

# Implementation of Green Supply Chain Management Practices in South African Manufacturing Industry

**Boitumelo Masokoameng, Khathutshelo Mushavhanamadi**

Department of Quality and Operation Management

University of Johannesburg,

South Africa

[216006035@student.uj.ac.za](mailto:216006035@student.uj.ac.za), [kmushavhanamadi@uj.ac.za](mailto:kmushavhanamadi@uj.ac.za),

## Abstract

The manufacturing industry need to be more conscious of how its impact the environment. The manufacturing companies are to blame for global warming because of their waste generation, depletion of natural resources, and disruption of the ecosystem. Green Supply Chain Management (GSCM) is a concept introduced to help reduce environmental issues caused by industries. The aim of this study was to evaluate the implementation of Green Supply Chain Management (GSCM) in the manufacturing industry in South Africa. Data was collected from employees working in various manufacturing companies, from management level to lower levels. A descriptive research method was adopted to evaluate the implementation of GSCM, in terms of identifying the suitable practices, the right approach, the value added as well as the benefits and challenges of implementation. It was found that the manufacturing industry is indeed aware if its impact on the environmental and have put measures in place to reduce this impact, such as adopting GSCM. This study identified the suitable GSCM practices that can be adopted to reduce environmental impact in the manufacturing industry as well as identify the approach to implementing the GSCM practices.

## Keywords

Green Supply Chain Management, Manufacturing Industry, South Africa

## 1. Introduction

Environmental issues are accelerating rapidly all around the world. Conserve Energy Future defines environmental issues as problems developed due to human mistreatment towards the plant's system. Woo (2020) stated the three main environmental issues faced in South Africa as 'pollution, lack of energy, and deforestation' Pollution is process of taking out harmful materials in the environment, the harmful materials are named pollutants (National Geographic Society 2011). These pollutants destroy the water, land and even the quality of air. The second issue faced is lack of energy, Woo (2020) further mentions that South Africa depends on coals as 77% of the produced energy is through coals. The lack of energy is caused by the reliance of the current source of energy. Coals are a source energy that gets to be released into the air when used, causing environmental problems. The third issue mentioned by Woo (2020), is deforestation which refers to the removal and cutting of forest, deforestation can birth other major issues as such pollution from the use of machines and chemicals used when cutting down trees. This process can lead to the decrease in oxygen provided to the plants and animals.

The South African manufacturing industry comprises three sectors: food and beverages, chemical products, and metal and machinery (Statistics South Africa 2014). This industry produces more products during its manufacturing process than other industries to meet customer demands. The manufacturing industry need to be more aware of how its processes impact the environment. Shaharudin et al. (2017) mentioned that manufacturing companies are to blame for global warming because of their waste generation, depletion of natural resources, and disruption of the ecosystem. Green Supply Chain Management (GSCM) is a concept introduced to help reduce environmental issues caused by industries (Khan, 2018). Khan, (2018) further mentioned that the main goal of GSCM is to decrease pollution (air, water and waste) while at the same time enhancing the firms' performance in reusing and recycling products. GSCM integrates Supply Chain Management and objectives of environmental protection to increase the supply chain profitability and market share while decreasing ecological risks and inefficiencies (Aslam 2018). Environmental

issues are caused by a lot of factors, as Huntington (2020) stated that the manufacturing industry accounts for 19% of the global emission and 11%, from the power used to manufacture products used daily by customers.

### 1.1 Objectives

The research objectives of this study were to:

- i. Evaluate the manufacturing industry's awareness of its environmental impact
- ii. Provide insight on the suitable GSCM practices to be adopted in the manufacturing industry
- iii. Identify the approach taken in implementing GSCM practices in the manufacturing industry
- iv. Identify the challenges and barriers of GSCM implementation in the manufacturing industry
- v. Identify benefits of implementing GSCM practices in the manufacturing industry

## 2. Literature Review

### Factors affecting GSCM practices

The implementation of GSCM initiatives can be affected by several factors. There are studies done over the years that identified the internal and external factors affecting the GSCM initiatives. The internal factors are those factors that operate inside the business that have an impact on the implementation of GSCM initiatives, whereas external factors are the outside factors, but still impacting the business in implementing GSCM initiatives. The factors are explained below:

