The maturity of sustainable supply chain management practices: an applied study on pharmaceutical firms

Abderrazak Laghouag
Departement of Business Administration, King Khalid University, Abha, Saudi Arabia

Abstract

Purpose – The aim of this paper is to contribute to empirical research dealing with the measurement of green and sustainable supply chain management(SSCM) practices. The paper intends to empirically evaluate the practices maturity related to green supply chain management (GSCM) in one of the most strategic sectors in Saudi Arabia, namely, pharmaceutical sector.

Design/methodology/approach – Based on a research questionnaire, data were collected from 111 respondents in pharmaceutical companies. Data analysis has been conducted based on Statistical Package for the Social Sciences (SPSS) program to evaluate the extent to which pharmaceutical companies in Kingdom of Saudi Arabia (KSA) are mature regarding each sustainable SCM dimension.

Findings – The results reflect high adoption of green practices related to SCM by pharmaceutical companies operating in KSA that are highly meeting environmental requirements that represent one of the core objectives of KSA vision 2030.

Research limitations/implications – The study presents a platform based on which future studies can link the maturity of Sustainable SCM with the firm's performance.

Practical implications – This study provided professionals and managers in the pharmaceutical sector with in-depth insights regarding the maturity of their green practices related to SCM. This study also proposed a framework that could be by managers to continuously assess their Sustainable SCM practices.

Originality/value – This research intends to demonstrate to what extent SSCM in pharmaceutical sector are mature.

Keywords Maturity evaluation, Sustainable supply chain management practices, Pharmaceutical sector

Paper type Research paper

1. Introduction

Supply chain management (SCM) concept seems to be easy to assimilate while the nature and variety of decisions taken within this network reflect high level of complexity of this business concept (Sanders, 2012, p. 03). Thus, due to the complex nature of SCM, many definitions have been provided to this concept either by academicians or professionals; hence, the content of this concept and what englobes is relatively not clear (Quayle, 2006). For some researchers such as Reid and Sanders, (2010), Russell and Taylor (2010), Sanders (2012) and Laghouag and Sahli (2021), SCM is considered a set of practices relating to the design and management of different types of flows, namely products, information and financial flows the supply chain network.

Pharmaceutical supply chain (PSC) is a specific where medications are made, delivered and consumed (Xie and Breen, 2012). Any healthcare system must involve the

pharmaceutical industry, whose responsibilities include the creation, production and marketing of pharmaceutical products.

Due to several factors, the PSC is of utmost importance. For example, according to Papageorgiou (2009), the PSC is a source of competitiveness and supply chain surplus, and firms cannot be competitive if they do not take SCM activities into account. The PSC aids in expanding the accessibility of affordable medicine.

Alruthia et al. (2018) and Tawfik et al. (2022) are two researchers who looked into the primary causes of Saudi Arabia's medication shortages. The results show that SCM is the main cause of drug shortages in the KSA, followed by a lack of government regulations requiring prompt notification of shortages, a government procurement strategy out of step with changes in the pharmaceutical market, low profit margins for some essential medications, insufficient and ineffective legal sanctions against pharmaceutical companies and authorized drug importers and distributors and, finally, a lack of government procurement regulations. Based on this goal, the research question may be stated as follows: how sustainable are SCM practices in Saudi Arabian pharmaceutical companies? To put it another way, the purpose of this article is to assess the degree to which pharmaceutical organizations use SSCM methods, including supplier relationship management (SRM), internal SCM, customer relationship management (CRM) and ecological design practices. The main query could be broken down into a few sub-questions, like: What are the various SSCM dimensions and their corresponding practices? Do managers in pharmaceutical companies pay attention to these SSCM practices?

This work has been organized as follows in order to address each of these research questions: The writers will first introduce the idea of sustainable (green) SCM and its advantages for all shareholders before going over the many SSCM elements and practices that go along with them. Following that, the research model, hypothesis, and conceptual framework will be provided. After that, the methodology will be described, including the study approach used, the measurement scales created, the sample chosen and the outcomes of the validity and reliability tests. The conclusion will include a presentation of the hypothesis testing findings and a discussion of them. Additionally, a global assessment of pharmaceutical companies' readiness to implement SSCM techniques will be offered.

