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Sustainable supply chain management practices in developing countries: An empirical study of Jordanian manufacturing companies

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ABSTRACT

Sustainable supply chain management (SSCM) is continuously gaining importance. It has been studied widely in developed countries and to some extent also in developing countries. This paper contributes to the latter by studying environmentally related SSCM practices in Jordanian manufacturing firms and provides a base for policy- and decision-makers as it assesses the current situation of the Jordanian manufacturing companies in terms of voluntarily adopting sustainable development practices or doing so under external pressure. This study aims to evaluate how adopting sustainable practices can affect economic performance in developing countries within the context of Jordanian manufacturing companies. Based on existing literature, a questionnaire was developed covering aspects of sustainability in internal and external supply chain practices, SSCM drivers, and company performance. A total of 92 responses were analyzed to test the proposed hypotheses using regression analyses to test the single-variable hypotheses, and structural equation modeling to test the multivariate hypotheses. The results show that the adoption of SSCM practices is still in its initial stages for Jordanian manufacturers. Sustainability awareness is quite low, and Jordanian companies mostly do not seem to consider the environmental impacts of their manufacturing operations. The results also show a difference between manufacturing types: process industries were less likely to adopt SSCM practices voluntarily, while discrete industries were more likely to do so. Finally, for Jordanian manufacturers to compete in international markets, they should take further steps toward adopting sustainability. To enhance the investment potential of multinational companies, Jordan should take the advantages of the industrial parks/estates and adopt regulations that force manufacturers to adopt sustainability practices under external pressure.

1. Introduction

Sustainability has become more and more important for many stakeholders in our society, due to increasing environmental degradation and concerns about human rights. Sustainable development (SD) deals with meeting the needs of the present generation while considering the requirements of future generations (WCED, 1987). This development also effects on supply chain management (SCM). Integrating SD with SCM can be defined as a set of approaches utilized to create efficient product value when materials move from suppliers to manufacturers, warehouses, and stores. The products are produced and distributed to the final customers while taking into consideration what is the needed product, the needed quantity, where it is needed, and when; to meet the customer needs at a higher quality level and reasonable price (Chen and Paulraj, 2004).

Many definitions of Sustainable SCM (SSCM) can be found in the literature and focus on the triple bottom line (3BL) of sustainability (Khan et al., 2021). For instance, SSCM can be defined as optimizing processes and operations of a firm while maintaining their environmental impacts at a low level, and enhancing social benefits through their corporate social responsibilities (CSR) (Giannakis and Papadopoulos, 2016). Maintaining low industrial environmental impacts is a challenge facing many manufacturing companies and their supply chains, especially in countries where environmental awareness among society is at high levels. Environmental concerns have also increasingly affected SCM, since production and distribution strategies often affect the environment in all supply chain stages. Reducing environmental impacts requires significant interventions in all parts of the supply chain, ranging from the sustainable sourcing of raw materials to the resource-efficient planning of manufacturing activities. Sustainable SCM (SSCM), or Green SCM

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(GSCM) has attracted manufacturers due to the huge amount of solid waste generated by industrial processes and increasing levels of air pollution resulting from other SCM operations. This leads to the re-evaluation of raw materials, product redesign, and supply chains for the environment (e.g. (de Giovanni, 2012; Shi et al., 2012; Wong et al., 2012; Zailani et al., 2012),).

Taylor and Vachon (2018) reviewed empirical studies on SSCM and found a research gap in the social dimension of SSCM. Sodhi and Tang (2018) analyzed the social aspect of sustainability and discussed how it influences a company's performance. They proposed a 4P model, to show how SCM practices can be affected by pressure and partnerships, which later effects the system performance. Galal and Moneim (2016) mentioned in their research that companies in developed countries are voluntarily adopting SSCM practices to compete in the market and raise their market share, due to the relatively high customer awareness of sustainability issues in these countries. Also, legislation in developed countries is more likely to force organizations to adopt SSCM practices.

Some developing countries also showed improvement in SSCM practices. For instance, Hong et al. (2018) discussed the importance of SSCM practices for Chinese manufacturers, even though they also mentioned that this is especially the case for companies operating in developing countries. Dai et al. (2021) investigated the driving forces to implement SSCM practices using empirical statistics for Chinese firms. For Indian organizations, Das (2018) studied how social dimension could affect firm performance. In general, it seems that there is less market and legislative pressure to adopt SSCM practices in developing countries – even though this seems to be increasing. Khan et al. (2021) recently also concluded that there is a research gap in the literature related to the adoption of SSCM practices in developing countries.

Generally, most research about SCM in Jordan is directed to improve specific key performance indices (KPIs) of a company in a specific supply chain stage (e.g., Alzubi et al., 2019), without considering sustainability issues. This made a greater gap between practitioners in SCM and academia because of lack of research on sustainability within SCM in Jordan. Therefore, this paper aims at analyzing the SSCM practices in Jordan, the willingness of manufacturing companies there to adopt these practices, and adding a study on SSCM practices in developing countries in general. More specifically, the objective of this paper is to enrich the literature by studying and assessing sustainable practices in Jordanian manufacturing within industrial parks. Also, to evaluate how economic performance and competitiveness will be affected by adopting SSCM practices voluntarily or under external pressure.

Countries all over the world have competed to develop their economies through different methods. The Jordanian government aims at enhancing SCM practices by establishing industrial parks to develop services around these parks. Even though the management of industrial parks often allows us to focus on both economic and environmental performance of the companies (e.g., Bellantuono et al., 2017; Herczeg et al., 2018), there does not seem to be any interest for environmental performance within the industrial parks in Jordan. To the best of the authors' knowledge, the impact of adopting environmentally friendly internal or external practices on economic performance is a hot research area in developing countries. To contribute to this discussion, this paper studies the extent to which SSCM practices are used in Jordan with a focus on adopting practices related to environmental impacts and their relationship to economic performance. Structural Equation Modeling (SEM) has been implemented for this purpose. Even though SSCM has been studied since the early 2000s, it is still relatively new for developing countries like Jordan. To the best of the authors' knowledge, research about SSCM in Jordanian manufacturing firms does not exist. Therefore, this study contributes to the literature as it is considered one of the first studies evaluating the current state of sustainable practices within the Jordanian manufacturing companies located in industrial parks.

The remainder of this paper is organized as follows. Section 2 reviews related literature on SSCM practices. Section 3 describes the methodology. Section 4 presents and discusses the results, and practical and theoretical implications. Finally, the conclusions are presented in Section 5.

2. Literature review

This section is divided into different subsections to differentiate between SSCM practices, adoption drivers for SSCM practices, and affected performance when adopting these practices. The relationships between these practices, drivers, and performance are presented in section 2.4. The constructs and related questionnaire items are described accordingly.

2.1. Adoption drivers for SSCM practices

When studying SSCM, it is important to identify the drivers that motivate or force companies to integrate sustainability into their operations. Several studies have discussed and identified the drivers that push firms to take part and move forward in adopting sustainability, whereas many different drivers play a vital role in adopting SSCM practices (León-Bravo et al., 2019). A number of studies concluded that companies tend to adopt sustainability in their operations to gain a competitive advantage and/or to comply with regulations (e.g., (Green et al., 2012; Rao, 2002; Zhu and Sarkis, 2004). Similarly, Peters et al. (2011) identified two strategies that can be followed when adopting SSCM practices: (*i*) a compliance strategy, in which a company adheres to rules and regulations, or (*ii*) a voluntary strategy, in which a company adopts SSCM practices voluntarily to gain a competitive advantage.

Sodhi and Tang (2018) discussed in their 4P model how partners put pressure on companies to integrate sustainability into performance enhancing SCM practices. Companies would be either proactive or reactive to apply SSCM practices within their operations (Rehman et al., 2021). Fousteris et al. (2018) discussed the nature of the relationship between adopting sustainable practices proactively and competitiveness. The reasons that companies adopt SSCM practices may include the following: managers' awareness, enhancing the firm's image, and to find an outstanding position among competitors. Similar conclusions were found by Bloemhof et al. (2015) and León-Bravo et al. (2021), where companies implemented sustainability to enhance their competitiveness, improve their reputation in the market, reduce energy costs by utilizing renewable energy, execute top management vision, and improve the quality level of the product.

On the other hand, different researchers identified the pressure of external parties as a driver to consider and implement sustainability within SC practices. According to Bloemhof et al. (2015), Meinlschmidt et al. (2018), León-Bravo et al. (2019), and Özbay (2021), governmental regulations and the pressure of other stakeholders in the SC are important factors in forcing manufacturers to adopt sustainable practices. Based on the above-mentioned drivers, the construct "adopting SSCM voluntarily" is considered, and its related questionnaire items are presented inAppendix A. However, internal and external drivers are not the only mentioned drivers. Other driving forces are considered by (León-Bravo et al., 2021), such as product quality, efficiency, and workers safety, which are all under the category of internal drivers. Additional external drivers include market forces, social issues, and global warming.

2.2. SSCM practices

To identify practices involved in the analysis, the following internal and external practices were considered from the literature in this study. Literature differentiates between those practices and activities performed inside or outside the company. In general, SSCM practices can be divided into internal and external practices. Internal SSCM practices can include the redesign of products with biodegradable materials, or the design of more energy-efficient production and distribution processes (Rao, 2004; Rao and Holt, 2005; Wu et al., 2018; and Rehman et al., 2021). Moreover, some authors found that internal practices may also include waste

reduction, using clean energy, redesigning processes for less pollution, energy consumption, water use, and the implementation of ISO 14001 (de Giovanni, 2012; and Green et al., 2012). Wong et al. (2012) also considered product assembly and disassembly as internal practices. Nevertheless, firm responsibility toward the environment such as using recyclable materials for redesigning product and packaging are also classified as internal practices (Rehman et al., 2021; Wong et al., 2012; and Zhu et al., 2012). .

