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The effects of sustainability practices on the performance of risk management and purchasing

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Abstract

Companies need special purchasing and supply management practices to ensure that their supply chains are sustainable and transparent. However, sustainability practices do not only serve the purpose of securing sustainability, but also help companies to avoid economic and reputational damage and risks. This paper studies the influence of sustainable purchasing practices on the risk management performance and purchasing performance by using quantitative survey data collected from 111 Finnish companies. The direct and indirect relationships between the concepts are examined using a partial least squares methodology. The results show that the use of sustainable purchasing practices improves the purchasing performance of businesses. Firms that invest in sustainability management in their purchasing will more likely have better performance in their purchasing and supply management. It was also found that sustainable purchasing practices improve reputational and operational risk management performance, which indicates that sustainability practices are significant in risk management in general, not only in relation to sustainability.

Keywords: Sustainability, Supply Chain, Risk Management, Performance, Supply Management

1 Introduction

Managing the sustainability and ensuring transparency of supply chains are key tasks of firms' purchasing and supply management functions today (Schneider and Wallenburg, 2012; Kim et al., 2019; Xu et al., 2019). Many sustainability-related scandals, such as the milk powder scandal in China in 2008, the horse meat scandal in Europe in 2013, and the modern slavery scandal in the clothing industry in the UK in 2016, have emerged from companies' supply bases and supply chains. These scandals have caused serious problems and negative public attention for buyer companies, such as retailers or manufacturers who are selling the products under their own brand labels. Despite companies putting a lot of effort into handling sustainability issues, as these examples show there is still a high risk that sustainability-related failures and incidents will occur in the future (Giannakis and Papadopoulos, 2016; Lintukangas et al., 2016; Xu et al., 2019). Hence, managing and securing the sustainability of supply chains requires strong risk management skills from purchasing professionals and well-defined purchasing processes within companies as also Hallikas and Lintukangas (2016) and Kwak et al. (2018) have stated.

Supply management has a considerable role in mitigating sustainability risks arising from supply chains and the management of these risks has become increasingly relevant to companies in many industries (Multaharju et al., 2017; Xu et al., 2019, Abdel-Basset and Mohamed, 2020). A company's sustainability-related risk management performance has been found to be affected by the firm's sustainable purchasing practices (e.g., Giannakis and Papadopoulos, 2016), which do not only serve the purpose of securing sustainability and minimizing sustainability-related risks, but also aim to avoid economic, operational, or reputational damage. Many practices of sustainable purchasing and supply management are, at the same time, mechanisms for risk reduction in general, rather than only for sustainability-related risks (Beske et al., 2014).

Previous research (e.g., Lintukangas et al., 2016) has shown a clear connection between risks related to company brand and image and sustainable supply management. Sustainable purchasing practices are needed for the protection of the company's reputation as serious reputational damage may cause a decrease in equity value (Lange and Lee, 2011). Sustainable purchasing practices are also necessary for supply chain operational performance objectives such as quality, reliability, and flexibility (González-Benito and González-Benito, 2005). Therefore, firms need to develop practices, processes, and procedures to secure the sustainability of their purchases and to mitigate the reputational and operational risks arising from supply chains (e.g., Gualandris et al., 2014; Miemczyk and Luzzini, 2018). Despite the large number of studies conducted in the field of sustainability in supply chains, only a few have investigated the sustainable purchasing practices affecting the overall supply chain risk management performance (Gouda and Saranga, 2018; Miemczyk and Luzzini, 2018).

Using quantitative survey data collected from Finnish companies, this paper examines the effects of sustainable purchasing practices on purchasing and supply chain risk management performance based on the perspective of a company's reputation and operations. This study contributes to the literature by showing that the use of sustainable purchasing practices improves the purchasing performance of businesses. It is significant for managers to acknowledge that by investing in sustainability management in purchasing, the firm will more likely perform better in purchasing and supply management overall. This study also shows that sustainable purchasing practices improve firms' reputational and operational risk management

performance. This indicates that sustainable purchasing practices are significant in risk management in general, not only in relation to sustainability issues. Thus, the study provides novel insights into and empirical support for the effects of sustainable purchasing practices on supply chain risk mitigation and performance. Even though that some recent studies are evaluating supply chain risks and suggesting risk mitigation strategies in sustainability and cleaner production (e.g., Ali et al., 2019), there is a lack of research focusing on how sustainability practices influence different types of risks in supply chains. This study contributes to addressing this shortage by evidencing that sustainable purchasing practices positively influence both operational and reputational risk management, and thus shows that operational risks related to, for example, non-availability or the quality of the products, or reputational risk related to, for example, brand and image, can be mitigated by sustainable purchasing practices.

In the following section, the relevant literature concerning sustainable purchasing practices is reviewed and their relation to purchasing performance and supply chain risk management performance is defined and hypothesized. Next, the methodology and analyses are presented. Finally, the results are discussed in light of previous studies, conclusions are drawn, and managerial implications are given.

2 Literature background and hypothesis development

2.1 Sustainable purchasing practices

Sustainable supply chain management is defined as the management of material, information and capital flows, as well as cooperation among companies along the supply chain, while aiming at goals along all three dimensions (economic, environmental and social) of sustainable development (Seuring and Müller, 2008). External pressures, such as stakeholder requirements, legislation and regulation, and internal drivers, such as company policies and the values of the owners (Walker et al., 2008), are pushing companies towards more sustainable supply chains. Putting the external pressures and internal drivers into action is not easy, however; thus, implementing sustainable supply chain management requires the development of sustainability practices that truly put these requirements and values into action.