2. Sustainable supply chain management: benefits and dimensions

Sustainable practices refer to all methods adopted to protect organization's resources from damage with particular intention to grow these resources for future generations while green practices refer to the use of eco-friendly materials. Going from this fact, it is to say that green practices are all sustainable practices. Based on this latest, green supply chain management (GSCM) practices are sustainable practices. Also, the term sustainable and green will be used interchangeably. GSCM finds its origin in two domains, namely environmental management and SCM (Srivastava, 2007). Integrating the greening approach to supply chain concept implicates directly the environmental issues in the management of SC. In other words, environmental concerns become the primary driver for SCM. The scope of GSCM ranged from simple green purchasing to the whole supply chain flows from suppliers' suppliers to customers' customers including reverse logistics (Zhu and Sarkis, 2004).

Green supply chain could be defined as environmental based thinking of all activities within supply chain network ranging from ecological design and raw materials sourcing to the delivery to the final customers passing through production processes as well as reverse logistics activities (Srivastava, 2007).

As a result, GSCM is a technique for effective strategic management that enhances the environmental performance of manufacturing organizations as well as other sustainability performance goals, according to Hassan et al. (2016). De Giovanni (2012) makes the case that GSCM is a unique strategy for increasing social welfare as well as creating economic rewards in support of this. It is more than just a tool for making items and processes less harmful to the

environment. The empirical data that are now accessible also makes it abundantly evident that environmentally friendly policies frequently exhibit respectable social performance, such as fostering consumer loyalty (De Giovanni, 2012) and enhancing firm image (Eltayeb et al., 2011). GSCM practices could be divided into many dimensions. Zhu et al. (2008) highlighted that GSCM practices have different level of implementation going from simple green purchasing to the whole management of flows starting from supplier and product design through the production and packaging, to the customer and after-sale service. For the researchers, there are five (05) GSCM practices as follows: (1) internal environmental management, (2) green buying, (3) coordination with customers including environmental requirements, (4) eco-design practices and (5) and investment recovery. These five practices have received extensive study in earlier GSCM empirical studies (e.g. Gonzalez et al., 2022; Fang and Zhang, 2018; Gopal and Thakkar, 2016; Choi and Hwang, 2015). Another typology of GSCM practices has been provided by Huo et al. (2021). As per these researchers, GSCM could be divided into three main processes respecting the logic of strategic alignment with all parties involved in the supply chain network. These practices are as follows: (1) supplier green strategy alignment, (2) internal green strategy alignment and (3) customer green strategy alignment. Hervani et al. (2005) proposed a composition based on a perspective of performance measurement. For them, GSCM practices include (1) green purchasing, (2) green manufacturing/materials management, (3) green distribution/marketing and (4) reverse logistics. Rizki and Augustine (2022) proposed a mixed typology consisting of (1) green purchasing, (2) green manufacturing, (3) green marketing, (4) green distribution, (5) eco-design, (6) internal environment management, (7) environmental education, (8) investment recovery, (9) cooperation with customer and (10) green information systems. Zaid et al. (2018) provided three categories of GSCM practices based on a process view, namely (1) internal GSCM practices that include eco-design and internal environmental management and (2) external GSCM practices that encompass green purchasing, environmental cooperation and reverse logistics. For the present study, all the previous model are confronted to each other, and finally four main practices are obtained: (1) ecological and environmental design and (2) internal SCM are those controlled internally such as green manufacturing, maintenance, inventory management, etc. (3) CRM refers to all practices related to marketing, distribution and after-sale services and (4) SRM refers to all practices related to green purchasing, transportation, etc.

3. Research model and hypothesis
A reference model for the subject of GSCM has been provided by Zhu et al. (2008) and adopted by Zaid et al. (2018). The research model for this study and hypothesis were all created using a revised typology of Zhu and Zaid.

