et al. (2005); Rao and Holt (2005)
Cooperation with supplier to implement environmental standard	Zhu et al. (2005); Pagel and Wu (2009).
Design of products for reduced consumption of material	Zhu et al. (2005); Rao and Holt (2005); Carter and Jenning (2004)
Supplier development	Zhu et al. (2005); Pagel and Wu (2009).
Environmental impact of products produced	GRI (2011); Delai and Takahashi (2011)
Environmental certification and auditing	Zhu et al. (2005); GRI (2011); Pagel and Wu (2009)
Economic factors	
Sales	Wang and Dai (2018); Khan et al. 2016; Rao and Holt (2005); GRI (2011).
Cost of goods	Wang and Dai (2018); Khan et al. 2016; GRI (2011).
Value added	Delai and Takahashi (2011)
Return on average capital employed	Delai and Takahashi 2011

Market share	Wang and Dai (2018); Rao and Holt 2005; Delai and Takahashi (2011)
Indicators and sub-indicators for sustainability risks and Market Performance	**Source**
Sustainability Risks	
Loss of buyers due to poor sustainability practices	Giannakis Papadopoulos (2016); Foerstl et al. (2010)
Negative media flash for non-compliance sustainability practices	Giannakis Papadopoulos (2016);Foerstl et al. (2010)
Worker strike due to poor wages and benefits and working environment	Giannakis Papadopoulos (2016);Foerstl et al. (2010)
Legal actions for non-compliance of social and environmental practices	Giannakis Papadopoulos (2016);Foerstl et al. (2010)
Market Performance	
Growth of market share	Paulraj (2004)
New market opportunity	Paulraj (2004)
Favourable attitude of the customers	Paulraj (2004)

Table 2: Scale development process

CONCEPTUALIZING SUPPLY CHAIN SUSTAINABILITY (SCS) - Identify dimensions from review of literature -Theoretical Justification.
DEVELOPING INSTRUMENT - contextualizing findings of literature on SCS dimensions and measurement instrument by qualitative study - Developing Scale *Item creation and sorting.* *Item purification.*
TESTING INSTRUMENT - Creating Initial questionnaire and pretesting. - Conducting Pilot testing. - Conducting confirmatory study. *Assessing the first order scale items* *Assessing the higher order construct* *Assessing the nomological and predictive validity.*

Table 3: Profiles of interview participants

Participant	Position	Type of the company	Company size (no of employees)	Age of the company
D1	General Manager	Garment manufacturer	2000-3000	20-25 years
D2	Manager Merchandising	Accessory supplier	200- 300	Less than 5 years
D3	Supply chain manager	Garment manufacturer	4000- 5000	5-10 years
D4	Deputy General manager	Accessory supplier	300-400	15-20 years
D5	Deputy General manager	Garment manufacturer	1000- 2000	10-15 years
D6	Manager Merchandising	Garment manufacturer	3000-4000	20-25 years
D7	Supply chain manager	Garment manufacturer	10000-15000	20-25 years
D8	Manager	Accessory supplier	200- 300	5-10 years
D9	Supply chain manager	Garment manufacturer	15000- 20000	15-20 years
D10	Manager Merchandising	Garment manufacturer	2000-3000	10-20 years
D11	Manager	Garment manufacturer	1000-2000	10-15 years
D12	Manager	Accessory supplier	100-200	5-10 years
D13	Supply chain manager	Garment manufacturer	20000-25000	20-25 years
D14	Manager Merchandising	Garment manufacturer	500- 1000	10-15 years
D15	Deputy general manager	supplier	300- 500	15-20 years

Table 4: SCS dimensions and relevant quotes

Themes/dimensions	Sample quotes
Social aspect	*"Today if you do not have a social code, you cannot do business. If you have a quality problem, you can recover and still do business. But if you lose your reputation for social issues, your business will be ended."* *"… We are concerned about [the] working environment, [and] health and safety standards. We have two cleaners for each floor; have at least one toilet for every 25 workers ..."* *"We are very careful in hiring workers. Our buyers show zero tolerance to child labour"* *"… we need to pay a minimum wage of 3000 taka per month for 8 hours' working day as per labour law and we need to show the pay register to the auditor …"*
Environmental aspect	*"... All suppliers and manufacturers need to show test reports to ensure that goods are lead-free, Azo-free and free from other hazardous chemicals. …"* *"… We have an effluent treatment plant (ETP) in our entire factory to reduce chemical and water pollution …"* *"We have two types of clothing wastes. Big wastes are sold to the small local apparel producers and small clothing wastes are sold to the recyclers …"*
Economic aspect	*"… we need to ensure quality and on-time delivery to satisfy the buyers and to continue business ..."* *"In [the] apparel business, you must respect the time. Otherwise, you need to quit from [the] business."* *"… we need to prove that our quality is good. We test quality when we buy material from suppliers and we show the sample to the buyer. If buyers approve the sample then we buy material from them ..."* *"Buyers place orders to those who can meet their requirements …."* *"… we calculate the cost of [the] product in advance. When we take an order, we calculate the cost and profit ..."* *"… demand for our product depends on demand for apparels. Our apparel export is increasing. In this situation we can make good profit after meeting all costs. I think we will sustain if this trend goes on."*
SC Governance	*"… We are a buyer-nominated supplier. our buyers come and visit our factory to monitor compliance issues ..."*