#### Internal Factors

##### *Management support and commitment*

Reddy (2016) stated that management support is very critical in implementing new practices and it is a key factor that affects GSCM initiatives. According to Kumar and Chanrakar (2012) management support and commitment can either positively or negatively affect the GSCM implementation. Lui et al (2019) found that management plays a significant part in the implementation of GSCM practices, supporting Niemann et al (2016) argument that management support is very necessary and crucial to effective GSCM implementation. Lui et al (2019) had a hypothesis that organizations with the high level of top management environmental commitment will have a higher level of green product design and green product manufacturing and proved it to be true. Reddy (2016) identified an illustration of the significance of management support in the implementation of new initiatives, the illustration is presented in figure 1 below.

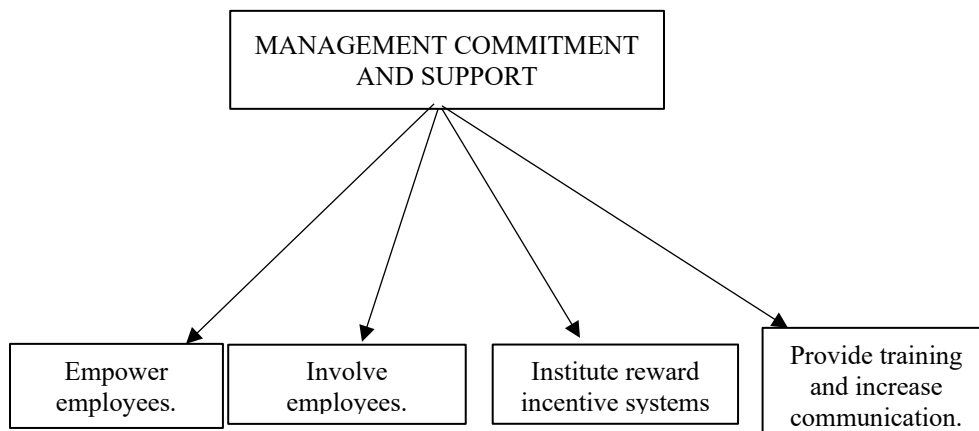


Figure 1. Significance of management support on new initiatives (source: Reedy, 2016)

### ***Organizational structure and strategy***

Organizational structure determines the official relations and reporting in the organization, it shows the number of hierarchy levels and determines the span of control of managers in an organization (Ahmady et al, 2016). Reddy (2016) stated that the organizational structure and strategy has the ability to drive or be a barrier to the implementation of GSCM initiatives. The author further mentions the success of an organizational strategy to achieving its goals depend on the organization's capabilities. When strategies are put in place to addresses sustainability, they are more likely to have a positive impact on the GSCM initiatives. The organizational structure effect the GSCM initiatives by determining if they are feasible or not (Reddy 2016).

### **External Factors**

#### ***Suppliers***

According to Ali et al. (2016) suppliers are the significant entity to an organization's GSCM, it is essential for organizations to collaborate with suppliers when initiating environmental initiatives in operations. However, Reddy (2016) highlighted that supplier have a considerable impact on GSCM practices, the author stated that the effect of suppliers can be either positive or negative. According to Diabat and Govindan (2011) suppliers must be environmentally compliant, meaning that they must have a certification of environmental management system. This can assist the organization buying from the supplier to implement environmental purchasing. Environmental purchasing, also known as green purchasing (Reedy 2016), is defined as purchasing any goods or services that reduce its environmental impact (Tat et al. 2015). Tat et al. (2015) stated that green purchasing's objective is to reduce negative impact on the environment in the process of manufacturing and transportation by making use of materials that can be recycled, reused and durable.

#### **Consumer**

Customers can also impact GSCM initiatives because they are the determiners of what they require from the company (Khiewnavawongsa and Schmidt, 2013). Customers with higher income choose their goods and services looking at sustainability whereas those with lower income go for lower price rather than sustainability. Lin et al (2013) explains this as a direct influence customers have on GSCM initiatives within an organization.