3.1 The maturity of green practices related to supplier relationship management
Supplier relationship management refers to the techniques and procedures for communicating with suppliers (Dubey et al., 2019). Many researchers have recognized the contribution suppliers make to the supply chain's sustainability (Caniels et al., 2013). As per Cao and Zhang (2011) to face environmental uncertainty, volatility and complexity, companies are asked to maintain an effective collaboration with partners (upstream and downstream partners) to be more reactive to market change. Fawcett and Magnan (2004) propose that enterprises should work toward increased supply chain collaboration to take use of the skills and expertise of their suppliers and consumers. Actually, Gimenez and Tachizawa (2012) highlight that strong supplier relationships are likely to lead to better performance for businesses. In the same line, Neumüller et al. (2016) confirm that to enhance risk management through collaborative learning and organizational sustainability is enabled by strategic supplier relationships. Dubey et al.

(2019) has drawn on institutional approach to show how an effective relationship with suppliers can allow a company to achieve a strategic fit with the external environment. Some researchers such as Zaid et al. (2018) use the term green purchasing instead of SRM to refer to all practices of cooperation with upstream partners to develop products and services that are environmentally friendly. Actually, pharmaceutical firms in Saudi Arabia are expected to maintain collaborative relationship with suppliers which environmentally oriented. So, based on the discussion above, we posit that:

H1. Pharmaceutical firms in Saudi Arabia are mature in terms of SRM practices.

3.2 The maturity of green practices related to internal supply chain management

Internal supply chain management refers to the process of turning GSCM into a strategic organizational imperative with the help of senior and mid-level managers who are committed to and supportive of the need (Zhu et al., 2008). According to Zaid et al. (2018), internal SCM includes practices such as the dedication of GSCM to top management, as well as the cross-functional collaboration to improve environmental aspects and also the implementation of total quality environmental management. Actually, pharmaceutical firms in Saudi Arabia are expected to be oriented towards internal supply chain management activities that improve customers' safety and environment protection. Therefore, it is hypothesized that:

H2. Pharmaceutical firms in Saudi Arabia are mature in terms of internal SCM practices.

3.3 The maturity of green practices related to ecological design

Manufacturers must create goods using eco-design principles to limit the wastage of resources and energy. The purpose of environmental design (ED) is also the re-exploiting, recycling and recovery of materials and parts and avoid using hazardous materials whenever possible (Zhu et al., 2008). The phrase "green design" has been used frequently in the literature to refer to creating goods that take certain environmental factors into account. During the development of new production and process, it is the systematic assessment of design issues related to environmental safety and health over the whole product life cycle (Srivastava, 2007). Actually, pharmaceutical firms in Saudi Arabia are expected to be oriented towards ecological design activities that improve customers' safety and environment protection. Therefore, it is hypothesized that:

H3. Pharmaceutical firms in Saudi Arabia are mature in terms of ecological design practices.

3.4 The maturity of green practices related to customer relationship management

CRM refers to all practices aiming to attract, retain and enhance relationships with customers. It is a tool to identify and maintain the most profitable customers and, on the other hand, increase the profitability of the less profitable. CRM's goal is to collect data from customers to build a certain knowledge about their preferences and requirements to provide them with customized products and services and increase their value (Wang and Feng, 2012; Sofi et al., 2020). Also, CRM consists in enhancing collaboration with the key customers to design a clean production process to provide sustainable products and services (Zhu et al., 2008). Actually, pharmaceutical firms in Saudi Arabia are expected to be oriented towards CRM activities that improve customers' safety and environment protection. Therefore, it is hypothesized that:

H4. Pharmaceutical firms in Saudi Arabia are mature in terms of customer relationship management practices.

Figure 1 summarizes all hypotheses mentioned above.

## 4. Methodology
4.1 Research method
When it comes to the methodology used in this research, the descriptive approach appears to be more appropriate given that the main objective is to describe the maturity of SSCM processes in pharmaceutical businesses operating in KSA. This research relies on a survey that was created to gather information regarding SSCM aspects in pharmaceutical businesses other than managers and employees. In other words, this study adheres to the post-positivist paradigm, which holds that reality exists but is only partially accessible. Due to this feature, we may be able to learn a little bit about the maturity of SSCM practices by developing a research hypothesis and a questionnaire to evaluate it. Additionally, the data obtained through this questionnaire could serve as the foundation for additional research to support or refute them.