The value considerations of companies when evaluating and selecting suppliers are broader when their decisions take sustainability into account as well (Giunipero et al., 2012). Thus, the sustainability practices of the purchasing and supply functions can be defined as practices that help companies achieve their goals in a sustainable and profitable manner by considering environmental and social values in addition to economic ones (Giunipero et al., 2012). In previous studies, the practices related to a company's purchasing and supply management or supply chain management have been categorized into social and environmental practices based on the sustainability dimension (Hollos et al., 2012), into internal and external practices based on the boundaries of the organizations (Gualandris et al., 2014; Vachon and Klassen, 2006), into advanced practices and basic practices based on the maturity of the practices (Marshall et al., 2015), and into reactive and proactive practices based on the strategic type of the practice (Kähkönen et al., 2018).

Overall, the number of different sustainability practices in purchasing and supply management is huge (e.g., Tate et al., 2012) and the implementation of such practices depends on the company, its values, the industry in which it operates, the characteristics of its purchases, and

its supplier base. Vanalle and Santos (2014) suggest that sustainability practices should be included in the supplier selection process and that they should also cover the process of seeking partnerships with companies with similar sustainability behaviours. Including sustainability criteria in supplier and partner selection is one of the most commonly used sustainability practices in purchasing and supply (see Alikhani et al., 2019; Beske and Seuring, 2014; Luthra et al., 2017). Also very common is the use of codes of conduct (Hoejmose and Adrien-Kirby, 2012), which can be seen as a company's own standards for managing supplier relationships and ensuring the sustainability of suppliers. In addition, companies utilize different certificates and standards, such as ISO 14001 for environmental management or ISO 26000 or SA8000 for securing social responsibility (Marshall et al., 2015; Miemczyk and Luzzini, 2018). Previous studies (e.g., Foerstl et al., 2010; Grosvold et al., 2014) very often also highlight the significance and the use of third-party audits in ensuring suppliers' sustainability.

Companies that see sustainability as a key issue that has to be managed are most likely to also assess risks in their supply chains to avoid non-compliance and reputational and economic damage (Hofmann et al., 2014). For example, by requiring that suppliers have certifications and follow standards, or by selectively monitoring suppliers, the risks of non-compliance can be reduced (Beske and Seuring, 2014). Thus, standards and certifications are seen as relatively simple ways to handle risk-related issues (Müller et al., 2009) and are commonly used as risk-reduction mechanisms (Beske and Seuring, 2014). Many practices of sustainable supply management are also practices and mechanisms for risk reduction and assessment—not only of sustainability-related risks, but supply chain risks in general. Due to sustainability requirements, companies have intensified their practices and principles related to supplier assessment, which further help with risk management in general. For instance, quality risk, considered as an ordinary supply chain risk, may be mitigated and prevented much more efficiently when using sustainability practices, such as supplier audits and material regulations, in purchasing. Thus, sustainable purchasing practices do not only serve the purpose of securing sustainability but also help avoid economic and reputational damage. Hence, companies that use and implement sustainable purchasing practices are value-driven and follow sustainable policies, aiming to improve their firm's performance through sustainability efforts (Beske and Seuring, 2014).

2.2 Purchasing performance

The connections between sustainable purchasing practices and performance have been examined in several studies. For example, it is found that supply chain management's operational performance objectives such as quality, reliability, and volume flexibility can be improved by using sustainable purchasing practices and by promoting recycling and reverse logistics systems (González-Benito and González-Benito, 2005). It is also found that the strategic level of supply management and the company's commitment to sustainability efforts drive efficient supplier management practices, which, in turn, improve the company's sustainability performance (Large and Gimenez Thomsen, 2011). Moreover, according to the extensive meta-analysis of Golicic and Smith (2013), environmental sustainability practices in particular improve various aspects of a firm's performance. This is also supported by Cousins et al. (2019), who found that sustainability practices improve environmental and operating cost performance. However, studies examining how sustainability practices affect purchasing performance are few.

Purchasing performance refers to the ability and capability to align and execute internal and external practices in accordance with the corporate strategy aiming to improve a firm's profitability and competitiveness (Pohl and Förstl, 2011). According to Baier et al. (2008), strategic alignment between the business, its purchasing strategy, and its purchasing practices is a significant driver of a firm's financial performance. Therefore, the firm's management should invest in and implement purchasing practices that are in accordance to a firm's competitive priorities (Baier et al., 2008). Hence, if sustainability is the firm's core value and is included in corporate strategy, the purchasing practices should be aligned accordingly. However, multiple strategic goals may have been set for purchasing functions, and transforming strategy into measurable goals can be complicated. To motivate companies to measure purchasing performance beyond traditional cost reduction goals, there should be direct linkages for both financial and non-financial measures (Pohl and Förstl, 2011).

Gunasekaran et al. (2001) have showed that purchasing performance measurements can be divided into financial and non-financial measures. According to van Weele (2002), internal customer satisfaction must be included in the assessment of purchasing performance, which can be divided into two primary components: efficiency and effectiveness. Efficiency is related to resource usage and the input–output perspective and effectiveness to the degree to which the planned outcomes are achieved (Ritchie and Brindley, 2008). Measures of purchasing effectiveness are mostly financial, and efficiency and internal customer satisfaction assessments are abstract and subjective evaluations of purchasing performance (Lintukangas and Kähkönen, 2010). According to Sánchez-Rodríguez et al. (2005), purchasing performance consists of the quality of the purchased goods, their on-time delivery, how well the actual purchasing costs meet the targeted or budgeted costs, how well the purchased goods and materials meet internal customer satisfaction requirements and whether inventory goals have been met. Caniato et al. (2014) have developed a framework of purchasing performance management dimensions that includes three divergent perspectives: i) purchasing measurement structure, ii) purchasing management process and iii) organizational architecture (horizontal and vertical product category settings in the organization). Purchasing performance traditionally consists of a set of performance indicators regarding the costs, time, quality, and flexibility of the purchasing function. However, sustainability has become one of the most important indicators, encompassing both environmental and social aspects in purchasing (Caniato et al., 2014). Therefore, purchasing performance should reflect the sustainability actions and values of a company, and it is necessary to investigate the influence of sustainable purchasing practices on purchasing performance. Along these lines, it is posited that:

H1: Sustainable purchasing practices positively influence purchasing performance.