External SSCM practices are related to aspects outside a company's borders, such as suppliers' selection and cooperation. Such external practices were extensively discussed in the literature; (e.g., Rao, 2004; Rao and Holt, 2005; Wu et al., 2018). For instance, selecting suppliers based on their sustainability performance, and auditing them based on their environmental performance can lead to improvements in product quality and increased market share by attracting new customers (Rao and Holt, 2005). This enhances competitiveness and consequently the economic performance is improved (Fousteris et al., 2018; and Rehman et al., 2021). Implementing the ISO14001 system has a significant impact on the environmental performance and overall competitiveness (Govindan et al., 2014; Ikram et al., 2020). Regarding transportation and logistics, warehouses and storage do need significant financial investment to be redesigned so as to minimize their environmental impacts. Transportation mode plays a vital role in enhancing the environmental performance measures, and therefore some research considers these under internal practices (Rehman et al., 2021; Shi et al., 2012; and Wong et al., 2012). Based on the previously mentioned practices in this sub-section, the constructs “internal SSCM practices” and “external SSCM practices” are considered and their related questionnaire items are presented in in Appendix A.

2.3. Firm performance

Firm performance when adopting SSCM practices had also been widely discussed in the literature. Balasubramanian and Shukla (2017) studied SSCM practices within the construction sector and they found that economic performance measures could be affected in a positive way when implementing environmentally friendly SSCM practices. However, Zailani et al. (2012) differentiated between different performance measures, including the following: environmental performance, operational performance, organizational performance, financial performance, economic performance, marketing performance, and competitiveness. Some authors took a more aggregated perspective. For example Rao and Holt (2005) classified financial performance, economic performance, and marketing performance under economic performance. In addition, Zhu and Sarkis (2004) and Zhu et al. (2012) considered cost savings as part of the economic performance. Other authors, such as Shi et al. (2012), contemplated more specific measures, e.g., operational performance includes quality, productivity, efficiency, and flexibility. Green et al. (2012) also considered product quality under operational performance, which is classified under competitiveness. Enhancing companies' image in the market can improve firms’ competitiveness measures, since the market share will be increased (Fousteris et al., 2018). Furthermore, Rehman et al. (2021) considered different aspects to enhance environmental performance starting from internal activities such as avoiding waste, designing products using biodegradable/recyclable materials, using renewable energy, and wastewater treatment to enhance competitiveness as it is positively correlated to economic performance. However, the analysis performed in this study considers the impact of adopting sustainability within internal as well external practices focused on economic performance and competitiveness. Therefore, the constructs of economic performance and competitiveness were considered and the related questionnaire items are presented in Table A.1 in Appendix A.

Empirical analysis has been widely used in the literature to examine the relationship among SCM stakeholders in terms of sustainability (e.g., Dai et al., 2021; Fernando and Wah, 2017; Rezaei Vandchali et al., 2021). Yet, different approaches were considered in the literature to analyze and test relationships between different drivers to SSCM and sustainability performance (environmental and economic). For example, Hashim, et al. (2021) employed failure mode and effect analysis (FEMA) in their research to model and evaluate sustainability-related practices within Pakistani SCM. Ghosh (2019) conducted an SEM to study the impacts of environmentally friendly practices within SCM on firm environmental performance within Indian manufacturing companies. Gupta et al. (2018) used in their research confirmatory factors analysis (CFA) to build an assessment model to evaluate SSCM practices within Indian manufacturing companies. On the other hand, exploratory factor analysis (EFA) has been used by Prasad et al. (2018) to identify environmental practices affecting SSCM. Additionally, Analytical Hierarchy Process (AHP) has been also used in the literature to study sustainable practices with SSCM. For instance, Thanki et al. (2016) applied AHP to analyze environmental practices within SCM on environmental performance. Hashim et al. (2021) employed fuzzy AHP in their research to evaluate sustainability within the textile sector in Pakistan. The extensive empirical research on SSCM practices since the early 1990s has mostly focused on the context of developed countries. Some of this literature will be used in the following section to develop our research questions.

As mentioned in the introduction, there is a research gap concerning SSCM in developing countries, as also emphasized by Jia et al. (2018). Research on SSCM in developing countries was also already labeled infrequent by Galal and Moneim (2016). Only a few studies have been conducted in Jordan to assess and evaluate Jordanian companies’ initiatives related to SSCM. For instance, Al-ghwayeen and Abdallah (2018) found that firms that implemented green SCM practices within their operations have better opportunities to enhance their export performance. Another study conducted in Jordan found that business performance is positively influenced when a firm adopts green SCM practices (Abdallah and Al-ghwayeen, 2020). In this paper, a deeper investigation on the relationship between various internal and external SCM practices and their relationships to economic performance and competitiveness, and the proposed hypotheses connect different sustainability aspects to environmental performance and economic, which makes this study different than what has been proposed in studies presented in the same area. For this purpose, simple linear regression, CFA and SEM have been employed to study and evaluate adopting environmental-friendly practices, and how they impact economic performance under the umbrella of environmental dimension (social dimension has been not considered) within the Jordanian manufacturing companies located in industrial parks/estates mentioned in Table 1.

2.4. Research questions

In the present survey, the authors analyzed how firm competitiveness and economic performance are influenced by adopting internal and external SSCM practices. According to previous literature, *e.g.,* Flint and Golicic (2009), Peters et al. (2011), and León-Bravo et al. (2021), being proactive and adopting SSCM practices voluntarily without pressure from regulations, customers, or competitors can provide companies with competitive advantages through sidestepping the high cost of implementing SSCM procedures at an advanced point because of any type of pressure, especially external pressure such as competitors, customers, or governmental legislation, which most probably will lead to a barrier for

Table 1
The number of companies located in selected industrial parks in Jordan (JIEC, 2021).

Industrial Park	Number of Companies
Abdullah II Ibn Al-Hussein Industrial Estate (AIE)	405
Al-Hassan Industrial Estate (HIE)	154
Ad-Dulayl Industrial Park (ADIP)	25
Al-Hussein Bin Abdullah II Industrial Estate (HUIE)	34
Aqaba International Industrial Estate (AIIE)	44
Al Tajamouat Industrial City (TIC)	69

new firms with unsustainable SC and then to higher economic performance (Walker and Jones, 2012). The current research on adopting SSCM practices voluntarily have positive impacts on operational performance which in return influence competitiveness, and consequently economic performance will be influenced positively (Khan et al., 2021; Rezaei Vandchali et al., 2021; Zhu et al., 2012). This means there is a relationship between the driver of adopting SSCM practices within operations and economic performance as well as competitiveness. However, Fousteris et al. (2018) claimed that competitiveness can be positively influenced when being proactive to adopt SSCM practices voluntarily. These kinds of relationships were considered in hypotheses H1 and H2 to be tested within the Jordanian context. Voluntarily adopting SSCM practices is considered the independent variable for both H1 and H2 where competitiveness and economic performance are the dependent variables in H1 and H2 respectively.

H1. Voluntarily adopting SSCM practices has a significant and positive effect on competitiveness.

H2. Voluntarily adopting SSCM practices has a significant and positive effect on economic performance.

According to Peters et al. (2011), proactive firms are more likely to adopt sustainable schemes in the form of rules in their standard practices, plans, strategies, checklists, procedures, process sheets, and all related systems and management programs for their own interest and stakeholders, than companies implementing SSCM under external forces, like regulations and/or customer awareness, are. In addition, internal and external practices, generally have an impact on economic performance and competitiveness, especially when it comes to cost and quality, and therefore voluntary integration of sustainability to internal and external practices will impact economic performance and competitiveness (Iranmanesh et al., 2019). To examine this relationship within the Jordanian context, hypothesizes H3 and H4 have been proposed considering the connection between voluntarily adopting SSCM to external and internal SSCM practices respectively. Voluntarily adopting SSCM practices is considered the independent variable for both H3 and H4 while external SSCM practices and internal SSCM practices are the dependent variables in H3 and H4 respectively.

H3. Voluntarily adopting SSCM practices has a significant and positive effect on external SSCM practices.

H4. Voluntarily adopting SSCM practices has a significant and positive effect on internal SSCM practices.

Considering the 4P model, proposed by Sodhi and Tang (2018); H3 and H4 are presenting the first part of the model where they test how pressure influence SSCM practices, while the second part of the model is presented in hypothesis H1 and H2 as they test the influence of adoption pressure on performance.

Other researchers also assessed how implementing SSCM practices affected each other. For instance, there might be impacts on external activities when applying the internal SSCM activities and vice versa (Zhu et al., 2012). Another research paper conducted in Indonesia studied the relationship between internal and external practices, and how they affect each other when adopting sustainability within these practices (Siagian et al., 2020). And therefore, hypothesis H5 is formulated to be tested within the Jordanian context. H5 works in 2 directions, the first of which considers internal SSCM practices as the independent variable, where external SSCM practices are the dependent one. The second direction is the opposite where external SSCM practices are the independent variable and internal SSCM practices act as the dependent variable.

H5. Internal SSCM practices are positively associated with external SSCM practices.