4.2 Measurement scales
A research tool englobing the four main SSCM aspects has been developed utilizing numerous related studies in the issue to assess the research hypothesis of this study. Additionally, a Likert five-point scale was utilized to assess 18 items, as indicated in Table 1 as follow.

4.3 Sampling
A total of 111 people from pharmaceutical businesses in the Kingdom of Saudi Arabia made up the convenience sample for the study. The features of the analyzed sample are displayed in Table 2 according to four dimensions: level of management, education, years of experience and gender.
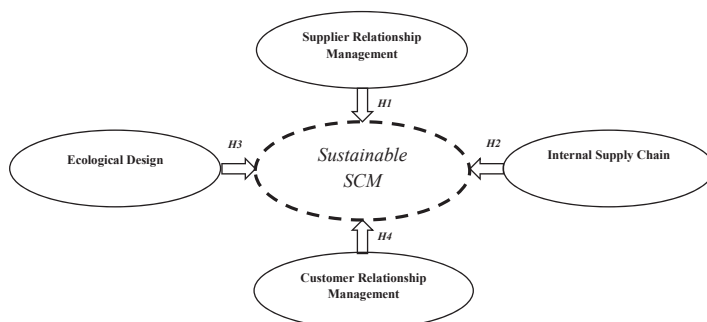
Source(s): Adopted from Zhu *et al.* (2008)

Figure 1.
Research model

Dimensions	Items	Scales	Related research
SRM	5	Likert 1–5	Zhu et al. (2008), Zhu et al. (2013), Longoni et al. (2016), Zaid et al. (2018)
INTSC	5		
ECOLD	4		
CRM	4		
Total of items	18		
Source(s): Table by the author			

Table 1.
Description of
research tool

	Frequency	%
Management level		
• Top management	29	26
• Middle management	36	33
• Operative management	46	41
Educational level		
• Bachelor	89	80
• Master	17	15
• PHD and more	5	5
Years of experience		
• 1–5 years	51	46
• 5–10 years	29	26
• More than 10 years	31	28
Gender		
• Male	82	74
• Female	29	26
Total	111	100
Source(s): Table by the author		

Table 2.
Descriptive analysis of studied sample

5. Results and discussions

5.1 Reliability test
The consistency with which a questionnaire yields the same findings after several attempts is referred to as reliability. Table 3 demonstrates a notable uniformity across all dimensions. For all SSCM dimensions, the alpha Cronbach ranges from 0.942 to 0.961, which demonstrate the research tool's good stability.

5.2 Validity test
The extent to which statements reflect the variable that is supposed to be measured is referred to as the construct validity. Table 4 demonstrates that all statements are significantly correlated to their relevant variables in support of this.

When discussing and decomposing the data, it is essential to present a descriptive statistical analysis for each of the SSCM items and dimensions. To accomplish this, it is crucial to first display the mean value range criteria that will be used to evaluate each survey question for each dimension. Table 5 provides a summary of the various value ranges and how they should be evaluated for a survey using five-point Likert scales.

5.3 The evaluation of supplier relationship management practices maturity
Based on the responses provided by the respondents who were polled, the most significant statistical data are shown in Table 6 below. These statistics offer a foundation for making a

Sustainable SC dimensions	Alpha Cronbach	N of items
SRM	0.942	5
INTSC	0.961	5
ECOLD	0.953	4
CRM	0.954	4
Global dimensions	0.984	18
Source(s): Table by the author		

Table 3.
Reliability scores

preliminary assessment of SRM's maturity. The study will also consider each item's mean and standard deviation as well as its overall dimension.

