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SUSTAINABLE SUPPLY CHAIN MANAGEMENT PRACTICES IN GHANA

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Abstract:
The study assessed the sustainable supply chain management (SSCM) practices of 303 manufacturing firms in Ghana with an annual turnover of at least $1,000,000, which were purposively selected for the study. A questionnaire comprising closed-ended questions was used to collect data on the SSCM practices of the firms, which were sustainable product design (SPD), sustainable process design (S.P.), supply-side collaboration (SSC) and demand-side collaboration (DSC). A weighted average index was used for the data analysis, which revealed that in manufacturing firms under study, SPD had a mean score of 4.44, S.P. had a mean score of 4.48, SSC had a mean score of 4.52 and DSC had a mean score of 4.52. The study identified many issues policymakers should consider promoting SSCM practices in manufacturing firms. In addition, policies should prioritize energy/material consumption; the reusing, recycling and recovering of materials; a standardized product design to facilitate reuse; environmentally-friendly materials, products and manufacturing processes; the easy disassembly of materials products; product life cycle analysis; and the formalization of procedures for environmentally-friendly product design. Based on the diminishing of the world's natural resources and the importance of SSCM, it is recommended that all manufacturing firms in Ghana and the world adopt SSCM practices. Moreover, manufacturing firms need to collaborate with their customers to anticipate and solve sustainability problems to achieve sustainability goals.

Keywords: Management, Manufacturing Firms, Supply Chain, Sustainable Practices

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INTRODUCTION

With the unfolding of a new economic order, people have recognized that profit and profitability are only one aspect of long-term business and economic success (Kleindorfer et al., 2005). Moreover, people have recognized that attention needs to be paid to the future of the planet (Kleindorfer et al., 2005), which in recent times, has led to pressure on organizations to lessen their adverse effects on the environment and to attend to social concerns (Hsu et al., 2016; Maama, 2020). Therefore, businesses have adopted environmental and social policies to enhance economic, social and environmental sustainability.

SSCM is concerned about manufacturing that negatively impacts the environment because of competition, market globalization and the increasing importance of the customer's experience and orientation (Ahi & Searcy, 2013; Maama et al., 2021). Moreover, manufacturing can lead to environmental degradation, carbon emissions, the depletion of rare natural resources without replacing them and pollution, for example. However, environmental protection should be ensured at the firm level and throughout the supply chain, from production through retail to the end-user (consumer) (Köksal et al., 2017; Petljak, 2019).

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SSCM is, however, grounded in environmental sustainability and social and economic sustainability, which comprise the three pillars of sustainable development (De Camargo et al., 2018; Wang & Dai, 2018). However, there is limited evidence of firms embracing SSCM practices. Therefore, the study described in this article investigated the SSCM practices of selected Ghanaian manufacturing companies.

In Ghana, on average, the growth rate of the manufacturing sector from 2006 to 2018 was less than 3% if the 17% growth rate reported in 2011 is included (Adarkwah et al., 2018). Therefore, the Ghana Investment Promotion Centre (GIPC) listed manufacturing as a priority target sector for development, which means it should seek ways to improve. This should be possible since an analysis of Ghana's export data reveals that the country has a comparative advantage in many product categories other than the usual exports of crude oil, timber, gold and cocoa (Adarkwah et al., 2018).

The World Bank (2013) examined Ghana's manufacturing sector and reported that food processing, construction materials, electronic component assembly, chemicals and health-related products are promising production industries. However, manufacturing firms in Ghana must address sustainability issues related to waste generation, chemical emissions, wealth creation, deforestation, employment, social projects, illegal logging, and air, water, and soil pollution. This would help to solve the problems of climate change, pollution and diminishing natural resources.

Even though SSCM practice and theory have been developing quickly, several businesses are struggling to integrate sustainability practices into their supply chain. In addition, there needs to be more implementation of SSCM practices in emerging nations such as Ghana and research on SSCM is primarily conducted in advanced nations (Nti, 2015; Geng et al., 2017). The study investigated the SSCM practices of selected manufacturing companies in Ghana. Based on the description above, the authors chose the study's title, "Sustainable Supply Chain Management Practices in Ghana".