Table 5: factors and variables derived from field study

Factor	Variable	Participants														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SCS1	Wages	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
SCS2	Benefits & facilities	/	/	/	/	-	/	-	/	/	/	/	-	/	-	-
SCS3	Hazard and safety	/	/	-	/	/	/	-	/	/	/	/	/	/	/	/
SCS4	Local employment	/	-	/	/	/	/	/	/	-	/	/	/	/	-	/
SCS5	Health and sanitation	/	/	/	/	/	/	-	/	/	/	-	-	-	/	
SCS6	Charities in community	-	/	-	/	/	-	/	/	/	-	/	/	/	/	-
SCS7	Child labour	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
SCS8	Forced labour	/	/	/	/	/	/	-	/	/	/	/	/	-	/	/
SCS9	Training to improve suppliers' social sustainability	-	/	/	-	-	/	-	/	/	-	-	/	-	-	-
SCS10	Top management support	/	-	-	/	-	/	-	/	-	/	/	-	-	-	/
SCS11	Employee satisfaction	/	-	/	/	-	/	-	/	-	/	/	-	-	-	/
SCS12	Water pollution	/	/	/	/	-	/	/	/	/	/	/	/	/	/	-
SCS13	Air pollution	/	/	/	/	-	/	/	/	/	/	/	-	-	/	-
SCS14	Soil pollution	/	/	/	/	-	/	/	/	/	/	/	-	-	-	/
SCS15	Recycling wastes	/	/	/	/	/	/	/	/	/	/	/	-	-	-	/
SCS16	Hazardous material	/	/	/	-	/	/	/	/	/	-	/	/	/	/	/
SCS17	Environmental certification	/	/	/	/	-	/	-	/	/	/	/	/	/	/	-
SCS18	Complying legislation	/	/	/	/	-	/	/	-	/	/	/	/	/	/	-
SCS19	Training to improve suppliers' environmental performance	-	/	-	-	/	-	-	-	/	/	-	-	/	-	-
SCS20	Invest in improving supplier's environmental performance	-	/	-	/	-	-	-	-	/	/	-	-	-	/	-

SCS21	Reduction of resource consumption	/	/	-	-	-	-	-	-	-	/	-	-	-	-	/
SCS22	Meet expected lead time	-	/	-	/	/	/	/	/	/	/	/	/	/	/	/
SCS23	Manage desired Quality	/	/	/	/	/	-	/	/	/	/	/	/	/	/	/
SCS24	Conformance Quality (meeting specifications) of our products	/	-	/	/	/	/	/	/	-	/	/	/	/	/	/
SCS25	Use updated Machinery and technology	-	/	/	-	-	/	-	/	/	-	/	-	/	-	-
SCS26	We have flexibility in production	/	-	-	/	/	-	/	/	-	/	/	-	-	/	-
SCS27	Sales	/	/	/	/	/	/	/	/	/	/	-	/	/	/	/
SCS28	Cost	/	/	/	/	/	-	/	/	/	/	/	/	/	/	/
SCS29	Profit	/	-	/	/	/	/	/	/	/	/	/	/	-	/	/
SCS30	Return on investment	/	/		/	/		/	/		/	-	/	/	/	
SG1	Monitoring social compliance of suppliers	/	/	/	/	-	/	-	/	/	-	/	-	-	-	-
SG2	Incentives to suppliers to improve social sustainability	-	-	/	/	-	/	/	-	/	/	/	-	-	-	/
SG3	evaluate suppliers' sustainability performance in selecting suppliers	-	/	/	/	-	/	/	-	-	/	-	-	-	-	/
SG4	Monitoring environmental suppliers	/	/	/	/	-	/	-	/	/	-	/	-	-	-	-
SG5	Incentives to suppliers to improve environmental performance	-	/	-	/	/	-	/	-	/	/	-	/	/	-	/
MP1	Growth of market share	/	-	/	-	/	/	/	-	/	/	/	/	/	/	-
MP2	New market opportunity	/	/	-	/	-	/	-	/	/	-	/	-	/	-	
MP3	Favourable attitude of the customers	/	/	-	/	/	/	-	/	/	/	/	/	-	/	/
SR1	Loss of buyers due to poor sustainability practices	/	-	/	/	/	/	-	/	/	/	-	-	/	-	/