Finally, the study analyzed how the economic performance measures will be impacted by adopting SSCM practices. Different researchers in the literature found indirect relationships between SSCM practices and firm performance. For instance, Feng et al. (2018) conducted an empirical study on automotive companies located in China and concluded that the economic performance measures are influenced by SCM practices when integrating green aspects to them. Other researchers like Klassen and McLaughlin (1996) argued that economic performance measures are positively linked to sustainability within SCM operations. On the other hand, the literature could define the nature of the connection between performance measures and implementing SSCM practices to be positively influenced, e.g., Zhu et al. (2012). Similarly, Siagian et al. (2020) concluded in their study on Fast-Moving Consumer Goods (FMCG) a positive relationship between SSCM practices and performance. The study evaluated these relationships within the Jordanian context; therefore, it included the hypotheses H6, H7, H8, and H9. Competitiveness is the dependent variable in H6 and H8, whereas economic performance is the dependent variable in H7 and H9. Meanwhile, external SSCM practices are the independent ones in H6 and H7, but for H8 and H9, internal SSCM practices are the independent variable. A summary of the hypotheses is illustrated in Fig. 1.

H6. External SSCM practices have a significant and positive effect on competitiveness and vice versa.

H7. External SSCM practices have a significant and positive effect on the economical dimension.

H8. Internal SSCM practices have a significant and positive effect on competitiveness.

H9. Internal SSCM practices have a significant and positive effect on economic performance.

By analyzing the above-mentioned hypotheses, it is expected to give clear answers to the following three research questions:

RQ1: What is the current level of sustainability integration within SCM practices in Jordan?

RQ2: Is there any influence from being in an industrial park/estate on sustainability adoption?

RQ3: Does sustainability adoption influenced by industrial sector/industry type?

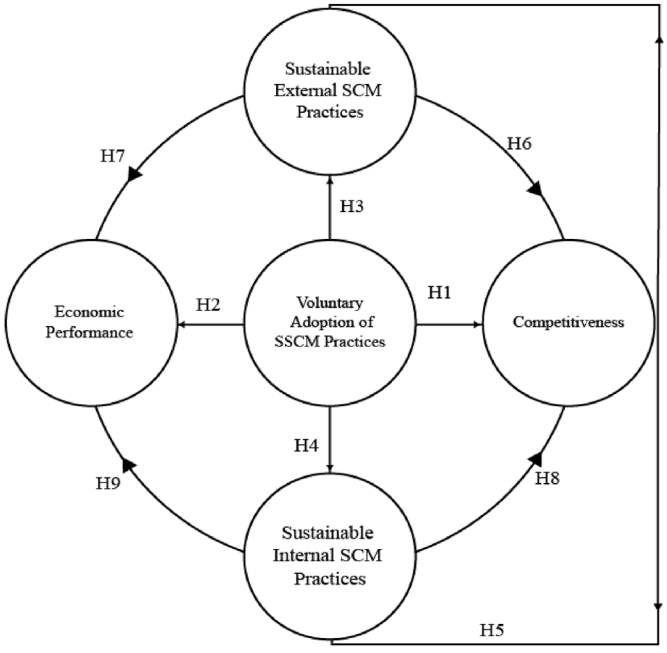

Fig. 1. provides an overview of the constructs used in this study and the hypotheses related to adopting SSCM practices.

3. Methods

The methodology followed in this study started with performing extensive literature review to provide a basis information about SSCM practices, drivers, potential connections to sustainability performance, which have been tested by utilizing empirical analyses. Based on the literature, a research instrument was designed for the Jordanian context. To collect the required data for analysis, all questionnaire items and related constructs were collected from the literature review analyzed in Section 2. A summary of all items and constructs were listed in Table A.1 and Table A.2 in appendix A. In Jordan, most manufacturing companies are located in industrial parks (JIEC, 2021), but industries are not limited to being in these parks. However, Table 1 lists the industrial parks/estate considered in the study with the number of companies located in each industrial park.

The questionnaire items were divided into two parts. The first part of the questionnaire includes general questions related to the participating company, industrial sector, industrial park, company size, and respondent position. The second part aims to assess the sustainability adoption level on various attributes related to SSCM operations, such as the motivation to adopt SSCM practices, level of sustainability awareness, the degree to which implementing SSCM practices is accepted, and how adopting SSCM affected the company performance.

As previously mentioned, the questionnaire has been designed based on the literature review. Rao and Holt (2005) mentioned in their research how adopting GSCM will lead to improving the economic performance measures as well as the competitiveness. Therefore, items related to these dimensions were added based on references such as Shi et al. (2012). The constructs of voluntary adoption of SSCM practices is added according to Peters et al. (2011). Moreover, the internal and external dimensions were also added based on Zhu and Sarkis (2004) and Green et al. (2012). The relevant questionnaire items had been added to cover aspects related to each construct based on the literature review in Section 2 and summarized in Appendix A.

Responses were assessed based on a Likert scale from 1 ("strongly disagree") to 5 ("strongly agree"). The questionnaire was tested using a pilot system by selecting 2–3 companies randomly from each industrial park, to check the clarity of all questionnaire items for the respondents, and to test if they were able to answer. Based on their feedback, the questionnaire items were reformulated and finalized to be understandable for all respondents. Consecutively, the questionnaire was sent via email and fax to the participating companies. In many cases, personal interviews were conducted or direct telephone contacts were made to look for the supply chain function at the relevant company, to explain the questionnaire questions when they were unclear because of the language or terms used. Mainly such interviews were conducted to make sure that responses will be collected, and/or if the respondents ask for clarification.

The questionnaire was distributed from September 2016 to January 2017 with the help of the Amman Chamber of Industry (ACI), which increased the response rate. The questionnaire was uploaded online at Smartsurvey.co.uk (the questionnaire is attached in Table A.2 in appendix A), and the link to the questionnaire was sent to 230 companies from the industrial parks/estates listed in Table 1. The positive responses received were 132. To avoid including responses from respondents that did not seriously answer questions and ensure the reliability of the data collected, incomplete responses and responses with a responding time of fewer than 10 min were removed. This resulted in a total useable response number of 92 with a response rate of 40%. More details about the respondents' positions can be found in Table 2, and the location of the respondents in terms of industrial parks/estates in Fig. 2. Finally, a round of communicating the results with practitioners from Academia (2 Professors) and 6 SC managers from different industrial parks in occurred in September 2020 to collect feedback and validate the results.

Although the results indicate that the implementation of SSCM practices within manufacturing companies in Jordan is still in its initial stage, it was noted from the performed descriptive statistics that the level of adopting sustainability practices differs according to the type of industrial sector presented in Fig. 3. Therefore, it was decided to perform the analysis after dividing the collected data based on their sector to discrete industries and process industries following Dennis and Meredith (2000), and Fransoo and Rutten (1994). Following Fransoo and Rutten (1994) and Dennis and Meredith (2000) the study considers pharmaceuticals and chemicals, food, plastic, metals, and textile as process industries and e.g., machinery, engineering companies, and automotive as discrete industries. It was found that 55.4% of the respondents could be considered under process industries while 44.6% are categorized as discrete industries. It was expected the results would be more consistent within the industrial categories and to be able to compare SSCM of process industries versus SSCM of discrete industries. Therefore, the data was divided according to the respondent's sectors. Fig. 3 represents the percentages of the respondents' sectors, which gives more insights about which sectors considered process industries and those considered discrete ones.

All data were collected and interpreted in Microsoft Excel. They were analyzed with SPSS and AMOS. The authors also analyzed the number of variables needed to perform the test. Hypotheses H1 – H4 were tested using regression analysis, where single input is required, using items related to the connected constructs in each hypothesis. Hypotheses H5 –

Table 2
represents respondents' distribution based on the positions.

Respondent's Position	Count
General Manager	9
SCM Director, Manager, Officer, Logistics Officer	22
Operations Manager	14
Material Planning officer	7
Sales Director, Manager, Officer	16
R&D, Product development	9
Production Director	7
Sustainability Manager, officer	8
Total	**92**

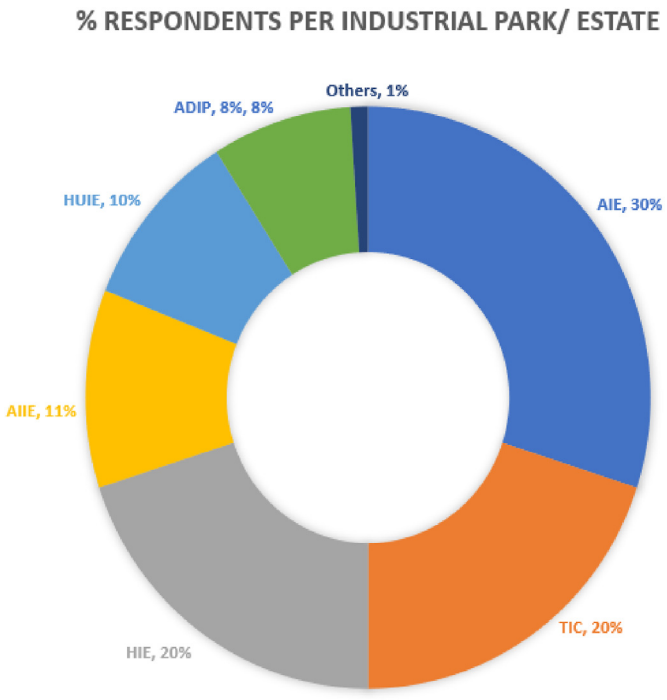

Fig. 2. represents respondents' distribution over the industrial parks/estates involved in this study (Abbreviations listed in Table 1).