METHODS

Study site. The study was conducted in the manufacturing sector of Ghana, the second-largest economy in West Africa and, in 2019, was identified as one of the world's fastest-growing economies in the world (IMF, 2020). The country has 16 regions, each carrying out particular economic activities. However, the manufacturing sector is dominated by the Ashanti, Greater Accra, Bono and Western regions. In each of these regions, manufacturing is carried out in their regional capitals: Kumasi, Accra/Tema, Sunyani and Takoradi, respectively, where the study was conducted.

Target population. The study population comprised staff of selected manufacturing firms in four dominant manufacturing regions in Ghana. In ascending order, the topmost five manufacturing subsectors in Ghana are shearing and forming (3%), joining (4%), machining (6%), casting and molding (7%), textiles (9%); non-metallic products (9%); chemicals and chemical products (13%); paper and paper products (19%); food and beverages (30%). In Ghana, the last time an industrial survey was carried out was 2003, when 27,000 manufacturing firms employed 244,000 individuals. Only 4% of the manufacturing firms were large enterprises employing more than 100 people. The number of manufacturing firms in the study area is 1900 (Nti, 2015, Adarkwah et al., 2018).

Sampling and sample size. The study made use of purposive sampling, also called personal, selective or judgemental sampling is a form of non-probability sampling whereby researchers depend on their judgment to choose respondents from a population to participate in a study.

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At first, the purposive sampling method was used to select firms with an annual turnover of not less than one million dollars ($1,000,000) within the study area. Moreover, the selected firms' staff (particularly procurement officers) were purposively selected. Therefore, not every firm or staff member within the study area was selected.

The number of respondents was selected based on the guidelines of Krejcie and Morgan (1970), according to whom a sample size should be determined using the following formula:

$$S = X2NP(1-P) \div d2(N - 1) + X2P(1 - P)$$

Where :

S = required sample size
X2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841)
N = the population size
P = the population proportion (assumed to be 0.50) since this would provide the maximum sample size
d = the degree of accuracy expressed as a proportion (0.05)

Therefore, based on the formula, the sample size from an estimated population of 1900 was determined as follows:

s = X2NP(1-P)/ d2(N-1)+X2P(1-P)
s = 3.841 x 1900 x 0.50(1-0.50)/0.052(1900-1) + 3.841 x 0.50(1-0.50)
s = 3648.95(0.50)/0.0025(1899) + 1.92(0.50)
s = 1824.46/4.75 + 0.96
s = 1824.46/5.70
s = 320

Quantitative data collection. Quantitative data were collected from procurement officers, accountants and chief executive officers of the firms under study through a questionnaire comprising closed-ended questions as the data collection instrument. Creswell and Creswell (2017) emphasize that in quantitative research, the investigator develops knowledge from a postpositive perspective through measurement, observation, cause and effect thinking, reducing data to specific variables, hypotheses, questions and the testing of theories.

Data collection instrument. A survey questionnaire was employed as the data collection instrument in the study because it gathers data from many participants. Only closed-ended questions were included in the questionnaire to enable easy analysis. Closed-ended questions suggest answers to research questions, which makes it simple for respondents to choose an answer. Closed-ended questions enable a researcher to compare the responses provided by participants (Reja et al., 2003).

The questionnaire consisted of Likert-scale questions. The answers to the questions were measured according to a five-point Likert scale whereby respondents had to choose from the following statements to indicate their response to the questions: Strongly Disagree (SD), Disagree (D), Neutral (N), Agree (A) and Strongly Agree (SA) (Bryman & Bell, 2007). Three hundred and twenty (320) questionnaires were distributed, although 303 (94.9%) were returned.

Measurement model. The questions on SSCM practices were grouped into four sections representing SPD, S.P., SSC and DSC, as explained in Table 1 below, which indicates the number of statements/items for each practice/variable and their sources.

Table 1. Measurement model

Construct	Variables	Number of questionnaire items	Literature source
SSCM practices	Sustainable product design (SPD)	7	Carter and Easton (2011); Paulraj, Chen & Blome (2017)

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Sustainable process design (S.P.)	5	Zhu and Sarkis (2004); De Giovanni (2012); Wong et al. (2012)
Supply-side sustainability collaboration (SSC)	7	Carter et al. (2000); Vachon and Klassen (2006); Shi et al. (2012); Zhu et al. (2013)
Demand-side sustainability collaboration (DSC)	5	Vachon and Klassen (2006); Paulraj et al. (2017)

Data analysis. The quantitative data analysis provided a summary of the firms' SSCM practices as indicated by the participant's responses to the statements about particular activities. A weighted average index was used to investigate the SSCM practices of the selected manufacturing firms in Ghana (Equation 1). Each number is multiplied, weighted, added and divided to obtain the weighted average by the sum of the weights (Lent & Dorfman, 2009).