2.3 Supply chain risk management performance

According to Zsidisin (2003), supply risks are supplier failures or supply market occurrences that hinder the purchasing firm in meeting their customer demands or that threaten customer life and safety. Many literature reviews about risk management in supply chains can be found. For example, Ho et al. (2015) recently summarized a detailed review concerning supply chain risk definitions, risk types, risk factors and management strategies. Because of the vast amount of literature and divergent views on risk management, this study concentrates only on supply chain risk management from the viewpoint of sustainability.

The sustainability of upstream supply chains has become increasingly important in companies' risk management efforts (Hofmann et al., 2014); however, deeply structured supply chains make it challenging to monitor upstream suppliers (Xu et al., 2019). Companies cannot assess supply risks from only an operational perspective regarding disruptions in their supply chains. According to Hoffman et al. (2014), traditional supply and sustainability risks can be distinguished by their triggering mechanism. They observed that supply risks are triggered by upstream disruptions, while sustainability risks are triggered by negative reactions from stakeholders. Holistic view of the possible consequences that risk incidents might cause to stakeholders in a broader sense is needed. The consequences of sustainability misconduct in supply chains can include serious reputational damage to the company's image and significant costs because of disruptions, delays and low quality (Roehrich et al., 2014). Therefore, one of the most important tasks of supply management is to prevent and mitigate these risks. Risk management includes risk assessment and actions that lead to improved performance and minimize supply disruptions (Wieland and Wallenburg, 2012). It is a management process starting with identifying risks and defining the mitigation strategies to reduce supply chain vulnerability as a whole (Jüttner, 2005). From a sustainability point of view, companies are responsible for their actions beyond organizational boundaries; hence, increased concern regarding sustainability in the supply chain also increases efforts in risk management (Shafiq et al., 2017).

Risk management can help companies become more confident in their supply chain sustainability decisions (Abdel-Basset and Mohamed, 2020). Miemczyk and Luzzini (2018) examined the role of risk management in maintaining sustainable supply chains and found that focusing on sustainability in risk management improved sustainability performance but did not significantly affect either the operational or the financial performance of a supply chain. However, sustainable supply management causes a long-term improvement in the company's reputation (Croom et al., 2018) and thus, sustainability practices may decrease brand risk. Hence, purchasing practices play an essential role in supply risk management, linking risk management to supplier relationship management practices (Hallikas and Lintukangas, 2016). Moreover, the risk management capabilities of a company and knowledge of sustainability practices that may prevent and/or mitigate risk occurrences decrease uncertainty and improve sustainability along the whole supply chain (Hoffmann et al., 2013).

Supply chain risk management is a process whereby firms coordinate and collaborate with their supply chain partners to reduce the vulnerability of a supply chain and ensure profitability and continuity along the whole chain (Jüttner, 2005; Tang, 2006). Supply risks are commonly categorized as external and internal to a company (Christopher and Peck, 2004) or based on the supply chain management process (e.g., Manuj Mentzer, 2008; Tummala and Schoenherr, 2011). From a sustainability point of view, the management of supply chain risks can be divided into operational and reputational risks. Table 1 summarizes the views of sustainability regarding risk management and purchasing performance.

Table 1. Sustainability, supply chain risk management and purchasing performance.

Views of sustainability risk management in supply chain	Impact of sustainability practices on purchasing performance
Sustainability risk assessment and actions to minimize supply chain disruptions (Wieland and Wallenburg, 2012)	Improve operational performance (González-Benito and González-Benito, 2005)
Increased sustainability in supply chain increases efforts in risk management (Shafiq et al., 2017)	Increase of recycling and reverse logistics systems (González-Benito and González-Benito, 2005)
Sustainability risk management increases firm-level sustainability performance but does not affect the operational or financial performance of a supply chain (Miemczyk and Luzzini, 2018)	Increase strategic supply management, firm level commitment to sustainability and promote efficient supplier management (Large and Gimenez Thomsen, 2011)
Sustainable supply management causes a long-term improvement in the company's reputation (Croom et al., 2018)	Links both financial and non-financial measures (Gunasekaran et al., 2001; Pohl and Förstl, 2011)
Risk management capabilities of a company and knowledge of sustainability practices decrease uncertainty in supply chain (Hoffmann et al., 2013)	Improve firm's environmental performance and operational cost performance (Cousins et al., 2019)
Sustainability risks affect shareholder value (Freise and Seuring, 2015; Grimm et al., 2016; Shafiq et al., 2017)	Promote strategic alignment between the business and purchasing (Baier et al., 2008)

Reputational risk refers to the probability of an incident that negatively changes a firm's stakeholders' perceptions of the firm's behaviour and performance (Roehrich et al., 2014). Reputational risks can arise, for example, because of a lack of corporate governance processes, as in conflicts regarding counterfeit goods and ownership of patents and innovations (Norrman and Jansson, 2004; Roehrich et al., 2014), or through environmental and social hazards, which may decrease brand value and threaten people's lives and safety (Koplin et al., 2007; Hofmann et al., 2014). According to studies on sustainable risks, the main identified effects of an incident that negatively impacts a company's reputation are related to the brand image, as well as subsequent consequences to shareholder value (Freise and Seuring, 2015; Grimm et al., 2016; Shafiq et al., 2017). Sustainable purchasing practices are thus identified as processes that can reduce the risks to the reputation and brand image of companies; thus, it is proposed that:

H2: Sustainable purchasing practices positively influence the reputational risk management performance of a supply chain.