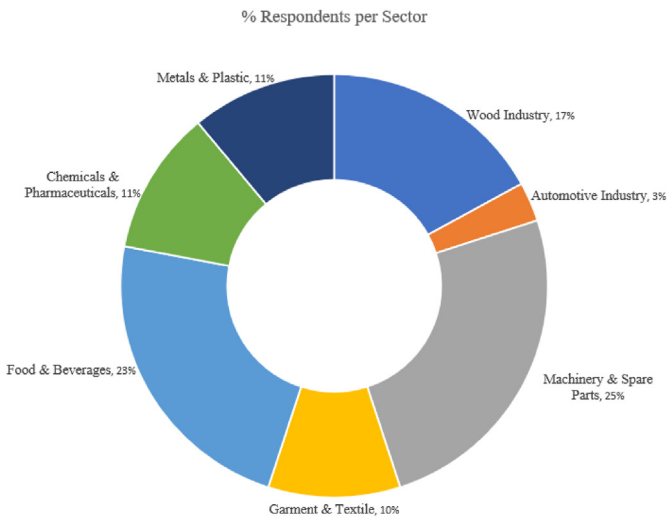

Fig. 3. shows respondents' distribution based on the industrial sectors.

H9 were tested using structural equation modeling, which was performed using AMOS, to test the multivariate hypotheses. Confirmatory factor analysis (CFA) is conducted to see how reliable the data collected is. Unless mentioned otherwise, a significance level of 95% was used in the analyses.

4. Results and discussions

The results of the hypothesis tests conducted are presented and discussed in this section. Before starting with the analyses, descriptive statistics were calculated for all items, and based on these descriptive statistics the confirmatory factor analyses were performed.

4.1. General findings

The descriptive statistics of questionnaire items related to governmental regulations indicated the regulations in Jordan are not enough to enhance sustainability practices within SCM operations in manufacturing companies. This was clear from the mean value of items related (12a – 12d from Table A.2). These items have mean values of less than 3 ranging from disagreeing and neutral. However, the weak sustainability awareness in Jordan, as customers or as competitors, toward environmental impacts of products and the associated SCM operations, reduces the pressure on manufacturers to adopt SSCM practices. That was clear from the mean values of items (11a – 11d from) where mean values did not exceed 2 (disagree). This means customers are only caring about product price and quality. This goes in line with a study performed in Malaysia (Zailani et al., 2012).

Among the 92 responses, only 5 respondents answered "YES" in question 7 in Table A.2 this means manufacturing companies are not taking part in reverse logistics operations, which in many cases the returned items may still have value and can be reused, remanufactured, or even recycled. However, all 5 responses gave a score of 1 (Strongly disagree) to item 8a in Table A.2, indicating that consumers in Jordan do not participate in product returns handling. And therefore, analyses regarding reverse logistics (Questions 7–9 in Table A.2) were dropped from the analysis. It seems that from the results, the sustainability dimension in Jordan does not have a similar priority level as product cost and quality for competition in the market. This leads to the argument ~~of~~ that customers play a vital role in pushing companies to integrate sustainability practices into their operations. This is also reported by León-Bravo et al. (2021), Özbay (2021), and Zailani et al. (2012).

4.2. Discriminant validity

The discriminant validity was calculated following Wiley (2005). However, they suggested an indicator called Heterotrait-Monotrait Ratio (HTMT) to show how the constructs are correlated to each other. The discriminant validity is valid if HTMT is below 0.90. Table 3 summarizes the HTMT values between constructs of the study and shows that all values are below 0.90 indicating that the discriminant validity is present.

4.3. Confirmatory factor analysis (CFA) modeling

The results of Cronbach's alpha (α) for process industries show how two factors, voluntary adoption of SSCM and implementing SSCM under external factors pressure, are reliable with their input items when using the factor analysis for SSCM drivers. These values are 0.693 for voluntary adoption of SSCM practices and 0.771 for the implementation under external factors pressure. From the CFA model for the process industries in Fig. 4 and discrete industries in Fig. 5 it can be concluded that the model fits are good as all loading estimates (LE) have weights exceeding 0.7, these values confirm convergent validity based on Wiley (2005). Furthermore, residuals were less than 2.5, indicating a good fit of the model. Many factors could be used to assess the CFA model. Following Hooper et al. (2008), these indices were calculated: chi-square (χ^2), root mean square error of approximation (*RMSEA*), and the goodness-of-fit (*GFI*) statistic. In addition, the authors calculated the ratio of the χ^2 value to the degrees of freedom (*df*) to test the fit of our models (if < 3, the model fit is normally considered good). The results of these fit statistics are represented in Table 4.

In addition, two more factors were confirmed (external SSCM practices and internal SSCM practices) for both process and discrete industries with an $\alpha = 0.789$ for process industries for the internal SSCM practices and the external SSCM practices $\alpha = 0.892$. Similarly, the result of $\alpha = 0.902$ for discrete industries for the internal SCM practices and the external SCM practices $\alpha = 0.856$.

By performing factor analysis for the firm performance, two factors were confirmed: economic performance and competitiveness. For process industries, $\alpha = 0.888$ for the economic performance and $\alpha = 0.794$ for the competitiveness. Similarly, for discrete industries, for the economic performance $\alpha = 0.743$, and the competitiveness $\alpha = 0.842$.

Overall, the abovementioned values for α demonstrate a good internal consistency of our model and give a clear indication that our empirical data represents the variables in our research framework.

4.4. Regression analysis

Hypotheses H1 to H4 were tested by regression analysis, as each of these hypotheses only needs a single input variable.

To test H1, the statistical results from regression analysis are presented in Table 5. This regression is conducted with the questionnaire items behind the 'competitiveness' construct as the independent variable.

Table 3
represents HTMT values indicate the presence of discriminant validity.

	Voluntary adoption	Internal SSCM practices	External SSCM practices	Competitiveness	Economic performance
Voluntary adoption					
Internal SSCM practices	0.601				
External SSCM practices	0.525	0.724			
Competitiveness	0.559	0.559	0.345		
Economic performance	0.630	0.465	0.599	0.404	

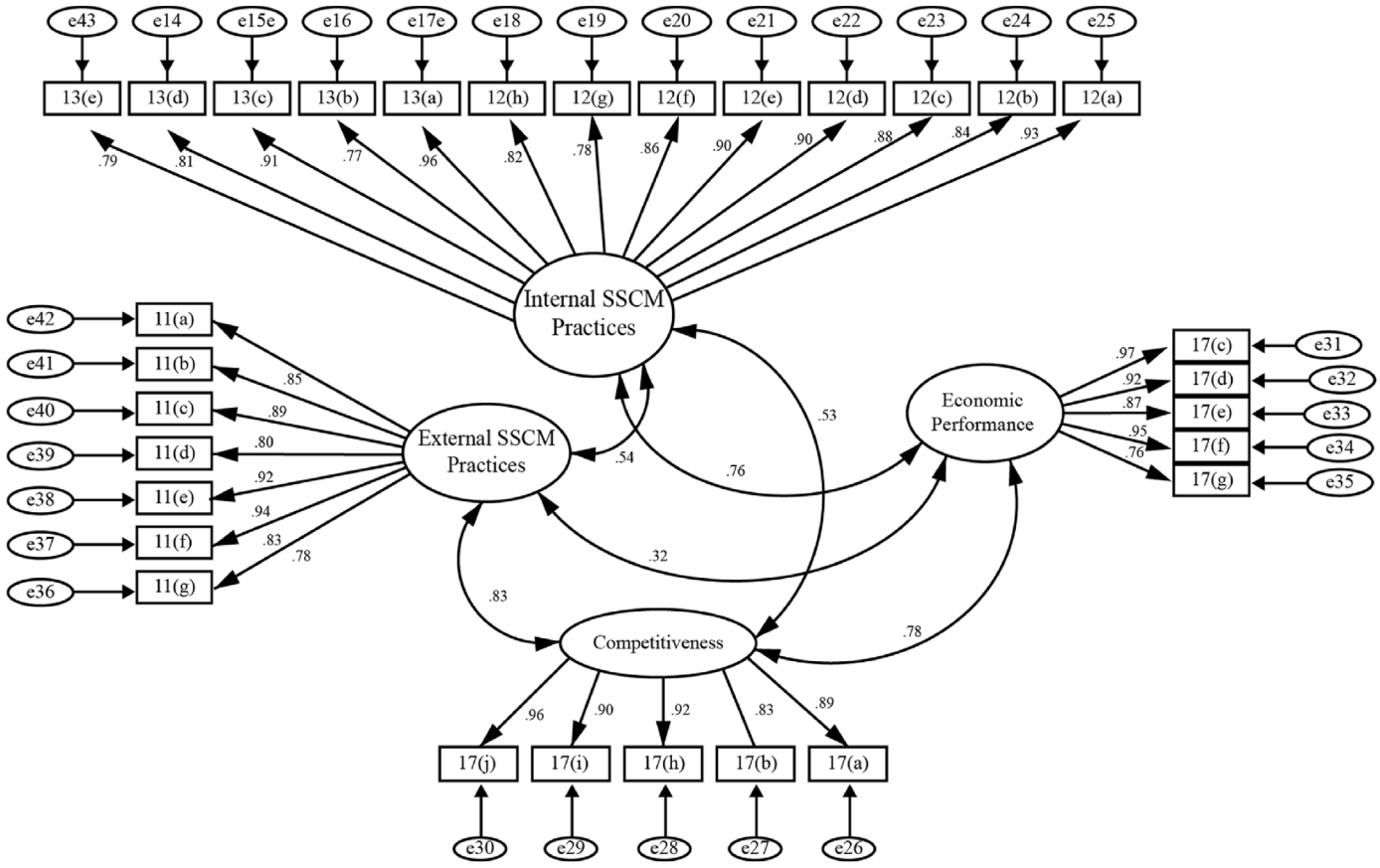

Fig. 4. illustrates the CFA model with constructs and items' loadings for process industries.

The items behind the construct 'voluntary adoption of sustainability practice' were used as the dependent variable. For process industries, the results show that the p-values associated with the questionnaire items were all higher than 0.05, meaning that the data does not support H1 for process industries in Jordanian industrial parks, but it accepts H1 for discrete industries, as all related p-values were lower than 0.05.