RESULT AND DISCUSSION

Sustainable product design. The first SSCM practice evaluated in the study was SPD, which involves energy reduction and reusing, recycling and recovering materials. A five-point Likert scale was used to determine the participants' level of agreement with the statements about the SPD of manufacturing firms in Ghana. The seven statements are listed in Table 2 below, together with the results of the quantitative data analysis gathered through the participants' responses.

Table 2. Sustainable product design of manufacturing firms in Ghana

Sustainable product design statements	N	Min	Max	Mean	Std. Dev
Care is taken to reduce energy/material consumption	303	1	5	4.42	0.704
Attention is paid to reusing, recycling and recovering materials	303	1	5	4.42	0.736
Products are designed to use environmentally-friendly materials	303	1	5	4.44	0.743
Products are designed with standardized elements to facilitate the reuse	303	1	5	4.45	0.828
Products are designed for easy disassembly	303	1	5	4.44	0.747
Life cycle analysis is used to evaluate the environmental impact of our products	303	1	5	4.45	0.725
There are formal procedures for environmental product design	303	1	5	4.44	0.725
Valid N (listwise)	303				

Table 2 above shows that manufacturing firms in Ghana practiced SPD. The mean for SPD ranges from 4.42 to 4.55, implying that the manufacturing firms practiced sustainable product design. The mean response was 4.42 with a standard deviation of 0.704 for the statement "care is taken to reduce energy/material consumption ."This implies that manufacturing firms took care to reduce consumption and make good use of energy/materials (Vanille et al., 2017).

Similarly, the statement "attention is paid to reusing, recycling and recovering materials" recorded a mean response of 4.42 with a standard deviation of 0.736. Thus, participants indicated that their firms reused, recycled and recovered materials during manufacturing to reduce waste and

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ensure efficient use. Several companies prefer reused, recycled or recovered packaging because it is cost-effective. However, investment in this sustainability practice could be more attractive to some manufacturing firms (Geng et al., 2017).

The statement "products are designed to use environmentally friendly materials" had a mean response of 4.44 and a standard deviation of 0.743. In addition, the statement "products are designed for easy disassembly" recorded a mean response of 4.44 and a standard deviation of 0.747. This shows that the manufacturing firms designed products for easy disassembly using environmentally friendly materials. Moreover, the participants agreed that their firms followed formal procedures for environmental product design, with a mean response of 4.44 and a standard deviation of 0.725.

The remaining two questionnaire items on sustainable product design recorded mean responses of 4.45. The responses to the statement "products are designed with standardized elements to facilitate reuse" recorded a standard deviation of 0.828, and responses to the statement "life cycle analysis are used to evaluate the environmental impact of our products" recorded a standard deviation of 0.725. This shows that reuse was factored into all the manufacturing firms' products, which were analyzed carefully in terms of their effect on the environment throughout their lifespan.

Sustainable process design. The study evaluated the manufacturing firms regarding the SSCM practice of S.P., which involves ensuring the realization of sustainability goals during the manufacturing process. A five-point Likert scale was used to determine the level of the participants' agreement with the statements about S.P. The five statements, which were inspired by Zhu and Sarkis (2004), De Giovanni (2012) and Wong et al. (2012), are listed in Table 3 below, together with the results of the analysis of the quantitative data gathered through the participants' responses.

Table 3: Sustainable process design of manufacturing firms in Ghana

Sustainable process design	N	Min	Max	Mean	Std. Dev
Our processes are incredibly reliant on sustainability goals	303	1	5	4.44	0.702
Our existing processes are evaluated to minimize their impact on the environment	303	1	5	4.44	0.738
There is a formal environment guiding principle for process design	303	1	5	4.49	0.718
Our processes are re-engineered to minimize their environmental impact	303	1	5	4.48	0.709
We enhance the environmental friendliness of our production	303	1	5	4.53	0.694
Valid N (listwise)	303				

The mean response for the S.P. questionnaire items indicated in Table 3 above ranged from 4.44 – 4.53. These mean responses imply that the representatives of the manufacturing firms in the study agreed that they practiced S.P. The respondents agreed that their process relied on sustainable goals, as the mean response was 4.44, with a standard deviation of 0.702. Similarly, they agreed that their existing processes were evaluated to minimize their environmental impact, with a mean response of 4.44 and a standard deviation of 0.738.