Supply risks that cause operational problems are related to the movement of physical materials from their origin to the final customer. Operational supply risks concern disruptions in delivery or availability, as well as technology, financing and quality issues (Steele and Court, 1996; Manuj and Mentzer, 2008). Other examples of operational supply risks are price risks (Zsidisin, 2003) and supplier bankruptcy (Blackburn, 2007). These kind of supply risks directly influence operations of supply chains. Moreover, as pointed out by Christopher et al. (2011), no single practice is adequate to mitigate risks in global supply chains. Therefore, sustainability practices are needed to reduce the negative impacts of risks arising from global sourcing. Thus, it is also necessary to consider the effects of sustainable purchasing practices on the management of operational risks in supply chains. Therefore, it is posited that:

H3: Sustainable purchasing practices positively influence the operational risk management performance of a supply chain.

Table 2 summarizes the determinants of reputational and operational supply chain risks.

Table 2. Determinants of the supply chain risks.

Determinants of reputational risk	Determinants of operational risks
Lack of corporate governance (Norrman and Jansson, 2004; Roehrich et al., 2014)	Disruptions in supply chain (Manuj and Mentzner, 2008)
Counterfeiting/protection of business secrets (Norrman and Jansson, 2004; Roehrich et al., 2014)	Problems regarding availability (Manuj and Mentzner, 2008)
Conflicts regarding ownership of immaterial rights (Norrman and Jansson, 2004; Roehrich et al., 2014)	Problems regarding quality (Manuj and Mentzer, 2008)
Environmental hazards (Koplin et al., 2007; Hofmann et al., 2014)	Price volatility and increase of costs (Zsidisin, 2003)
Violations of human rights (Koplin et al., 2007; Hofmann et al., 2014)	Lack of finance in supply chains (Blackburn, 2007)

This study establishes a link between a company's sustainable purchasing practices and risk management. Sustainability in supply chains as well as sustainability practices are well-studied subjects (see Table 1), and sustainability risk sources in supply chains are mapped, as summarized in Table 2. However, as Gouda and Saranga (2018) and Miemczyk and Luzzini (2018) have noted, the research regarding the effect of sustainable purchasing practices on supply chain risk management performance and purchasing performance is still mainly on a conceptual level and has not been empirically explored. It is argued that sustainability in risk management improves the sustainability performance of a firm but neither the operational nor the financial performance of a supply chain (Miemczyk and Luzzini, 2018). Therefore, in this study, the connections between sustainable purchasing practices and risk management performance are highlighted.

2.4 Conceptual model

Figure 1 presents the conceptual framework of the study. It combines the hypotheses and suggested relationships between the key concepts of sustainable purchasing practices, operational and reputational risk management performance and purchasing and supply management performance. Arrows in the figure represent the assumed cause-and-effect relationships between concepts. The concepts are operationalized to constructs to enable empirical testing of the relationships between the concepts.

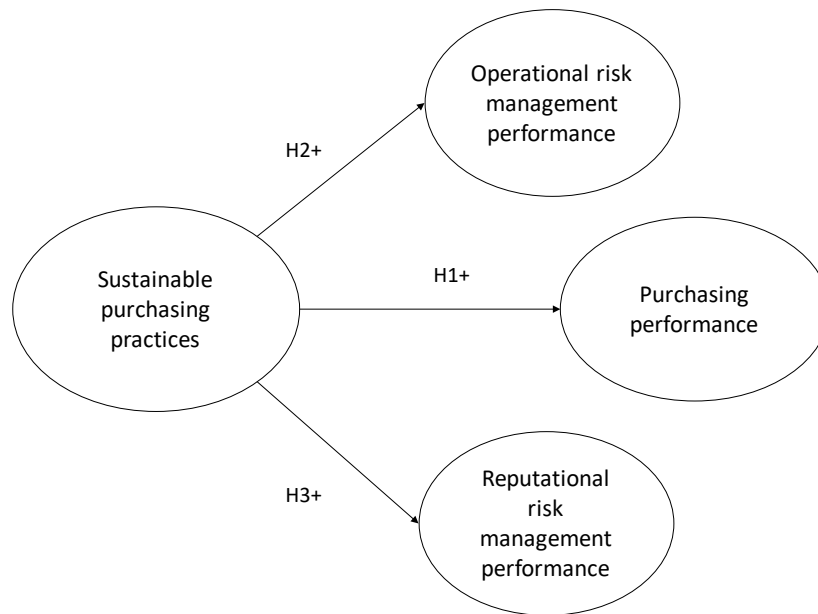


Fig. 1. Conceptual model.

The construct of ‘sustainable purchasing practices’ consists of social and environmental practices collected from the existing studies of Carter et al. (2000), Gualandris et al. (2014) and Hollos et al. (2012). The construct of ‘Operational risk management performance’ is operationalized based on the studies of Steele and Court (1996) and Manuj and Mentzer (2008) and contains items regarding the mitigation of delivery, availability, technology, financing and quality risks. ‘Reputational risk management performance’ consists of the management of reputational risks, which concerns the company brand, co-created innovations and intellectual property protection, according to studies by Norman and Jansson (2004) and Roehrich et al. (2014). The construct of ‘purchasing performance’ consists of operations that serve and fulfil internal needs in the company as based on the studies of Hemsworth et al. (2005) and Sánchez-Rodríguez et al. (2005). The items used to measure the constructs are presented in Appendix A.