#### **2.3.2.4 Competitors**

Bhool and Narwal (2013) stated that a reputation of green image drives GSCM. Green image is defined by Tat et al (2015) as a positive recognition of firms that incorporate manufacturing processes that are environmentally friendly by customers. Kumar and Chandrakar (2013) mentioned that customers are getting sensitive to environmental issues are optioning to firms that are responding to these issues. Niemann et al (2016) stated that organizations can gain competitive advantage by having the right green image and attract customers. However, competitors focusing on reducing costs and providing lower prices of products can negatively affect GSCM initiatives because it gets difficult to focus on GSCM initiatives and at the same time achieve lower production costs (Dhull and Narwal 2016), this results in pressure from competitors discouraging the implementation of GSCM.

### **Challenges in implementing GSCM**

#### ***Lack of advanced technical expertise***

One of the leading factors to an effective implementation of GSCM according to Gandhia et al (2015) is human technical expertise. Khushbu and Shah (2014) stated that the lack of advanced technology and resisting to adopt the latest technology can set back implementing GSCM. This statement is supported by Pooe and Mhelembe (2014) as a factor that obstruct successful GSCM implementation. Advanced information technology (IT) systems are required to back up the activities of GSCM in the manufacturing processes (Sithole, 2019). According to Pooe and Mhelembe (2014) and Luthra et al (2011), IT systems allow for proper flow of information and tracking of suppliers, materials, flow of production, waste, emissions, distribution, and distribution disposal and recycling of materials. Sithole (2019) mentioned that IT also ensures information sharing and enables integration between supply chain partners. It becomes even more challenging even organizations resist adopting the latest technology, it makes it harder to implement even small changes. The manufacturing industry should develop strategies that will respond to this resistance in order to ensure effective implementation of GSCM.

### **Poor Motivation and no support from management**

Management support is highlighted as a very critical factor in implementing new practices and it is a key factor that affects GSCM initiatives by Reddy (2016), Gandhia et al. (2015) and Nieman et al. (2016). Mwirigi (2016) stated that top management can ensure its commitment to improving environmental performance by developing sustainability strategy and policy. Furthermore, Toke et al (2012) stipulated that management has a huge role in ensuring that the adoption of GSCM is allocated the necessary resources for a successful implementation. However just allocating necessary resources is not enough, management needs to offer people implementing GSCM motivation, Sithole (2019) mentioned that rewards can be offered to encourage them and provide enough support for when challenges arise. On top of motivation and support, there must also be training, and education provided in order to equip the personnel with necessary skills to ensure successful implementation (Sithole 2019). Luthra et al. (2011) found that in some organizations management do not offer any support when implementing GSCM initiatives and concluded that lack of top management commitment and support leads to ineffective GSCM initiatives.

#### *Financial implications*

Sithole (2019) indicated that cost is always being used to measure performance of an organization, the author also mentioned that high costs are the biggest obstruct to effective implementation of GSCM initiatives. There are high initial investments for green methodologies. Luthra et al (2011) stated that an organization to incorporate environmental management involves two kinds of costs: direct and transaction cost. Financial implications seem to be proving to be a challenge in adopting GSCM, according to Niemann et al (2016) some organizations are focused highly on short-term gaining opposed to long term benefits of GSCM.

#### *Lack of GSCM knowledge*

Not enough knowledge and training on GSCM is a challenge to implementing effective GSCM (Tay et al, 2015). Neimann et al (2016) found that lack of education and necessary knowledge is found as barrier to implementing GSCM in the manufacturing industry. Even with the increasing customer awareness on environmental issues and demanding green products, other countries like India do not have a demand for green products simply because they are not aware of GSCM (Luthra et al, 2011). Therefore, organizations will not initiate GSCM because the market is not aware and does not demand environmentally friendly products (Sithole, 2019). Luthra et al (2011) concluded that awareness on the necessity of green products by customers resulted in manufacturers are producing no green products.