For hypothesis H2, a regression analysis was conducted with the items behind the construct 'economic performance measures' as the dependent variable and items behind the construct 'voluntary adoption of sustainability practices' as the independent variable. The results are shown in Table 6. Based on these results, H2 had to be rejected for the Jordanian manufacturing companies, both process industries, and discrete industries, as all p-values associated with the questionnaire variables are higher than 0.05.

The regression analysis results for H3 are summarized in Table 7, which shows the items behind the construct 'external SSCM practices' as the dependent variables and items behind the construct 'voluntary adoption of SSCM practices' as the independent variable. As can be seen in the table, H3 get accepted for both industry types as the p-values were lower than 0.05, and the data, therefore, provides an indication that all the considered external SSCM practices were found to be likely to be implemented by firms that voluntarily adopt SSCM practices.

Similarly, for H4, the results of the regression analysis are summarized in Table 8, which shows the items behind the construct 'internal SSCM practices' as the dependent variable and items behind the construct 'voluntary adoption of SSCM practices' as the independent variable. The p-values shown from these results tend to not support H4 for the process industries. Meanwhile, H4 is found to be supported across all the items behind the construct.

For comparison, the results of the abovementioned regressions are summarized in Table 9 for both process and discrete industries.

4.5. Structural equation modeling

In this part of our analysis, SEM has been applied based on the CFA model to test the hypotheses H5 – H9. Fig. 6 shows the items loading results from the model for the process industries data and Fig. 7 shows the loadings for discrete industries. The model fit statistics for both process and discrete industries are summarized in Table 10. The results show that the fit of both the SEM models is good. The statistical significance can also be seen from the values of the critical ratio in Tables 8 and 9. As a 95% confidence level was considered, all values of the critical ratio are higher than 1.96.

The covariance values are presented in the standard path estimates values. For process industries, the highest covariance value for example is 0.88, for the link from 'internal SSCM practices' and 'economic performance' (see Fig. 6). and the same from external SCM practices to competitiveness. In Fig. 7, for discrete industries, the highest covariance value is 0.79 for the link from 'external SSCM practices' to 'competitiveness' is. Therefore, convergent validity is present.

The overall SEM results for process industries data are represented in Table 11. SEM results for process industries show that H6, H8, and H9 will be rejected as their associated P-values are greater than 0.05. But the analysis does fail to reject both H5 and H7. The overall SEM results for discrete industries data are represented in Table 12. These results show that H6 will be rejected as its associated p-value is greater than 0.05. But the study does fail to reject H5, H7, H8, and H9.

Comparing the results of discrete industries to the process industries, it had been noticed that discrete industries are performing much better than process industries in terms of successful voluntary SSCM adoption. As external SSCM practices are influencing economic performance, there is an important implication here: Jordanian manufacturers can improve their environmental performance and economic performance when

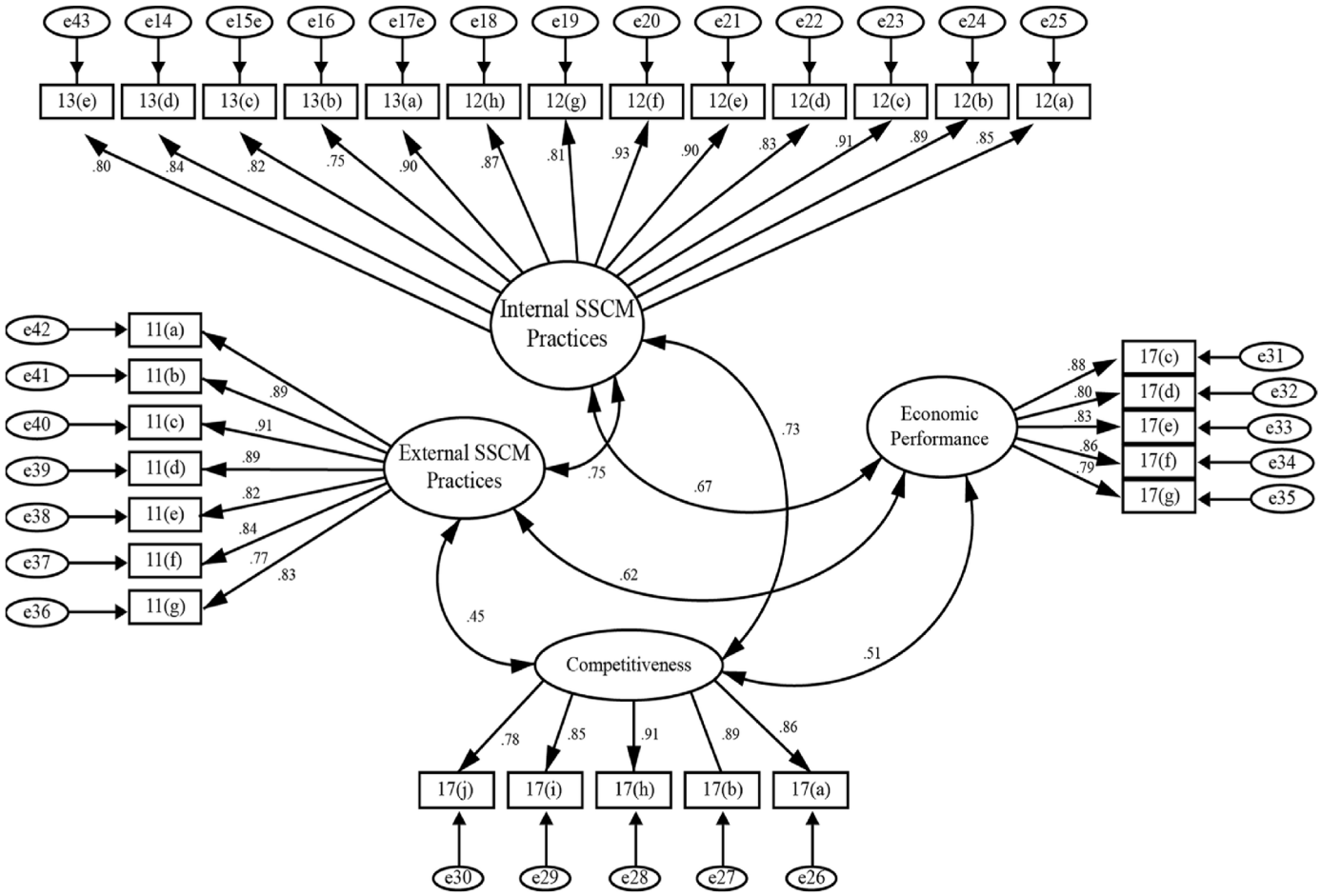

Fig. 5. illustrates the CFA model with constructs and items' loadings for discrete industries.

Table 4
represents the statistical values for CFA model fit according to industries type.

	Statistical value				
Industry type	χ^2	*df*	χ^2/df	*RMSEA*	*GFI*
Process industries	181.74	78	2.33	0.081	0.89
Discrete industries	138.06	78	1.77	0.076	0.86

Table 5
represents the results of regression for hypothesis H1.

Questionnaire variables	Process industries		Discrete industries	
	t-Stat	P-value	t-Stat	P-value
Improving the quality of product/process	- 0.440	0.662	- 0.085	0.019
Improving Efficiency measures	1.021	0.314	- 1.598	0.012
Supporting creativity	0.346	0.732	0.240	0.004
Supporting products'/processes' innovation	- 0.448	0.657	0.805	0.043

Table 6
represents the results of regression for hypothesis H2.

Questionnaire variables	Process industries		Discrete industries	
	t-Stat	P-value	t-Stat	P-value
Production and distribution cost reduction	- 0.201	0.842	- 0.820	0.418
Sales volume rise	1.508	0.141	0.892	0.378
Improve company's image	- 0.909	0.370	- 1.460	0.153
Accessing new markets	0.310	0.758	0.842	0.405
Involved in the decision-making process along with environmental organizations	0.436	0.665	1.314	0.197

adopting sustainability in their external practices. For instance, selecting their supplier based on sustainable practices might improve economic performance through an improvement of the company image in the market as also mentioned by Sodhi and Tang (2018).

It is also interesting to note that the influence of adopting internal SSCM practices on competitiveness and economic performance could not be identified for process industries. Typically, internal practices such as designing products and processes to be more environmentally friendly, using recyclable materials for packaging, and escalating the use of renewable energy in their manufacturing processes help improve competitiveness as well as the economic performance of the organizations. The results here comply with Zhu and Sarkis (2004), who also find that companies in developing countries are less likely to invest to adopt sustainability in their internal operations to reduce their environmental pollution; this also applied to Jordan. Another factor that might play a role here is that process industries might also have fewer opportunities to implement internal SSCM practices, as products and processes in industries such as pharmaceuticals, plastics, and textiles might be more difficult to develop towards sustainability.

The results of H5 for both process industries and discrete industries give a clear indication that integrating sustainability within internal practices can help companies to build on and influence the integration of

Table 7
represents the results of regression for hypothesis H3.

Questionnaire variables	Process industries		Discrete industries	
	t-Stat	P-value	t-Stat	P-value
Rising the environmental awareness	-1.625	0.0113	-0.946	0.0035
Green manufacturing practices	-2.223	0.0032	-0.811	0.0042
Adopted EMS/ISO 14001	0.060	0.036	0.060	0.0020
Motivation for applying to EMS/ISO 14001	-0.043	0.0051	0.329	0.027
Push to design and supply recyclable materials	-1.223	0.023	1.075	0.0029
Audit supplier green performance	1.444	0.016	-0.119	0.0033
Select according to their green performance	0.265	0.018	0.453	0.0019

Table 8
represents the results of regression for hypothesis H4.