Overall, pharmaceutical companies in Saudi Arabia are committed to working with their suppliers to achieve environmental standards. The maturity of SRM is rated as "high" in the table above (mean > 4.17) and (St.d > 1.07). This level reflects the willingness of pharmaceutical companies to maintain an effective relationship with suppliers which is environmentally oriented. With a mean that varies from 4.3423 to 4.2072, it is evident from the table that respondents strongly agree with propositions 2 and 5, respectively. These statements reflect that pharmaceutical companies are strict to receive from their suppliers only products that conform to predetermined specifications and standards, and all suppliers are committed to ISO14000 standards. In a similar vein, respondents highly agree with propositions (1, 3 and 4), with a mean that varies from 4.0090 to 4.1261 each. These results reflect that pharmaceutical companies require from their suppliers to put environmental labels on products and collaborate with them to develop sustainable products. The pharmaceutical companies are considerably willing that the suppliers are committed to the Environmental Audit. In addition to the analysis

Sustainable SCM dimensions

SRM Items N	Corr. Coef	INTSC Items N	Corr. Coef	Ecold Items N	Corr. Coef	CRM Items N	Corr. Coef
01	0.866^{**}	6	0.938^{**}	11	0.945^{**}	15	0.928^{**}
02	0.913^{**}	7	0.916^{**}	12	0.936^{**}	16	0.943^{**}
03	0.923^{**}	8	0.914^{**}	13	0.931^{**}	17	0.949^{**}
04	0.915^{**}	9	0.952^{**}	14	0.934^{**}	18	0.935^{**}
05	0.903^{**}	10	0.934^{**}				

Source(s): Table by the author

Table 4. Validity scores

Range	5P likert scale	Evaluation
[1.00, 1.8]	Strongly disagree	Low
[1.8, 2.60]	Disagree	Average
[2.60, 3.4]	Neither agree nor disagree	Moderate
[3.4, 4.2]	Agree	High
[4.2, 5.00]	Strongly agree	Very high

Source(s): Table by the author

Table 5. Mean values analysis

Items		Mean	Std. Deviation	Rank	Evaluation
SRM1	Suppliers of our company are obliged to put environmental labels on products	4.0090	1.33822	5	High
SRM2	Our company receives from suppliers only products that conform to predetermined specifications and standards	4.3423	1.14014	1	High
SRM3	Our company partners with suppliers to develop sustainable products	4.1712	1.20509	3	High
SRM4	Our company is willing that the internal management of suppliers are subject to the Environmental Audit	4.1261	1.18412	4	High
SRM5	Our suppliers are subject to ISO14000 standards	4.2072	1.09642	2	High
	SRM dimension	4.1712	1.07698		High

Source(s): Table by the author

Table 6. Descriptive analysis of SRM dimension

shown above, a non-parametric test utilizing Kolmogorov–Smirnov has been used. The results indicate that (Sig 0.05), indicating that the dimension of SRM practices do not conform to normal distribution. Additionally, the Wilcoxon test (One Sample Test) result for testing hypothesis (H1) reveals that the significance is superior than 0.05 (Sig> 0.05), indicating the significance of the high level of SRM practices.

5.4 The evaluation of internal supply chain management practices maturity

Regarding the maturity of internal SCM practices, the most significant statistical data are shown in Table 7 as follow.

Globally, pharmaceutical companies in Saudi Arabia are willing that internal SCM practices take into account the environmental requirements. The maturity of Internal Supply Chain Practices (INTSC) is rated as "high" in Table 7 above (mean > 4.09) and (St.d > 1.08). This level reflects the willingness of pharmaceutical companies to lead their internal process respecting the environmental requirements. With a mean that varies from 4.04 to 4.1352, it is evident from the table that respondents considerably agree with all propositions (1–5) respectively, with a mean that ranges from 4.04 to 4.1352. These statements reflect that pharmaceutical companies follow a sustainable industrial strategy that takes into account the environment and people as well as they have a strong commitment to logistics operations that take into account the environmental dimension from the top and middle management. Also, this reflects that all functions coordinated with each other to make improvements that respect the environment. In the same line, the results show that pharmaceutical companies adopt perfectly practices of total environmental quality management as well as they are committed to ISO 14001 certification standards. In addition to the analysis shown above, a non-parametric test utilizing Kolmogorov–Smirnov has been used. The results indicate that (Sig 0.05) the dimension of INTSC practices do not conform to normal distribution. Additionally, the Wilcoxon test (One Sample Test) result for testing hypothesis (H2) reveals that (Sig > 0.05), indicating the significance of the high level of INTSC practices.