SR2	Negative media flash for non-compliance sustainability practices	/	/	/	-	/	-	/	/	/	-	/	/	/	/	-
SR3	Worker strike due to poor wages and benefits and working environment	-	/	/	/	-	/	-	-	-	/	/	/	-	-	/
SR4	Legal actions for non-compliance of social and environmental practices	/	-	-	-	/	/	/	-	-	-	-	/	/	-	-

Note: SCS=Supply Chain Sustainability; SG=Supply Chain Governance; MP=Market Performance; SR=Supply Chain Risk.

Table 6: Results of exploratory factor analysis in the pilot study.

		Component			
		1	2	3	4
SCS1	We emphasize on paying fair wages to the employees in our supply chain	.699	.404	.350	.025
SCS2	We emphasize on providing due benefits to the employees in our supply chain	.625	.421	.417	.230
SCS3	We emphasize on managing hazard and safety issues in our supply chain	.624	.181	.371	.067
SCS4	We encourage local employment in our supply chain	.315	.115	.227	.246
SCS5	Our supply chain members manage adequate health and sanitation for the employees	.649	.304	.411	.230
SCS6	Our supply chain members contribute to local and community welfare activities	.427	.106	.058	.238
SCS7	Our supply chain members do not use child labor in their plants	.529	.060	.392	.255
SCS8	Our supply chain members do not use force labor in their plants	.653	.255	.175	.057
SCS9	We train our suppliers to improve social sustainability performance	.558	.512	.213	.128
SCS10	We emphasize on employee satisfaction in our supply chain	.538	.218	.513	.337
SCS11	We take measures to control water pollution in our supply chain	.400	.718	.119	.207
SCS12	We take measures to control Air pollution in our supply chain	.193	.748	.375	.194
SCS13	We take measures to control Soil pollution in our supply chain	.167	.570	.268	.404
SCS14	Our supply chain members recycle wastes or sell wastes to recyclers	.211	.810	.138	.103
SCS15	Our supply chain members do not use any environmentally hazardous material	.239	.635	.369	.329
SCS16	We emphasize on environment certification and audit process in our supply chain	.172	.626	.274	.208
SCS17	Our supply chain members comply environment legislation	.366	.487	.044	.222
SCS18	We train our suppliers to improve environmental sustainability performance	.211	.357	.138	.159
SCS19	We invest in suppliers' plant to improve environmental performance	.158	.311	.091	.126
SCS20	Our supply chain members take measures to meet expected lead time	.463	.207	.646	.535
SCS21	Our supply chain members take measures to manage desired Quality	.344	.288	.589	.240
SCS22	Our supply chain members conform to the specifications (design, colour etc.) of buyers.	.404	.421	.734	.365
SCS23	Our supply chain members use updated machinery and technology	.409	.265	.540	.364
SCS24	Our supply chain members have production flexibility	.103	.308	.413	.315
SCS25	Our supply chain members manage satisfactory sales volume	.386	.298	.375	.651
SCS26	Our supply chain members manage low cost of sales	.062	.060	.295	.772
SCS27	Our supply chain members manage good profit margin	.219	.386	.234	.689

Table 7: Results of exploratory factor analysis of the refined scale in the pilot study

Factors	Items	Loadings	Item total correlation	Eigenvalue	Cumulative variation	Cronbach's alpha
Social sustainability (SoS)	SCS1	.713	.775	3.368	25.6	.847
	SCS2	.643	.659			
	SCS3	.629	.709			
	SCS4					
	SCS5	.665	.613			
	SCS6					
	SCS7	.541	.525			
	SCS8	.694	.595			
	SCS9					
	SCS10					
Environmental sustainability (EnS)	SCS11	.729	.732	2.725	45.2	.825
	SCS11	.754	.775			
	SCS12	.583	.484			
	SCS13	.817	.730			
	SCS14	.643	.677			
	SCS15	.633	.744			
	SCS16	.648	.642			
	SCS17	.523	.625			
	SCS18					
	SCS19					
Economic (Production) sustainability (EcS_P)	SCS20	.655	.565	1.896	60.8	.814
	SCS21	.593	.730			
	SCS22	.741	.808			
	SCS23	.596	.559			
	SCS24					
Economic (Finance) sustainability (EcS_F)	SCS25	.658	.777	1.314	72.3	.829
	SCS26	.781	.691			
	SCS27	.701	.726			