### **3. Methods**

The research design of this study is a descriptive research design. The aim of this study is to analyze the implementation of GSCM in South African manufacturing industries. The objectives of this study were to evaluate the manufacturing industry's awareness of its environmental impact, provide insight on the suitable GSCM practices to be adopted, identify the approach taken in implementing GSCM practices and identify the barriers and challenges of GSCM implementation in the manufacturing industry.

### **4. Data Collection**

This study collected data using a quantitative data collection method: a questionnaire with open ended and closed ended questions relating to environmental awareness, GSCM practices, GSCM challenges and barriers, supplier and customer collaboration. All questions were related to the research objectives and questions. The questionnaire of this study was developed in a way that only allows accurate data to be collected, and this was done with a nonprobability sampling method.

Data was collected from the employees working in management and lower-level positions such as Operations/production supervisor/manager, supply chain manager, procurement/purchasing manager, warehouse operator, supply chain coordinator, logistics manager, store man and supply chain officer involved in the implementation of GSCM were considered. This study targeted a sample size of 30 respondents, although 25 respondents submitted their responses.

## 5. Results

Descriptive statistics was used to analyses the data collected in order to answer the research objectives and questions. Descriptive statistics in this study was used to describe what the data collected shows in a form of pie charts, tables and graphs. The analysis of the data collected from the questionnaire were outlined using the following to answer the research objectives and question of this study:

- i. The percentages of answers for questionnaire questions that focused discovering the manufacturing industry's awareness on its environmental impact.
- ii. The frequency of answers for each question aimed at revealing the suitable GSCM practices to be adopted in the manufacturing industry.
- iii. The frequencies of answers for each question aimed at identifying the approach taken to implement GSCM practices in the manufacturing industry
- iv. The frequencies of answers for each question aimed at revealing the challenges and barriers of GSCM implementation in the manufacturing industry.
- v. The frequencies and percentages of answers for each question that focused on the benefits of GSCM implementation in the manufacturing industry.

### Results

#### Objective 1: Evaluate manufacturing industry's awareness of its environmental impact

##### i. Awareness on environmental impact

The manufacturing companies are aware of their environmental impact, a highest percentage of respondents (60.90%) agreed that they are aware of their company's environmental impact, whereas 39.10% strongly agreed.

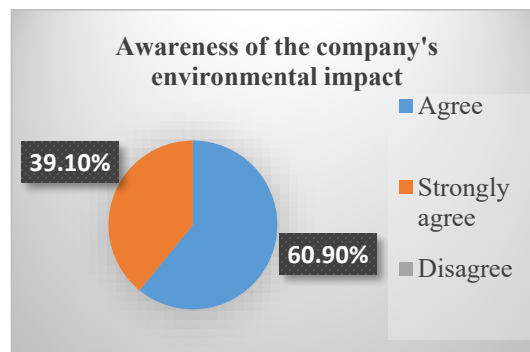


Figure 2. Awareness on environmental impact

##### ii. Measures taken to reduce the environmental impact

Figure 3 below indicates whether there is any measure taken to reduce environmental impact in the manufacturing industry. 52.20% of the respondents indicated that they agree that there are measures taken to reduce the environmental impact, and 47.80% strongly agreed.

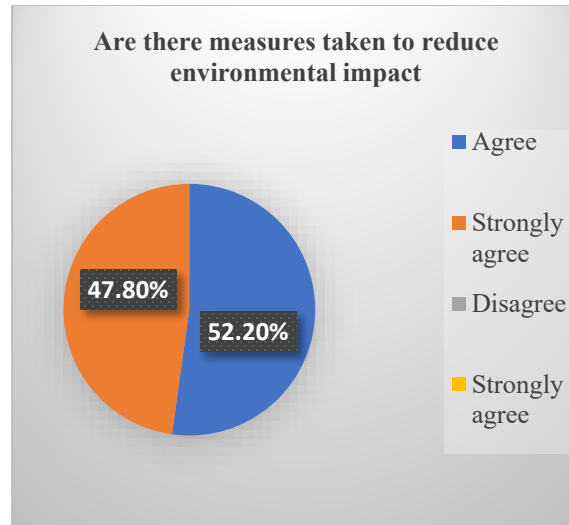


Figure 3. Measure taken to reduce the environmental impact

### Company compliance to relevant environmental legislation

Respondents indicated that their companies were complying to relevant environmental legislations, 47.80% strongly agreed and 52.20% agreed as indicated in figure 4 below