3 Methodology and empirical study

3.1. Data collection

This study is based on a survey conducted in Finnish large and medium-size manufacturing companies. Finland was chosen because of being one of the top-performing countries in terms of sustainability based on several international rankings. According to the latest *Environmental Performance Index* (Wendling et al., 2018), Finland is among the ten best performers in the field. Moreover, according to *The Global Sustainable Competitiveness Index 2017* (Schwab, 2017), Finland’s sustainable competitiveness is the fourth best in the world. However, the Finnish manufacturing industry is highly dependent on imports and global supply chains (Statistics Finland, 2018). The total value of imports in 2018 in Finland was 66.65 billion euros, consisting mostly of chemical industry products, electronics, and transport equipment (Statistics Finland, 2018). Because supply risks arising from global sourcing can be substantial (Christopher et al., 2011), it is interesting to examine how sustainable purchasing practices could improve firms’ risk management performance in the Finnish context.

The sample was extracted from the commercial Amadeus database (Bureau van Dijk). Manufacturing, construction, and logistics companies operating in Finland with at least a 30-million euro turnover and 100 employees were included to the sampling strategy. As a result, 387 firms were listed and contacted by phone to find suitable informants on supply management functions from operational and/or managerial levels. A web link to the questionnaire was emailed to those who agreed to participate in the survey. After a reminder email was sent, 111 usable responses were received, making the response rate 28.6% (111/387). Non-response bias was assessed by comparing the early and the late respondents (Armstrong and Overton, 1977) in terms of industry, turnover, and spending. Because no significant differences were found, non-response bias was not a concern in the data.

Of the purchasing and supply management professional respondents, 32% represented executives, 46% middle management, 21% expert and operative positions, and 1% other positions. The division of industries in the survey is presented in Table 3. The responses were grouped into six main industry categories, these being Construction, Chemical, paper and wood, Manufacturing of machinery and equipment, Food, Logistics services, and Other industries. The average operating revenue of the responding companies was 428 M€

Table 3. The division of industries in the survey.

Industry	N	%	Turnover (t€)	Employees
Construction	23	21 %	176 521	458
Machinery, equipment, industrial manufacturing	39	35 %	388 969	1 696
Chemical, wood and paper	18	16 %	1 269 497	3 223
Logistics services	18	16 %	99 117	189
Food	4	4 %	613 046	1 371
Other	9	8 %	137 322	618
Total	111	100 %	428 404	1 344

3.2 Measurement model

The applied items and connected references are shown in Appendix A. The existing scales were slightly modified for the purposes of this study. Moreover, sustainable purchasing practices, supply chain risks and purchasing performance items were identified from the literature. The respondents evaluated their sustainability practices and risk management performance on a Likert scale (1 = disagree totally, 7 = agree totally). According to Henseler et al. (2009), the survey measurement model can be validated by showing factor structure validity, measurement reliability, and discriminant validity. Therefore, a Confirmatory Factor Analysis (CFA) was used to test the reliability and validity of the measurement model. Checking the factor loadings revealed that all the measurement items were highly loaded to the pre-defined latent factors. The loadings varied from 0.56 to 0.88, and were on acceptable level, being clearly over the threshold 0.4 suggested by Hair et al. (2016). Moreover, the cross loadings of the measurement items were checked, all being below 0.48. The Composite Reliability (CR) and the Average Variance Extracted (AVE) were calculated to assess the reliability and convergent validity of the variables. The CR coefficient should exceed 0.50 to be acceptable (Kline, 2011). As shown in Table 4 the CRs of the latent variables varied between 0.87 and 0.93 indicating acceptable reliability for constructs. The AVE values were greater than 0.50 for all factors, implying acceptable convergent validity (Fornell and Larcker, 1981). Furthermore, the square root of the

AVE was used to assess discriminant validity, and therefore, the Heterotrait-Monotrait ratio of the correlations (HTMT) were calculated. According to Henseler et al. (2014), if the HTMT value is below 0.90, discriminant validity has been established between two reflective constructs. There was no HTMT correlation value higher than 0.5, which indicated a good discriminant validity of the measurement model.

Table 4. Measurement reliabilities and descriptive statistics.

	Loading	t-value	p-value	Mean	SD	AVE	CR
Sustainable Purchasing Practices						0.50	0.93
Supplier instructions and processes for CSR	0.709	13.38	****	4.577	1.642		
Supplier self-assessments	0.560	4.85	****	3.955	1.404		
Sustainability standards for suppliers	0.728	12.87	****	4.892	1.736		
Responsibility register	0.734	11.79	****	3.712	2.029		
Responsibility reporting of the product	0.755	13.97	****	3.829	1.845		
Supplier audits made regularly	0.690	14.79	****	4.405	1.871		
Sustainability standards for the company	0.715	11.68	****	4.505	1.931		
Supplier audits and selection incorporate CSR	0.791	20.58	****	5.252	1.473		
Sustainability problem handling process	0.692	11.54	****	5.432	1.340		
Sustainability reporting of supplier	0.668	10.36	****	2.955	1.527		
Sustainability measurement	0.689	9.92	****	3.856	1.780		
Sustainability in contracts	0.718	13.08	****	4.550	1.691		
Life cycle analysis	0.682	9.34	****	3.649	1.631		
Waste reduction targets	0.708	14.27	****	3.162	1.685		
Operational Risk Management Performance						0.57	0.87
Product non-availability	0.793	10.78	****	5.468	0.957		
Orders are delayed	0.784	11.66	****	5.360	1.080		
Quality	0.716	12.67	****	5.225	0.965		
Costs and prices	0.790	17.98	****	5.360	0.957		
Bankruptcy of suppliers	0.675	10.12	****	4.514	1.229		
Reputational Risk Management Performance						0.69	0.87
Property rights of co-created innovations	0.817	10.73	****	5.009	1.270		
Knowledge and know-how protection	0.880	20.04	****	4.856	1.106		
Corporate brand and image	0.786	10.12	****	4.865	1.197		
Purchasing Performance						0.56	0.90
Supplied products correspond to given specifications	0.740	11.02	****	5.982	0.771		
Products arrive at agreed time	0.688	8.58	****	5.685	0.794		
Internal clients are satisfied with how their problems are handled	0.709	14.70	****	5.117	1.002		
Internal clients' changing needs are answered flexibly	0.717	11.25	****	5.369	1.013		
Purchasing contracts correspond well to different needs	0.843	24.49	****	5.613	0.912		
Supply management provides up-to-date information to its stakeholders	0.729	13.90	****	5.045	1.173		
Supply management purchases quality products and services	0.815	22.12	****	5.703	0.855		

n) Not significant, *) Statistically significant at $p < 0.1$, **) Statistically significant at $p < 0.05$, ***) Statistically significant at $p < 0.01$, ****) Statistically significant at $p < 0.001$