Questionnaire variables	Process industries		Discrete industries	
	t-Stat	P-value	t-Stat	P-value
Our products are designed using bio-degradable materials	0.355	0.073	-0.029	0.022
Our products are designed using recyclable materials	1.443	0.159	0.275	0.008
Our products designed to be quickly disassembled	0.065	0.094	0.460	0.002
We understand product life cycle analysis	0.340	0.077	0.294	0.003
We put pressure to reduce our energy consumption along with production processes	-1.192	0.243	-1.078	0.029
We use renewable energy for our production	-0.902	0.067	0.867	0.004
Our resources are consumed considering sustainability issues during production	2.266	0.031	0.872	0.032
We put pressure to reduce solid waste during production	-1.467	0.153	-0.128	0.019
We use bio-degradable packaging materials	0.257	0.086	-1.687	0.010
Our packaging materials can be recycled	0.789	0.062	2.668	0.041
We use an eco-friendly storage	-0.839	0.089	-0.061	0.001
We use alternative transport techniques to reduce GHG emissions	0.194	0.085	-1.242	0.005
Optimization techniques are used to maximize transportation economics of scale	0.168	0.090	0.345	0.016

sustainability within the external ones. Similar results have been found in Indonesia in the research conducted by Siagian et al. (2020). To some extent, discrete industries are taking care of environmental performance in Jordan as it is clear in Table 9, where it is stating that SSCM practices are influencing and having impacts on companies' performance measures. This goes in line with Feng et al. (2018) who conducted their study on automotive companies in China. However, the opposite has been found for process industries in Jordan as they prefer to adopt SSCM practices under external pressure, maybe to comply with regulations because of the waste type they produce. The situation of FMCG in Indonesia stated different results as they found a positive connection between SSCM practices and companies' performance (Siagian et al., 2020).

Overall, the results give a clearer picture of the position of Jordanian industries on the sustainability road map. Moreover, they are offering novel insights for both managers seeking to adopt SSCM practices and policymakers who are looking to promote SSCM. The results can be used as an evidence base for all SCM stakeholders, that investing in adopting SSCM within operations will improve the satisfaction level of competitiveness.

Nevertheless, manufacturing companies can benefit from these results by implementing sustainability programs certificates such as ISO 14001, as has been also concluded by Abid et al. (2021) in their paper. There might be no direct or immediate benefits, but this can improve the business image in the market. The results can help Jordanian manufacturers to enhance sustainability by adopting innovation in their internal operations and product design, e.g., innovation in terms of recycling, using bio-degradable materials in product design as well as packaging materials, applying the concept of life cycle assessment (LCA).

Even though there were only limited responses for items related to reverse supply chains, an interesting observation is that Jordanian industries do not seem to be engaged in returns handling. Moreover, sustainability seems to be an invisible dimension in attractiveness to clients' priorities, compared to cost and quality. Therefore, Jordanian manufacturers might take more steps toward adopting sustainability in their operations and sharing their SSCM with their customers in order to compete and enlarge their market share. Managing sustainability across the product supply chain needs significant effort from all stakeholders within SCM to maximize its benefits and reduce the environmental impacts during production processes, where Jordanian industries still lag. Comparing the results from this study, which was conducted in Jordan, to other studies with similar approaches conducted in other developing countries, it seems that sustainability adoption is a great challenge for manufacturing companies in developing countries. Therefore, more research studies on sustainability within SCM are needed in those countries to help in implementing those aspects within the operations of SCM.

The level of sustainability adoption in Jordan is at a low level. This agreed with the results of a study conducted in Jordan by Abdallah and Al-ghwayeen (2020). These results are similar to different developing countries like the results from Egypt which were discussed by Galal and Moneim (2016) and from Pakistan which were published by Hashim, Nazam, Zia-ur-rehman et al. (2021). However, some developing countries are doing better in the direction of adopting SSCM practices and improving the performance of their manufacturing companies. For instance, Özbay (2021) discussed how regulations put pressure on manufacturing companies to adopt SSCM practices in Turkey. A similar conclusion was mentioned by León-Bravo et al. (2019) in their study on the food sector in Italy. Das (2018) expressed in their research how SSCM practices affected firm performance measures in India. And Dai et al. (2021), in their results, showed the importance of adopting SSCM practices to improve firm performance in China. And finally, Fousteris et al. (2018) found in their study, which was conducted in Greece, that firm performance and competitiveness are positively influenced when adopting environmentally friendly operational practices.

Table 9
compares the results of regression testing for hypotheses H1- H4 concerning industries' types.

Hypotheses	Factor	Direction	Factor	Results	
				Process Industries	Discrete Industries
H1	Voluntarily SSCM Adoption	→	competitiveness	Rejected	Accepted
H2	Voluntarily SSCM Adoption	→	Economic performance	Rejected	Rejected
H3	Voluntarily SSCM Adoption	→	External SSCM practices	Accepted	Accepted
H4	Voluntarily SSCM Adoption	→	Internal SSCM practices	Rejected	Accepted

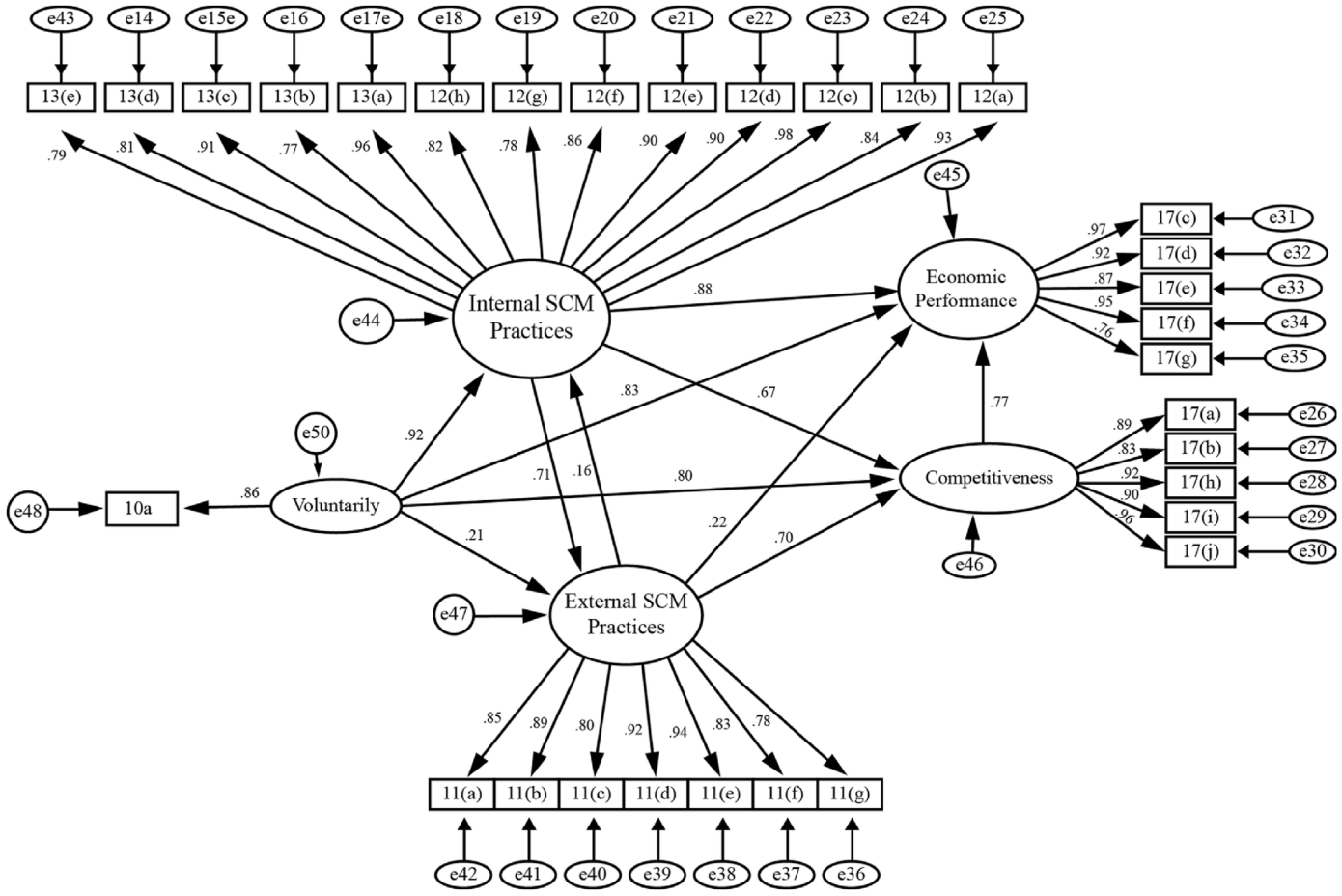

Fig. 6. illustrates how significant the Structural equation modeling for process industries.

4.6. Theoretical and managerial implications

There are several implications for those who work in the higher SC positions, academicians, and policymakers as well as decision-makers on the level of the Jordanian industrial parks. Concentrating on environmental practices and reducing environmental impacts can enhance the economic performance significantly. This could be achieved by redesigning products to be more eco-friendly and using recyclable or biodegradable materials for production. Energy costs can be reduced by redesigning processes and operations to use renewable energy rather than fossil fuel. However, this needs governmental support through more flexible regulations for the use of renewable energy. Additionally, the study can be a reference for SC managers to change their preferences regarding the environmental sustainability practices. For instance, selecting suppliers based on their environmental performance, their raw material source, or based on their transparency regarding their products, services, and the associated social impacts.