5.5 The evaluation of ecological design practices maturity

In general, pharmaceutical companies in Saudi Arabia are committed with their suppliers to meet environmental requirements. The maturity of ecological design is rated as "high" in Table 8 above (mean > 4.05) and (St.d > 1.15). This level reflects the willingness of

Items		Mean	Std. Deviation	Rank	Evaluation
INTSC1	The company follows a sustainable industrial strategy that takes into account the environment and people as well	4.0450	1.21646	5	High
INTSC2	There is a commitment in our company to logistics operations that take into account the environmental dimension from the top and middle management	4.0991	1.10334	3	High
INTSC3	All functions in our company cooperate with each other in order to make improvements that respect the environment	4.0721	1.17328	4	High
INTSC4	The company is committed to the practices of total environmental quality management	4.1352	1.14801	1	High
INTSC5	Our company is committed to ISO 14001 certification standards	4.1351	1.17153	2	High
	INTSC dimension	4.0973	1.08238		High

Table 7.
Descriptive analysis of INTSC dimension

Source(s): Table by the author

	Items	Mean	Std. Deviation	Rank	Evaluation
ECOLD1	Our company designs products in a way that reduces material/energy consumption	4.0901	1.16424	2	High
ECOLD2	Our company is willing to design pharmaceutical products in a way that facilitates the easy installation of raw materials at the lowest possible cost	4.0541	1.23464	3	High
ECOLD3	Our company designs products to allow reuse, recycling and recovery of materials and component parts	3.9730	1.31743	4	High
ECOLD4	Our company is willing to design products in a way that avoids hazardous emissions or increased pollution	4.1171	1.21908	1	High
	ECOLD dimension	4.0586	1.15550		High
Source(s): Table by the author					

Table 8.
Descriptive analysis of
ECOLD dimension

pharmaceutical companies to provide, with the collaboration of their partners, environmentally designed products and services.

With a mean that varies from 3.9730 to 4.2072, it is evident from the table that respondents considerably agree with all propositions (1–4), respectively. These statements reflect that pharmaceutical companies are willing to design products in a way that avoids hazardous emissions or increased pollution and reduces material/energy consumption. The results also show that pharmaceutical companies are willing to design pharmaceutical products in a way that facilitates the easy installation of raw materials at the lowest possible cost and design products that allow reuse, recycling and recovery of materials and component parts.

In addition to the analysis shown above, a non-parametric test utilizing Kolmogorov–Smirnov has been used. The results indicate that (Sig 0.05), indicating that the dimension of ECOD practices don't conform to normal distribution. Additionally, the Wilcoxon test (One Sample Test) result for testing hypothesis (H3) reveals that (Sig> 0.05), indicating the significance of the high level of ECOD practices.

5.6 The evaluation of customer relationship management practices maturity
Overall, pharmaceutical companies in Saudi Arabia are committed with their customers to meet environmental requirements. The maturity of CRM is rated as "high" in Table 9 above (mean > 4.06) and (St.d > 1.15). This level reflects the willingness of pharmaceutical companies maintain an effective relationship with downstream partners to be environmentally oriented.

With a mean that varies from 3.9640 to 4.1532, it is evident from the table that respondents considerably agree with all propositions (1–4), respectively. These statements reflect that pharmaceutical companies are willing to produce safe pharmaceutical products for both society and the environment (cleaner production). Also, the companies seek to provide environmentally friendly materials that do not have negative effects on customers and cooperate with customers to develop environmentally friendly packaging materials. Also, pharmaceutical companies are keeping listening to customers through receiving their suggestions regarding the design of environmentally friendly medicines.