Common method bias was assessed using Harman's single factor test. All the items in the measurement model were loaded to exploratory factor analysis using Principal Axis Factoring (PAF) and restricting the number of factors to one (Podsakoff et al., 2003). The result of the extraction showed that a first factor explained only 30.6% of total variance. Hence, common method bias was not a concern in this study.

The descriptive statistics of the survey item constructs—sustainable purchasing practices, operational risk management performance, reputational risk management performance and purchasing performance—are shown in Table 4. To highlight the descriptive findings, the most important sustainable purchasing practices among respondents included sustainability problem-solving processes, incorporating Corporate Social Responsibility (CSR) into supplier audits and selection, the use of sustainability standards, supplier instructions and processes for CSR and integrating sustainability into purchasing contracts.

3.3 PLS Path Model

The study used partial least squares structural equation modeling (PLS-SEM) techniques with the application of SmartPLS software. The findings of a review study by Mardani et al. (2019) on the utilization of SEM in green supply chain management showed that most published papers have used SmartPLS in their studies. In small samples, PLS-SEM is a usable method for achieving acceptable levels of statistical power (Reinartz et al., 2009). Variance-based PLS analysis should be preferred when the emphasis is on prediction and theory development (Reinartz et al., 2009) and when the observations range from 30 to 100 cases (Sarstedt et al., 2014). Because our dataset consisted only 111 responses, PLS-SEM was found appropriate analysis method. PLS-SEM is widely applied in many recent studies, see for example Hajmohammad et al. (2013), Laari et al. (2016), Blome et al. (2017) and Dubey et al. (2018). Moreover, we also conducted post-hoc statistical power test on the model and it confirms that the sample size holds enough statistical power to explain significant effects in the model.

3.4. Results

The results of the main effects of the conceptual model (Figure 1) are presented in Table 5 and Figure 2. The mediation of the indirect effects was also assessed. For the estimation of the parameters in the model we used 5000 iterations for the resampling of the data with the traditional bootstrapping method (Kline, 2011). We tested collinearity issues, overall fit, explanatory power and path significances in the structural model. The VIF values of the latent constructs do not suggest major issues relating to collinearity IF values remain below the value of 5. To assess the overall fit of the structural model a model fit of $RMS\theta = .142$ indicates moderate fit of the model (Hair et al., 2016).

In the path model, the r-squared for the latent variables were: operational risk management performance = .12, reputational risk management performance = 0.09 and purchasing performance = 0.27. The default model (see Table 5) shows that 'sustainable purchasing practices' has a strong and significant positive influence on the supplier 'operational risk management performance', 'reputational risk management performance' and 'purchasing performance', which confirms these hypothesis paths in the conceptual model. The model also illustrates that 'operational risk management performance' has a positive influence on the supplier 'purchasing performance'. However, 'reputational risk management performance' is

not significantly related to ‘purchasing performance’. These direct relationships were explored through the path model; however, they were not actually hypothesized in this study.

Table 5. Direct effects in the structural model to test the main hypothesis of the study.

Hypothesis	Effect	Path	β	t-statistics	p-values
Main effects in the research model					
H1	Direct	Sustainable purchasing practices -> Purchasing performance	0.234	2.466	0.014 **
H2	Direct	Sustainable purchasing practices -> Operational risk mgmt	0.346	2.949	0.000 **
H3	Direct	Sustainable purchasing practices -> Reputational risk mgmt	0.294	2.714	0.006 **
	Direct	Operational risk mgmt -> Purchasing performance	0.321	2.949	0.004 **
	Direct	Reputational risk mgmt -> Purchasing performance	0.120	1.269	0.215 n
	Indirect	Sustainable purchasing practices -> Operational risk mgmt -> Purchasing performance	0.111	2.428	0.015 **
	Indirect	Sustainable purchasing practices -> Reputational risk mgmt -> Purchasing performance	0.035	0.961	0.337 n

n) Not significant, *) Statistically significant at $p < 0.1$, **) Statistically significant at $p < 0.05$