(*The red-flagged items were deleted)

Table 8 Mann–Whitney test results

Construct	Z-Value	Significance (1-tailed)
Social sustainability (SoS1)	-.735	.462
Environmental sustainability (EN1)	-.1.811	.09
Economic financial sustainability (EcS_F)	-1.119	.263
Economic operational sustainability (EcS_P)	-1.590	.112
Sustainability Governance (SG1)	-.726	.433
Market performance (MP1)	-.561	.484
Sustainability Risk (SR1)	-.876	.364

Table 9: Psychometric properties of the measurement model

Constructs	Items	First order constructs				Higher order construct Sustainability	
Social sustainability (SoS)		L	L t-v	AVE	CR	AVE	CR
	SCS1	0.813	23.76	0.751	0.847	0.695	0.868
	SCS2	0.694	11.14				
	SCS3	0.752	22.18				
	SCS5	0.726	16.92				
	SCS7	0.691	14.25				
	SCS8	0.667	9.08				
Environmental sustainability (EnS)	SCS11	0.654	10.81	0.727	0.811		
	SCS12	0.787	40.65				
	SCS13	0.785	32.78				
	SCS14	0.693	19.16				
	SCS15	0.786	30.35				
	SCS16	0.647	9.78				
	SCS17	0.613	11.16				
Economic (production) sustainability (EcS_P)	SCS20	0.726	34.06	0.667	.752		
	SCS21	0.872	36.64				
	SCS22	0.658	17.89				
	SCS23	0.629	19.52				
Economic (financial) sustainability (EcS_F)	SCS25	0.710	17.69	0.753	.824		
	SCS26	0.745	23.33				
	SCS27	0.881	42.19				
Sustainability governance (SG)	SG1	0.753	18.51	.652	.736		
	SG2	0.616	7.38				
	SG3	0.609	6.56				
	SG4	0.672	8.91				
	SG5*						

Market Performance (MP)	MP1	0.718	22.60	0.735	0.773		
	MP2	0.863	34.14				
	MP3	0.622	12.82				
Sustainability Risks (SR)	SR1	0.673	9.05	0.768	0.835		
	SR2	0.721	13.68				
	SR3	0.592	7.39				
	SR4	0.773	14.67				

SG*- dropped due to low loading

Table 10: Inter-correlations of the first-order constructs

	SCS	ENS	ECS	OPS	SG	MP	SR	FS	FA	M1
SoS	**.923***									
ENS	.401	**.914***								
EcS_F	.517	.435	**0.902***							
EcS_P	.512	.379	.556	**.817***						
SG	.378	.411	.329	.381	**0.808***					
MP	.289	.379	.415	.472	.298	**.879***				
SR	-.414	-.431	-.387	-.296	-.449	-.428	**.876***			
FS	.216	.304	.351	.312	.319	.411	-.206	**1**		
FA	.127	.216	.259	.215	.059	.148	.105	.216	**1**	
M	.116	.085	.127	.211	.092	.178	.058	.153	.071	**1**

*Discriminant validity: square root of AVE on the diagonal > correlation coefficients
SoS= Social sustainability, ENS= Environmental sustainability, EcS_F= Economic financial sustainability, EcS_P= Economic production sustainability, SG= sustainability governance, MP= Market Performance, SR= Sustainability risk, FS= Firm size, FA= Firm age, M= Marker

Table 11: Summary of regression models

	Model1 (Outcome MP)	Model2 (Outcome MP)	Model3 (Outcome MP)	Model4 (Outcome MP)	Model5 (outcome-SR)	Model6 (Outcome MP)
SCS	β =.868 t = 28.75			β = .865 t = 14.205	β = -1.378 t = -8.3434	β = .171 t = 1.62
SR		β = -.771 t = -19.92		β = -.221 t = -4.148		β = -.186 t = -3.323
SG			β = .274 t = 1.253		β = -1.7124 t = -7.323	β = -.045 t = -.192
SCS*SG			β = .0403 t = 1.028		β = -2.503 t = -5.808	β = .018 t = 1.008
SCS (indirect)				β = .2036 LLCI=.1019 ULCL= .3121		
SCS*SG (indirect)						β = .0708 LLCI= .0239 ULCI= .1669
Firm size	β =.163 t=3.21	β =.069 t=1.57	β =.053 t=1.68	β =.036 t=1.17		β =.029 t=1.05
Firm age	β =.176 t=3.78	β =.188 t=3.53	β =.138 t=2.67	β =.136 t=2.76		β =.037 t=1.16
	R^2= .754	R^2= .595	R^2= .782	R^2= .768	R^2= .713	R^2= .766

Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.