The results shown in Table 3 above show that there was general agreement that the manufacturing firms followed a formal environment guiding principle for process design, as the mean was 4.49 and the standard deviation was 0.718). In addition, the respondents agreed that the firms' processes were regularly re-engineered to minimize their environmental impact, indicated by

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a mean response of 4.48 and a standard deviation of 0.709. This implies that the manufacturing firms ensured that their processes did not have a detrimental effect on the environment.

As shown in Table 3 above, the data analysis results revealed that the respondents strongly agreed that their firms enhanced the environmental friendliness of their production (mean = 4.53, standard deviation = 0.694). Studies conducted by other researchers (De Giovanni, 2012; Wong et al., 2012) on SSCM confirmed that companies design environmentally-friendly processes, which was in agreement with the outcomes of the current study.

Supply-side sustainability collaboration. The study evaluated the manufacturing firms in terms of the SSCM practice of SSC, which involves teaming up with suppliers to attain sustainability goals, amongst other practices, as indicated in Table 4 below. A five-point Likert scale was used to determine the level of the respondents' agreement with the six statements about SSC, which were sourced from Carter (2000), Vachon and Klassen (2006), Shi et al. (2012) and Zhu et al. (2013). The statements are listed in Table 4 below, together with the results of the quantitative data analysis gathered through the participants' responses.

Table 4: Supply-side sustainability collaboration of manufacturing firms.

Supply-side sustainability collaboration	N	Min	Max	Mean	Std. Dev
We team up with our suppliers to attain sustainability goals	303	1	5	4.53	0.675
We provide our suppliers with sustainability requirements for their processes	303	1	5	4.50	0.713
We team up with our suppliers to provide services and products that support our sustainability objectives	303	2	5	4.50	0.608
We develop a mutual understanding of tasks with our suppliers concerning sustainability performance	303	1	5	4.54	0.664
We carry out mutual planning with our suppliers to anticipate and solve problems related to sustainability	303	1	5	4.48	0.718
We, at times, provide suppliers with feedback on their sustainability performance	303	2	5	4.56	0.611
Valid N (listwise)	303				

The minimum mean response to the statements about SSC was 4.48, and the maximum mean response was 4.56, with an average of 4.52. This implies that the respondents generally agreed that their firms practiced SSC, cooperating with their suppliers to attain sustainability goals and providing services, equipment, materials, various requirements and feedback to facilitate goal realization.

The SSC practice that recorded the lowest mean response was the joint planning with suppliers to anticipate and solve sustainability-related problems (mean = 4.48, standard deviation = 0.718). The remaining supply-side SSC practices recorded mean responses of 4.50 or above, showing the respondents' strong agreement with the statements. Moreover, the responses to the statement "We provide our suppliers with sustainability requirements for their processes" obtained a standard deviation of 0.713). In contrast, the responses to the statement "We team up with our suppliers to provide services and products that support our sustainability objectives" obtained a standard deviation of 0.608. Responses to both these statements recorded a mean of 4.50.

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Table 4 above shows that the respondents strongly agreed that their firms teamed up with their suppliers to attain sustainability goals, with a mean response of 4.53 and a standard deviation of 0.675. Furthermore, the respondents strongly agreed that their firms developed a mutual understanding of tasks with their suppliers concerning sustainability performance, with a mean response of 4.54 and a standard deviation of 0.664. Lastly, the respondents agreed that their manufacturing firms provided suppliers with feedback on their sustainability performance, with a mean response of 4.56 and a standard deviation of 0.611 (Table 4).

Demand-side sustainability collaboration. The study evaluated the manufacturing firms regarding the SSCM practice of DSC, which involves the practices indicated in Table 5 below. A five-point Likert scale was used to determine the level of the respondents' agreement with the six statements about DSC, which were sourced from Vachon and Klassen (2006) and Paulraj et al. (2017). The statements are listed in Table 5 below, together with the results of the quantitative data analysis gathered through the participants' responses

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Table 5: Demand-side sustainability collaboration of manufacturing firms