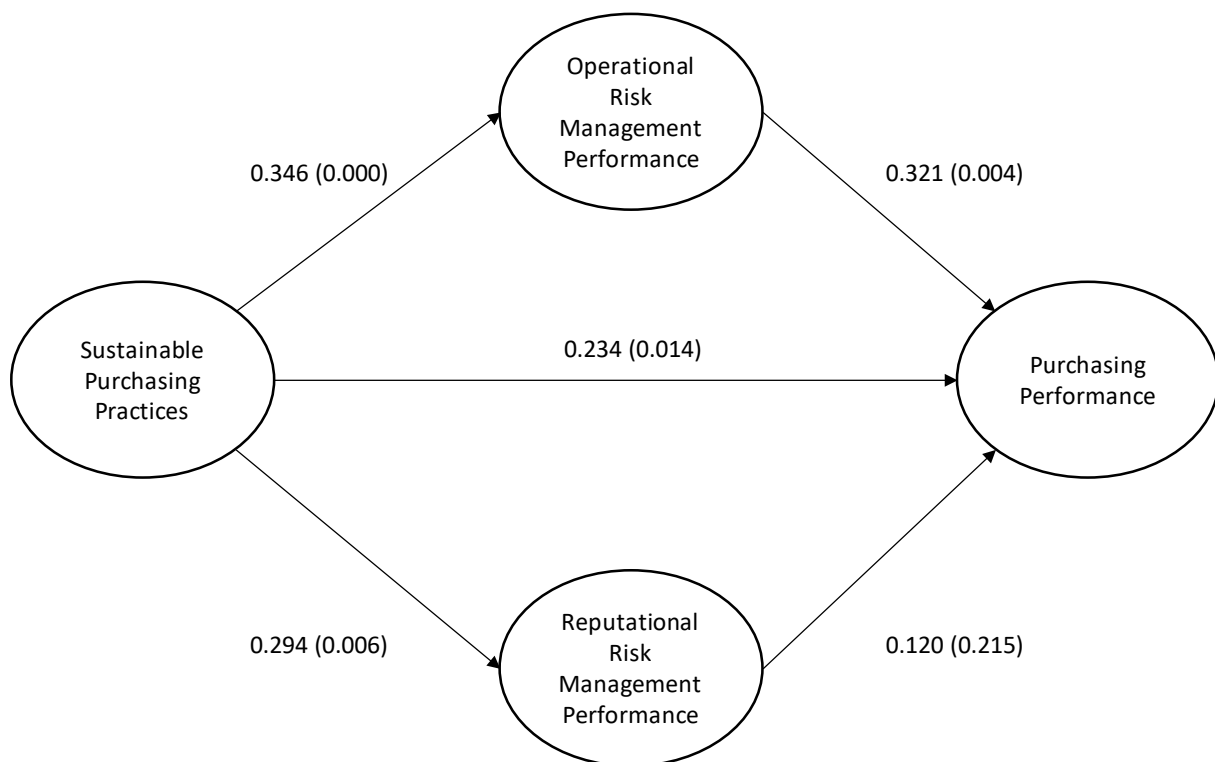


Fig. 2. The results of the conceptual model testing (path coefficients and p-values).

The assessment of the indirect paths confirms hypothesis H4 that the ‘operational risk management performance’ mediates the relationship between ‘sustainable purchasing practices’ and ‘purchasing performance’. However, no mediation effect was found of ‘reputational risk management performance’ on ‘purchasing performance’.

The results provide empirical support for the hypothesis that sustainable purchasing practices have a statistically significant relationship with purchasing and supply management performance. This indicates that the implementation of sustainability into a supply chain may lead to better overall performance. Our empirical results also support the hypothesis that sustainable purchasing practices influence both operational and reputational risk management performance. Sustainable purchasing practices thus help mitigate operational supply chain risks that are due to disruptions, such as product availability, delayed orders, quality, costs and prices, and supplier bankruptcy, in the upstream supply base. Sustainable purchasing practices can also prevent the reputational risks that arise from brand and image, ownership of co-created innovations, and protection of knowledge and know-how.

4 Discussion

Effective business and supply risk management have been highlighted as central motives for implementing sustainable purchasing and supply management practices (Schneider and Wallenburg, 2012) that, on the other hand, are the key in maintaining the sustainability of supply chains (e.g., Pullman et al., 2009; Hofmann et al., 2014). Based on previous research, we proposed three hypotheses for our study. The first hypothesis addressed the effect of sustainable purchasing practices on overall purchasing performance. The two subsequent hypotheses were related to the influence of sustainable purchasing practices on the two constructs of operational and reputational risk management performance. We used PLS-SEM to analyze the relationships between the variables.

4.1 Implications for theory and practice

Our study provides novel insights into and empirical support for the effects of sustainable purchasing practices on supply chain risk mitigation and performance and provides empirical support for the hypothesis that sustainable purchasing practices have a statistically significant relationship with purchasing and supply management performance. These findings support earlier research (e.g., Sajjad et al., 2015) arguing that the implementation of sustainability into a supply chain may lead to better overall performance. Furthermore, our empirical results support the hypothesis that sustainable purchasing practices influence operational risk management performance. This result, while somewhat surprising, confirms the early perceptions that sustainable purchasing practices enhance the operational effectiveness of companies and thus help mitigate operational supply chain risks. González-Benito and González-Benito (2005) found that sustainable purchasing practices are necessary for achieving the operational performance objectives of supply chains, such as quality, reliability, and flexibility. The results of our study support this by showing that operational risk management factors, such as the non-availability and quality of products, costs and prices, and delayed orders, can be managed by adopting certain practices in sustainable purchasing and supply.

Our findings also support the hypothesis that sustainable purchasing practices influence reputational risk management performance. This is perhaps the most interesting result, given that a vast amount of previous literature on sustainability risk management has concentrated on this relationship. For example, Seuring and Muller (2008), Freise and Seuring (2015), and Grimm et al. (2016) identified the effects of sustainability risks on a company's reputation and brand image. It has also been stated that reputational issues play an important role in driving sustainability and risk management in supply chains (Lange and Lee, 2011). Croom et al.

(2018) found that sustainable supply management leads to long-term improvement in a company's reputation, and our results support this by showing that sustainable purchasing practices do influence the performance of reputational risk management. Overall, the results show that sustainable purchasing practices positively influence both reputational risk management performance and operational risk management performance. Our findings are novel and important due to the lack of empirical research focusing on how sustainability practices influence different types of risks in supply chains.

Beyond direct effects, the empirical analysis also illustrated the significant indirect path between sustainable purchasing practices, operational risk management performance, and purchasing performance. This path shows that 'operational risk management performance' mediates the relationship between 'sustainable purchasing practices' and 'purchasing performance'. This novel exploratory finding provides important evidence that, in addition to the direct influence on purchasing performance, these practices influence the purchasing performance indirectly via operational risk management performance of a firm.