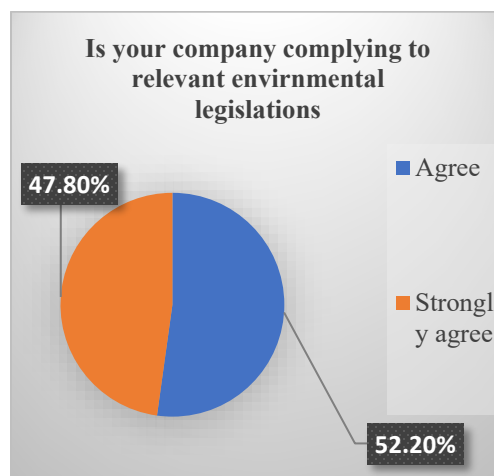


Figure 4. Is the company complying to environmental regulations?

### Objective 2: Provide insight on the suitable GSCM practices to be adopted in the manufacturing industry

A total of 9 GSCM practices were mentioned, the most common was green packaging that which was mentioned four (4) times, followed by recycling/reuse of products, green distribution/logistics and green procurement/purchasing that were all mentioned three (3) times. The second lowest (2 times) mentioned were green design and green manufacturing. Energy conservation, water management and green marketing were all mentioned only once.

Respondents were asked about which GSCM practices in their view should their company prioritize and the reason behind it. A total of 5 practices were mentioned, green manufacturing was the highest mentioned (4 times) the reason behind that was that it is more in line with the company's industry. Another reason mentioned was that green manufacturing "can help reduce the impact of manufacturing on the environment". Green design that was mentioned two times, reason being it would allow for efficient products that would reduce carbon footprint. Green packaging and

green procurement/purchasing were mentioned only once. It was also mentioned that companies should priorities any practice that is required by the customer, although it was only mentioned once.

The respondents were also asked on which GSCM they view to be the most suitable for the manufacturing industry in South Africa, figure 5 below demonstrates the responses. The highest mentioned GSCM practice as the most suitable is green manufacturing that was mentioned four (4) times. Green distribution/logistics and green procurement/purchasing were both mentioned two (2) times, even though green packaging was the most mentioned GSCM practice, mentioned two (2) times as the most suitable GSCM practice in the manufacturing industry. Green design, recycling/reuse of products and energy conservation are all mentioned once.

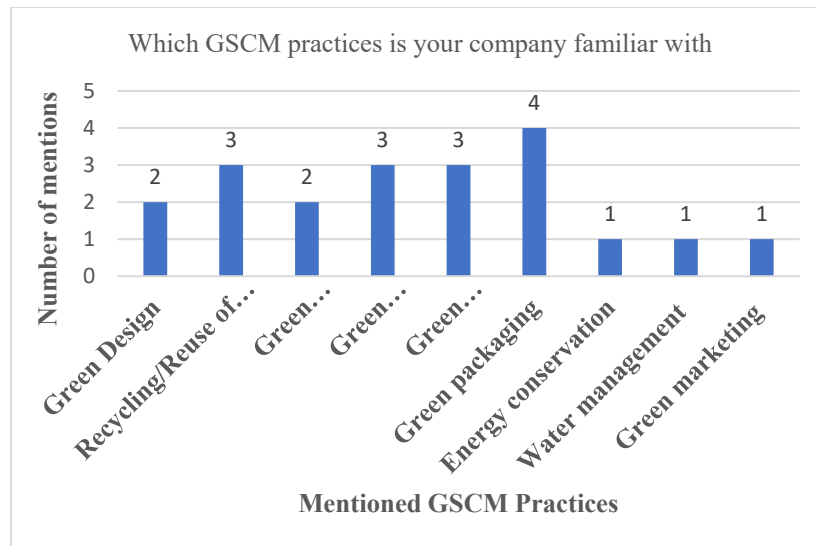


Figure 5. Which GSCM is your company familiar with?