In addition to the analysis shown above, a non-parametric test utilizing Kolmogorov–Smirnov has been used. The results indicate that (Sig 0.05), indicating that the dimension of CRM practices don't conform to normal distribution. Additionally, the

	Items	Mean	Std. Deviation	Rank	Evaluation
CRM1	The company is willing to know the suggestions of customers regarding the design of environmentally friendly medicines	3.9640	1.32066	4	High
CRM2	The company is willing to produce safe pharmaceutical products for both society and the environment (cleaner production)	4.1532	1.12975	1	High
CRM3	The company seeks to provide environmentally friendly materials that do not have negative effects on customers	4.1171	1.24125	2	High
CRM4	The company cooperates with customers to develop environmentally friendly packaging materials	4.0180	1.23570	3	High
	CRM dimension	4.0631	1.15575		High
Source(s): Table by the author					

Table 9.
Descriptive analysis of CRM dimension

Wilcoxon test (One Sample Test) result for testing hypothesis (H4) reveals that (Sig> 0.05), indicating the significance of the high level of CRM practices.

5.7 Global evaluation
After the evaluation of the practice's maturity of all the SSCM dimensions, it is to say that, by the order of priority and importance given to each dimension, the SRM practices come in the first rank and seem to be highly adopted by pharmaceutical companies and next comes the internal supply chain management practices that seem to be adopted with high level and then comes ecological design, Finally, the CRM practices seem to be also highly adopted and mature. Table 10 summarizes these results as follow.

The judgment that could be given to each hypothesis is compiled in Table 11 below based on the findings of the hypotheses testing and in light of the statistical analysis shown above. According to the following table, the most recent evidence supports the following three hypotheses.

Items	Mean	St.D	Rank	Eval
SRM	4.1712	1.07698	1	High
INTSC	4.0973	1.08238	2	High
ECOLD	4.0586	1.15550	4	High
CRM	4.0631	1.15575	3	High
Sustainable SCM dimensions	4.1016	1.06939		High
Source(s): Table by the author				

Table 10.
Global evaluation of CSR dimensions

Hypothesis	Subject	Test results
H1	Supplier relationship management	Supported
H2	Internal SCM	Supported
H3	Ecological design	Supported
H4	Customer relationship management	Supported
Source(s): Table by the author		

Table 11.
Hypothesis testing

6. Conclusion

As a result of the SSCM concept's complexity, the current research shows that it has been given several definitions. As long as businesses everywhere strive for sustainability, this idea has a significant present and a bright future. Additionally, this study aims to assess the SSCM maturity level of pharmaceutical companies operating in Saudi Arabia, as encouraging businesses, both private and public, to adopt sustainable practices is one of the key pillars of the kingdom's 2030 vision. In other words, using a typology offered by Zhu *et al.* (2008) as well as Zaid *et al.* (2018), this research provides the knowledge of how pharmaceutical businesses, in KSA, are devoted towards SSCM methods. The justification for employing this typology is that it has been verified by researchers in numerous contexts and offers a thorough understanding and analysis of the four SSCM concept building components.

Through the creation of a research questionnaire, the four aspects and practices within Saudi Arabian pharmaceutical businesses were assessed. The results show that pharmaceutical businesses of various levels of maturity have adopted the four SSCM dimensions. The findings in this context indicate that SRM strategies are at the top and that pharmaceutical businesses appear to be heavily utilizing them. The internal supply chain management methods follow, and they appear to have a level of "high" adoption. Ecological design is the next step, and finally, it appears that approaches for CRM are also well-established and widely used.

Finally, the current research may be expanded, just like any other research study, provided that it identifies any limitations that can be resolved in subsequent studies. First, a different SSCM typology found in the literature can be used to apply and compare the results to the existing findings regarding pharmaceutical companies operating in KSA. The impact of the current level of SSCM practice maturity in pharmaceutical businesses on many variables, such as organizational performance, is the second topic that might be thoroughly developed. Third, because the results obtained for pharmaceutical firms could not be extrapolated to the other companies in KSA, it seems pertinent for future research to assess the adoption of SSCM for numerous companies in various industries.

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Corresponding author

Abderrazak Laghouag can be contacted at: alaghouag@kku.edu.sa