Demand-side sustainability collaboration	N	Min	Max	Mean	Std. Dev
We liaise with our clients to attain sustainability goals	303	1	5	4.47	0.694
We liaise with our clients to enhance their sustainability initiatives	303	1	5	4.56	0.642
We team up with our clients to provide services and products that back our sustainability objectives	303	1	5	4.51	0.650
We develop a shared understanding of tasks with our clients concerning sustainability performance	303	1	5	4.54	0.654
We carry out mutual planning with our customers to anticipate and solve problems related to sustainability	303	2	5	4.53	0.624
Valid N (listwise)	303				

The results in Table 5 above indicated a minimum mean response to the questions on DSC of 4.47 and a maximum mean response of 4.56 with an average of 4.52. This implies that the respondents generally agreed that their firms practiced DSC. Moreover, the respondents agreed that their firms liaised with their clients to attain sustainability goals, with a mean response of 4.47 and a standard deviation of 0.694. The remaining four questionnaire items scored a mean response of above 4.50, thereby indicating that the participants strongly agreed that their firms practiced DSC.

The respondents strongly agreed that their firms teamed up with their clients to provide services and products that backed their sustainability objectives (mean = 4.51, standard deviation = 0.650). Additionally, the manufacturing firms strongly agreed that they carried out mutual planning with their customers to anticipate and solve problems related to sustainability (mean = 4.53, standard deviation = 0.624).

Generally, the participants representing manufacturing firms in Ghana strongly agreed that the companies developed a shared understanding of tasks with their clients concerning sustainability performance., This was indicated by a mean response of 4.54 and a standard deviation of 0.654. Finally, the responses to the statement "We liaise with our clients to enhance their sustainability initiatives" obtained a mean of 4.56 and a standard deviation of 0.642, suggesting that the manufacturing firms followed this DSC practice under study.

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The results of the data analysis suggest that the firms represented by the participants had adopted SSCM practices, such as SPD, S.P., SSC and DSC, which suggests that they adhere to the indivisible ethics described by Markman &Krause (2016):

(i) SSCM practices must improve ecological conditions, pursue ethical principles to promote social justice and enhance economic vigor.

(ii) SSCM practices have to give precedence to the environment, followed by society and then economics.

This indicates that SSCM has not only gathered momentum as a field of study (Beske and Seuring, 2014) and as a practice in manufacturing firms. Thus, studies have found that SSCM is implemented, such as Pagell and Wu's (2009) study classifying firms' adoption of practices to gain a competitive edge. In addition, gold et al. (2010) found that firms need to ensure that S.C. follows all the necessary internal SSCM practices, which the firms in the current study did, as indicated by the results of the data analysis.

Various studies have confirmed the results of the current study that firms achieve sustainability goals by performing SSCM practices. Morali and Searcy (2013) studied how Canadian companies dealt with the difficulties encountered in their SSCM practices. In Malaysia, Beske et al. (2014) studied SSCM practices that accompanied food production and summed up how they enabled firms to gain control of their S.C. and maintain a competitive edge. Employing Interpretive Structural Modelling, Jia et al. (2015) detected and examined prevailing SSCM practices in the mineral and mining sector. Esfahbodi et al. (2016b) studied the duty of governance in adopting SSCM practices and examined firms' performance gains concerning the economy and the environment.

Many researchers have indicated the necessity for companies to adopt SSCM practices and the positive effect of SSCM practices on an organization's performance (Luthra et al., 2017). Although the current study did not investigate the effect of SSCM practices on the performance of the firms represented by the participants, it might be that they were experiencing the value of moving from traditional S.C. to SSCM and thus continued to follow the practices indicated in the research results. Moreover, the study outcomes suggest that manufacturing firms, which are among the significant contributors to Ghana's GDP, ensure economic growth while preventing environmental harm and attending to social concerns, which historically have not accompanied economic development (Govindan & Jepsen, 2016).

CONCLUSION

The study assessed the SSCM practices of 303 manufacturing firms with an annual turnover of not less than one million dollars ($1,000,000) in Kumasi, Accra/Tema, Sunyani and Takoradi, Ghana. Data were collected from representatives of these firms through a questionnaire and analyzed with a weighted average index.

The internal SSCM practices investigated through the questionnaire were SPD, S.P., SSC and DSC, which the study revealed were being implemented in the manufacturing firms under study. This suggests that firms in Ghana are adhering to the environmental, social and economic pillars of sustainability by ensuring that their products, processes and collaboration with suppliers and clients are aimed at sustainability. Therefore, since SSCM practices are already being promoted in Ghana, it is recommended that all its manufacturing firms and those elsewhere promote them to ensure long-term economic development while protecting the environment and society.

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