Jordan, as a developing country, can benefit from these results by taking further actions toward greening the supply chain and improving the image of the country in terms of environmental protection. Different investors with multinational investments background would like to invest in countries where stable legislation toward the environment can be found (Zhu and Sarkis, 2004). This can enhance Jordanian opportunities by attracting new multinational investments which will result in reducing the unemployment rate that has reached 24.9% during the pandemic of COVID-19 (Jordanian Department of Statistics 2020). Such actions could be realized through stabilized regulations and legislation, especially since the industry is concentrated in industrial parks. This could also help decrease poverty and unemployment rates since it might increase the chance of attracting multi-national investors to invest in building their businesses or part of their supply chains.

Manufacturers act as a supplier at a particular stage in the SC, and they would benefit from voluntary adoption of SSCM practices and developing new markets, especially those which are selecting their suppliers based on environmental performance. Because of adoption of the concept of industrial parks in Jordan, this can be a great opportunity for Jordanian manufacturers to take serious steps in this direction on the level of the industrial park/estate. However, managers of industrial parks/estates should enhance sustainability practices within those parks by, for example, providing an information-sharing platform, providing resource sharing opportunities within the industrial park, providing shared recycling facilities, shared wastewater treatment plants, shared logistics facilities, shared warehouses, and many other actions to improve economic performance while maintaining environmental impacts of the occupied manufacturing facilities at a low level.

5. Conclusions

This research was directed to the study of SSCM practices in Jordan. A survey questionnaire was developed according to SSCM literature to investigate how companies in Jordan are practicing sustainability within their SCM operations and which factors are behind their adaptation of SSCM activities. Overall, it was found from the results that the SSCM activities in Jordan are still in their initial stages. Generally, Jordanian companies are more expected to implement sustainability in their SCM operations when there is pressure from external parties. However, when distinguishing between process industries and discrete industries, some interesting results were seen: the data do not support the voluntary

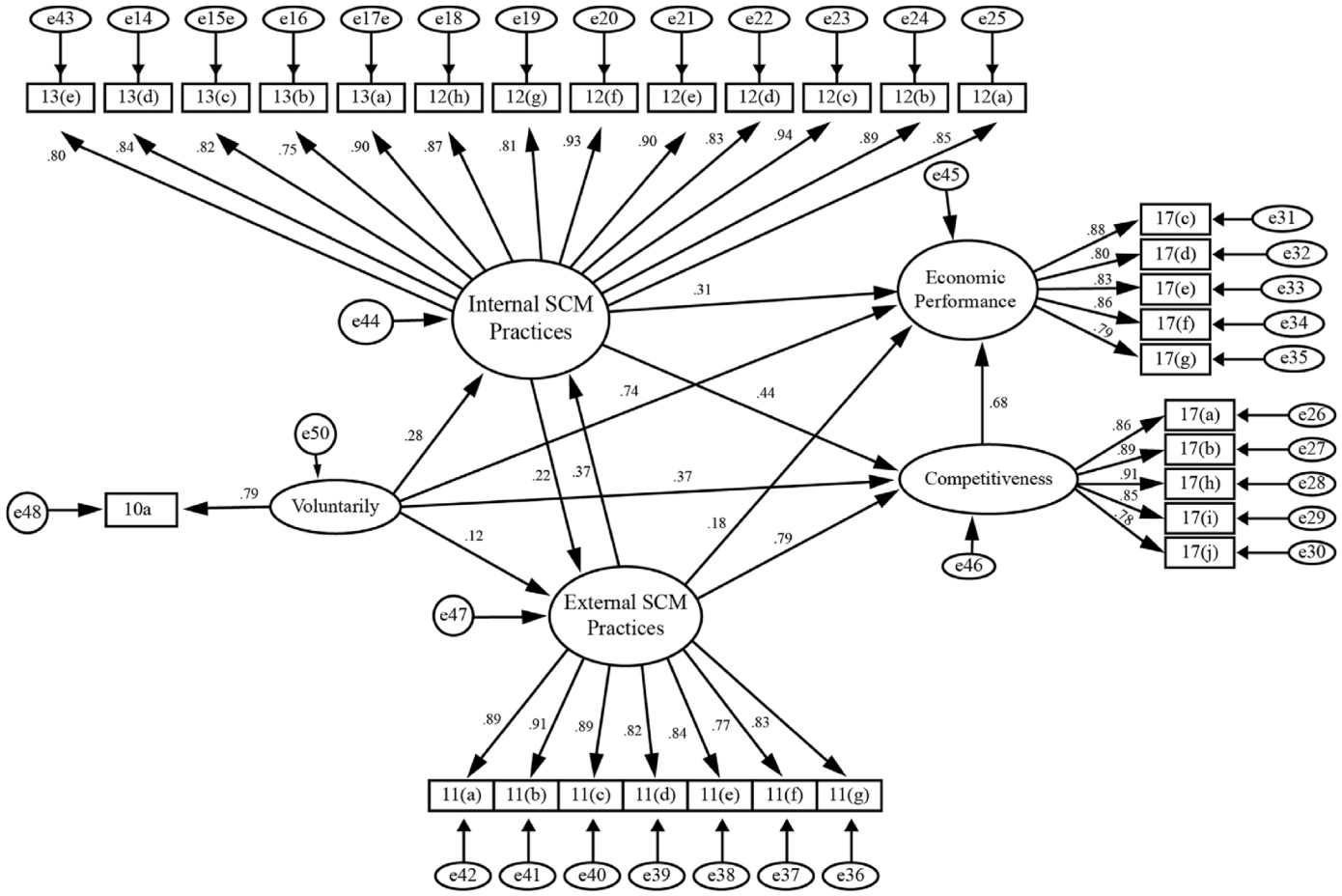

Fig. 7. illustrates how significant the Structural equation modeling for discrete industries.

Table 10
represents the statistical values for SEM model fit according to industries type.

	Statistical value				
Industry type	χ^2	*df*	χ^2/df	*RMSEA*	*GFI*
Process industries	177.10	77	2.30	0.075	0.87
Discrete industries	133.59	73	1.83	0.087	0.92

adoption of SSCM practices in the process industries, but they do seem to do so because of the type of their products and due to the waste generated concerns. Discrete industries are doing better in terms of adopting SSCM practices voluntarily, even if they do not apply it due to the type of their products and waste. This research discussed how able Jordanian manufacturers to implement SSCM in the manufacturing as well as whole SCM operations. The results indicated implementing sustainability within SCM by studying Jordan as a case for those countries which apply the

Table 11
represents the results of Hypotheses testing using SEM to test H5 – H9 for process industries.

Hypotheses	Factor	Direction	Factor	St. Path estimate	S.E.	Critical Ratio	P-value	Results
H5	External SSCM practices	→	Internal SSCM practices	0.16	0.09	5.322	0.018	Accepted
H6	External SSCM practices	→	Competitiveness	0.70	0.12	9.212	0.122	Rejected
H7	External SSCM practices	→	Economic performance	0.22	0.03	6.933	0.007	Accepted
H8	Internal SSCM practices	→	Competitiveness	0.67	0.08	13.428	0.192	Rejected
H9	Internal SSCM practices	→	Economic performance	0.88	0.17	9.172	0.083	Rejected

Table 12
represents the results of Hypotheses testing using SEM to test H5 – H9 for discrete industries.

Hypotheses	Factor	Direction	Factor	St. Path estimate	S.E.	Critical Ratio	P-value	Results
H5	External SSCM practices	→	Internal SSCM practices	0.37	0.04	8.322	0.008	Accepted
H6	External SSCM practices	→	Competitiveness	0.79	0.00	12.113	0.331	Rejected
H7	External SSCM practices	→	Economic performance	0.18	0.03	8.673	0.035	Accepted
H8	Internal SSCM practices	→	Competitiveness	0.44	0.01	10.046	0.049	Accepted
H9	Internal SSCM practices	→	Economic performance	0.31	0.11	6.242	0.011	Accepted

concept of qualified industrial zones/parks, and this should influence the firm performance in a positive direction.

Further, the force of the environmental regulations in Jordan does not seem to be enough to force the companies to adopt SSCM practices. As a developing country, Jordan would do better in terms of sustainability and SSCM if it would help in reducing waste resulting from industrial operations. Thus, involving manufacturers in decision-making processes with the environmental protection agencies to produce stricter environmental protection regulations. Meanwhile, poor consumer awareness of the environmental impacts reduces the concerns of the stakeholders to improve sustainability within supply chains. Comparing the regulations in Jordan with those in most developed countries reveals that there is a need to perform an extensive review of the regulations in Jordan that involves the inclusion of new clauses that force the industries to be engaged with reverse SCM processes to protect the environment from production wastes. A similar discussion was presented by Galal and Moneim (2016) about the current status of sustainability awareness and regulation in Egypt.

Finally, this study fills a research gap by adding information and analysis about SSCM practices in developing countries, with evidence from the Jordanian context. As the Jordanian industry is mostly organized in industrial parks, implementing sustainability could be considered in the early steps of management and should be done in the form of strategies and plans for these parks. For example, the concept of eco-industrial parks where organizations collaborate and share their SCM resources, transportation systems, information, strategies, as well as infrastructure to reduce industrial solid waste and air pollution. To this end, sharing and implementing such rules can help to achieve sustainable development goals, under which companies will maximize their economic performance measures, and increase the benefits of the societies associated with their SCM while maintaining the environmental impacts at a low level.

5.1. Limitation of the study and future research

There were several limitations to this study. On one hand, this study included only Jordanian manufacturing firms located in different industrial parks. Therefore, future research may include firms outside these parks for the analysis. On the other hand, competitiveness and economic performance were only considered in this study; extended work can be performed and include the social dimension to build a complete picture of sustainability within SCM in Jordan. Moreover, future researchers can build on the current study and conduct research about the circular economy and integrate it into SCM practices especially when it comes to raw material and natural resources scarcity.