These results provide interesting managerial implications that support companies in developing their sustainable purchasing practices and risk management in general. Companies nowadays put a lot of effort into handling sustainability issues and have noticed that there is a high risk of sustainability-related failures and incidents occurring, especially in their supply bases. Thus, firms' managers need to be aware of the significance of different practices, not only in managing the sustainability of their supply chains but also in managing the risks related to supply chains. Supply chain risk management continuously seeks new practices for mitigating risks in the global business environment. The most significant finding of the study from the managerial viewpoint is that sustainable purchasing practices seem to provide important tools and strategies to mitigate operational and reputational supply chain risks and to improve resiliency in supply chains. By demonstrating that sustainable purchasing practices positively influence both operational and reputational risk management, the study shows that managers can use sustainable purchasing practices to handle and mitigate operational risks related to, for example, non-availability and product quality, or to better protect themselves against reputational risks, such as risks related to brand and image or to the protection of knowledge and know-how. Risk management should take into account the requirements of the business environment and adapt the practices to each operating environment. Identifying the impact of sustainability on operational risks leverages the value-adding potential of sustainability practices and provides an additional reason for firms to invest in the resources and capabilities needed to implement sustainability practices in companies and global supply chains. The development of practices requires paying attention to the company's internal processes, supplier base and operations in entire supply chains.

The results of this study can be put into practice by utilizing the sustainable purchasing practices that are presented in the paper for risk management and performance improvement. Companies can also identify the maturity of their existing sustainable purchasing practices and their potential for risk management and performance. The application of these practices can be affected by the industry in which the company operates. While all business sectors can benefit from improving their sustainable purchasing practices, reputational risks, for example, may be higher in some sectors, and it may be worth investing more in the development of practices in those sectors.

5 Conclusions

Sustainability practices have an important role in managing global sustainability challenges in companies and in supply chains. The development of sustainable purchasing and corporate social responsibility has increased visibility and strengthened the requirements for process and product quality in supply chains. Despite the vast amount of research that has been conducted in sustainable supply chains (Seuring and Müller, 2008; Giunipero et al., 2012; Miemczyk and Luzzini, 2018, Xu et al., 2019), it is relatively unknown about whether adopting certain sustainable purchasing practices affect the risk management performance of the firm. When comparing the results with earlier work, this study has high significance especially in sustainable supply chain management research because the studied relations have not been empirically investigated in previous research. This study investigated the relationship between sustainable purchasing practices and risk management performance by using quantitative survey data collected from Finnish companies and by examining the relationships between the concepts using a PLS methodology. Based on previous studies, we proposed that sustainable purchasing practices positively influence purchasing performance, and this hypothesis was supported. We also hypothesized that sustainable purchasing practices positively influence both the reputational risk management performance and operational risk management performance of a supply chain. These hypotheses were also supported. It can be concluded that sustainable purchasing practices are significant in risk management in general, and not only when it comes to sustainability, and that these practices enhance the firm's overall purchasing performance.

6 Limitations and further research

One limitation of the applied survey based methodology is the simplification of the complex phenomena. The paper focused on a review of research and practice and identified links between sustainable purchasing practices and supply chain risk management that need to be further investigated. The data were collected from a business-to-business environment, which limited the possibility of studying consumer impacts on sustainability (see Shao and Ünal, 2019). Therefore, the consumer perspective on sustainability risks would be an interesting future research area. One limitation of the study is also its sample size. However, the applied PLS-SEM method allowed us to achieve acceptable levels of statistical power. It is also worth mentioning that the sample of this study consisted of selected industry sectors, and there are indications that some sustainable purchasing practices differ between industries. Thus, in future research, it would be beneficial to characterize the industry-specific requirements and circumstances of supply chain sustainability. More research is also needed in other sectors, and with a larger number of samples. Although our study provided evidence for the connection between sustainable purchasing practices and risk management performance, developing an in-depth understanding of these relationships will require further investigation. In future research, it would also be interesting to study how sustainability practices can help companies to create competitive advantage. Future research should also consider the more specific links between sustainable purchasing practices and risks in supply chains.

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APPENDIX A. Research instrument

<p>Sustainable Purchasing Practices (Evaluate the realization of the following sustainability controls and procedures in purchasing and supply management; 1 = Not at all, 7 = To a great extent)</p> <p>Supplier instructions and processes Supplier self-assessments Sustainability standards for suppliers Responsibility register Responsibility reporting of the product Supplier audits made regularly Sustainability standards for the company Supplier audits and selection incorporate CSR Sustainability problem-handling process Sustainability reporting of supplier Sustainability measurement Sustainability in contracts Life cycle analysis Waste reduction targets</p>	<p>Gualandris et al., 2014; Carter et al., 2000; Hollos et al., 2012</p>
<p>Operational Risk Management Performance (Ability to prevent following risks; 1 = Not at all, 7 = To a great extent)</p> <p>Product availability Delayed orders Quality Costs and prices Supplier bankruptcy</p>	<p>Steele and Court, 1996; Manuj and Mentzer, 2008</p>
<p>Reputational Risk Management Performance (Ability to prevent following risks; 1 = Not at all, 7 = To a great extent)</p> <p>Ownership of co-created innovations Protection of knowledge and know-how Brand and image</p>	<p>Norrmann and Jansson, 2004; Roehrich et al., 2014</p>
<p>Purchasing Performance (Evaluate the purchasing performance of your company; 1 = Fully disagree, 7 = Fully agree)</p> <p>Supplied products correspond to given specifications Products arrive at agreed time Internal clients are satisfied with how their problems are handled Internal clients' changing needs are answered flexibly Purchasing contracts correspond well to different needs SM provides up-to-date information to its stakeholders</p>	<p>Hemsworth et al., 2005. Sánchez-Rodríguez et al., 2005</p>