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Declaration of competing interest

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.

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Appendix A

In this appendix, an overview of the questionnaire items used in this research has been included. Table A.1 shows the questionnaire items, related constructs, and relevant sources from the literature.

Link to the Questionnaire: https://www.smartsurvey.co.uk/s/107857PNTHP.

Table A.1
Questionnaire items design and associated references

#">#	Questionnaire Item	Reference
Construct: Voluntarily Adoption		León-Bravo et al. (2021), Peters et al. (2011)
1	Company adopt SSCM practices voluntarily	Peters et al. (2011)
2	Company adopt SSCM practices under external pressure	Zhu et al. (2012), Green et al. (2012)
Construct: Competitiveness		Rao and Holt (2005)
3	Improving the quality of product/process	Shi et al. (2012)
4	Improving Efficiency measures	Rao and Holt (2005)
5	Supporting creativity	Zailani et al. (2012)
6	Supporting products'/processes' innovation	Zailani et al. (2012)
Construct: Economic performance measures		Rao and Holt (2005)
7	Diminishing cost of Production/distribution	Zailani et al. (2012), Green et al. (2012)
8	Increasing Sales volume	Rao (2002)
9	Improve company's image	Zailani et al. (2012)
10	Log On new markets	Rao and Holt (2005)
11	Involved in the decision-making process along with environmental organizations	Rao (2002)
Construct: External SSCM practices		Zhu and Sarkis (2004), Green et al. (2012)
12	Escalating the environmental awareness	Rao (2002)
13	Green manufacturing practices	Zailani et al. (2012)
14	Applying EMS/ISO 14001	Zailani et al. (2012)
15	Motivation for applying to EMS/ISO 14001	Zailani et al. (2012)
16	Push to design and supply recyclable materials	Zailani et al. (2012)
17	Audit supplier green performance	de Giovanni (2012)
18	Select according to their green performance	Zailani et al. (2012), Rao (2002)
Construct: Internal SSCM Practices		Zhu and Sarkis (2004), Green et al. (2012), Rehman et al. (2021)
19	Our products are designed using bio-degradable materials	Zhu and Sarkis (2004), (Rehman et al., 2021)
20	Our products are designed using recyclable materials	Wong et al. (2012), Rehman et al. (2021)
21	Our products designed to be quickly disassembled	Wong et al. (2012), Rehman et al. (2021)
22	We understand product life cycle analysis	Green et al. (2012)
23	Reducing energy consumption along with production processes	Wong et al. (2012)

(*continued on next column*)

Table A.1 (*continued*)

#">#	Questionnaire Item	Reference
24	Using renewable energy during production	Green et al. (2012)
25	Our resources are consumed considering sustainability issues during production	Wong et al. (2012)
26	Reducing solid waste during production	Wong et al. (2012)
27	Bio-degradable packaging materials	Zhu et al. (2012), Rehman et al. (2021)
28	recyclable packaging materials	Wong et al. (2012), Zailani et al. (2012), Rehman et al. (2021)
29	Eco-friendly storage	Wong et al. (2012), Zailani et al. (2012), Rehman et al. (2021)
30	Transport techniques to reduce GHG emissions	Zhu and Sarkis (2004)
31	Optimization techniques are used to maximize transportation economics of scale	Shi et al. (2012), Wong et al. (2012)

Table A.2
Questionnaire used for the data collection

Questionnaire for a Survey of Sustainable Supply Chain Management Practices in Jordanian Companies

A. General Information

1. Industrial Park: the company is located in the … … … … … … …. . industrial Park/Estate (Please select)
   - ◯ Abdullah II Ibn Al-Hussein Industrial Estate- Sahab (AIE)
   - ◯ Al Hassan Industrial Estate- Irbid (HIE)
   - ◯ Al-Hussein Ibn Abdullah II Industrial Estate- Karak (HUIE)
   - ◯ Aqaba Industrial International Estate- Aqaba (AIIE)
   - ◯ Ad-Dulayl Industrial Park – Zarqa (ADIP)
   - ◯ Al Tajamouat Industrial City – Amman (TIC)
   - ◯ Other
2. a. Respondent Position _____ b. Sector of the company: _____

B. Sustainable Supply Chain Management (SSCM)

3. The Company has adopted SSCM practices:

Please select (1–5): (1: Strongly disagree, 2: Disagree, 3: Neither agree nor disagree, 4: Agree, 5: Strongly agree)	**Related to Construct**
(a) Voluntarily	Voluntarily Adoption
(b) To comply with regulations	Voluntarily Adoption
(c) Under pressure from customers	Voluntarily Adoption
(d) Under pressure from competition	Voluntarily Adoption

4. With regard to the suppliers, the company does the following:

Please select (1–5): (1: Strongly disagree, 2: Disagree, 3: Neither agree nor disagree, 4: Agree, 5: Strongly agree)	**Related to Construct**
(a) Educate and generate awareness of the environment	Internal SSCM practices
(b) Help set up environment-friendly practices	Internal SSCM practices
(c) Put pressure to implement EMS and ISO 14001	Internal SSCM practices
(d) Gives incentives for applying to EMS/ISO 14001	Internal SSCM practices
(e) Put pressure to supply environment-friendly materials	Internal SSCM practices
(f) Audit supplier performance for conformance	Internal SSCM practices
(g) Select based on environment-related criteria	Internal SSCM practices

5. While designing products and processes, the company does the following:

Please select (1–5): (1: Strongly disagree, 2: Disagree, 3: Neither agree nor disagree, 4: Agree, 5: Strongly agree)	
(a) Design products with bio-degradable materials	Internal SSCM practices
(b) Design products with recyclable materials	Internal SSCM practices
(c) Design products for quick disassembly	Internal SSCM practices
(d) Carry out life cycle analysis for products	Internal SSCM practices
(e) Reduce energy consumption during production	Internal SSCM practices
(f) Use environmental-friendly sources of energy	Internal SSCM practices
(g) reduce resource consumption during production	Internal SSCM practices
(h) reduce wastage and spill-over during production	Internal SSCM practices

6. In packaging, storage, transportation, and distribution of raw materials and finished products, the company focuses on the following:

Please select (1–5): (1: Strongly disagree, 2: Disagree, 3: Neither agree nor disagree, 4: Agree, 5: Strongly agree)	**Related to Construct**
(a) use of bio-degradable packaging materials	External SSCM practices
(b) use of recyclable packaging materials	External SSCM practices
(c) use of environment-friendly storage	External SSCM practices
(d) use of alternative transport techniques to reduce GHG emissions	External SSCM practices
(e) achieve economies of scale in transportation	External SSCM practices

7. The company is engaged in the disposal and/or recovery of the products and packaging discarded/returned after use: (if “Yes” go to Q. 8, If “No” go to Q. 10) yes No

8. Regarding reverse supply chains, recyclable and/or non-recyclable of our products and packaging, we have the following observations

Please select (1–5): (1: Strongly disagree, 2: Disagree, 3: Neither agree nor disagree, 4: Agree, 5: Strongly agree)	
(a) Our customers are involved in returns handling	To evaluate the state of reverse logistics activities related
(b) We have a centralized returns collection facility	
(c) We have a centralized returns inspection facility	
(d) We have a centralized returns recovery facility	
(e) We engage third parties for product recovery	
(f) we engage in environmentally friendly disposal	
(g) our customers are environment-conscious	
(i) the recovery process is integrated with the production	
(j) there is a market for our recovered products	
(k) the price of our recovered product is competitive	

9. The product recovery options that best describe the company recovery operation are the following: Please select the best answers
   - ◯ Regenerate
   - ◯ Remanufacturing
   - ◯ Canning
   - ◯ Recycling
10. By adopting SSCM practices, the following advantages have been achieved: (Please encircle your response)

Please select (1–5): (1: Strongly disagree, 2: Disagree, 3: Neither agree nor disagree, 4: Agree, 5: Strongly agree)	**Related to Construct**
(a) Improving in product and process quality	Competitiveness
(b) Reducing cost in production and distribution	Competitiveness

(*continued on next column*)

Table A.2 (*continued*)

Questionnaire for a Survey of Sustainable Supply Chain Management Practices in Jordanian Companies		
A. General Information		
	(c) enhancing the efficiency of our business processes	Competitiveness
	(d) Increasing in sales of products	Competitiveness
	(e) Improving company's image	Competitiveness
	(f) Penetration of new markets	Economic performance
	(g) Attracting of new customers	Economic performance
	(h) Encourage creativity within the company culture	Economic performance
	(i) Encourage innovation in product and process design	Economic performance
	(j) Participating in decision making along with environmental institutions	Economic performance
11	Regarding our customers, they are	
	Please select (1–5): (1: Strongly disagree, 2: Disagree, 3: Neither agree nor disagree, 4: Agree, 5: Strongly agree)	
	(a) considering environmental impacts when buying products.	To evaluate the level of customer sustainability awareness
	(b) applying their role to reduce products' environmental impacts they are buying.	
	(c) making sustainable choices, that can reduce the energy consumption	
	(d) buying products if it has a recycling label	
12	Regarding the Jordanian government's legislation, there is/are	
	Please select (1–5): (1: Strongly disagree, 2: Disagree, 3: Neither agree nor disagree, 4: Agree, 5: Strongly agree)	
	(a) pressure from legislation to adopt sustainability in SCM	To evaluate governmental regulations and activities toward sustainability adoption
	(b) incentives from the government to adopt sustainability in SCM	
	(c) pressure from legislation to use renewable energy across SCM	
	(d) sponsoring seminars and introducing sustainability to business	
13.	Any other comments:	
Optional to answer		
Name of the respondent: _____ Company: _____		
Mobile: _____ E-mail: _____		

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