**Objective 3: Identify the approach taken in implementing GSCM practices in the manufacturing industry**

*i. GSCM planning*

Zhu et al (2019) identified dimensions that can assist organizations to plan for GSCM, the dimensions include, customer collaboration and cooperation, supplier collaboration, green purchasing/promotion of green products, end of life of life product management and internal environment management such as monitoring of energy consumed in the company during production. Respondents were asked whether these dimensions applied at their companies. The below figure represents the responses.

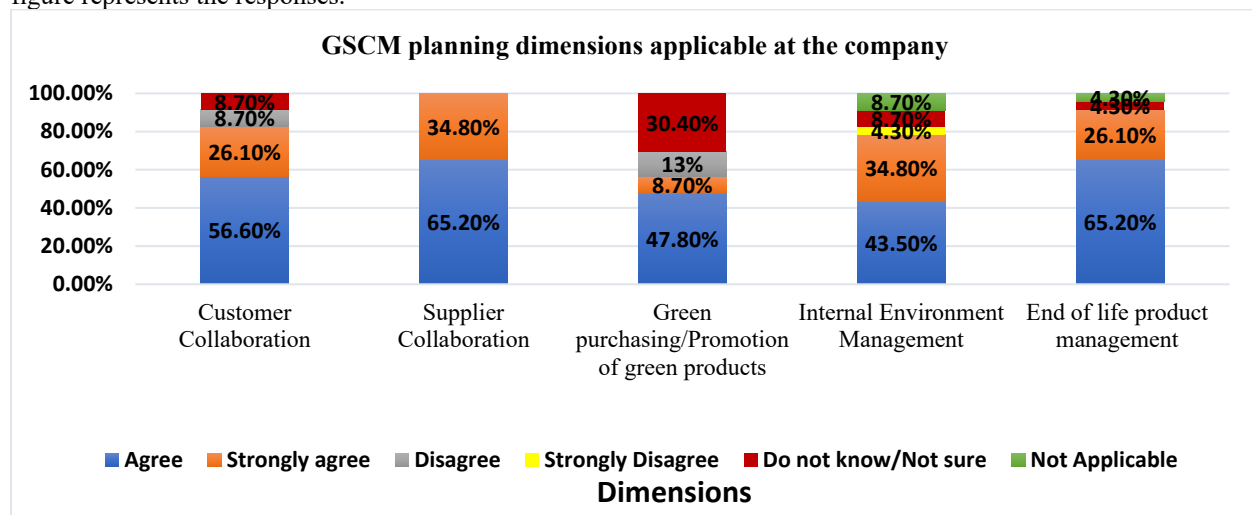


Figure 6 .GSCM planning dimensions applicable at the company

Figure 6 shows that 56.60% agreed that their company collaborates with customers to assist in reducing the environmental impact and plan for GSCM, 26.10% strongly agreed, whereas 8.70% disagreed and 8.70% indicated that they did not know or were not sure whether customer collaboration was applicable.

65.20% agreed that their company collaborate with its suppliers, and 34.8% strongly agreed.

47.80% agreed that their company promotes green products, 8.70% strongly agreed, 13% disagreed whereas 30.40% did not know or were not sure.

43.50% agreed that internal environment is managed at their company, whereas 34.80% strongly agreed, 4.30% strongly disagreed, 8.70% both indicated that they did not know or were not sure and that internal environment management is not applicable at their company.

65.20% agreed that they have end of life product management at their company, 26.1% strongly agreed whereas 4.30% did not know or were not sure, 4.30% indicated that end of life product management was not applicable at their company.

#### **Objective 4: To identify barriers and challenges of GSCM implementation in the manufacturing industry**

Zulkefli (2019) mentioned that even though the implementation of GSCM has sustainable benefits, it can however meet challenges and barriers when implementing. The results indicated that whether companies have met any challenges in implementing GSCM, 65.20% of the respondents agreed that their company has met challenges in implementing GSCM, 4.30% strongly agreed, 4.30% disagreed. However, 26.10% indicated that they did not know or they were not sure.

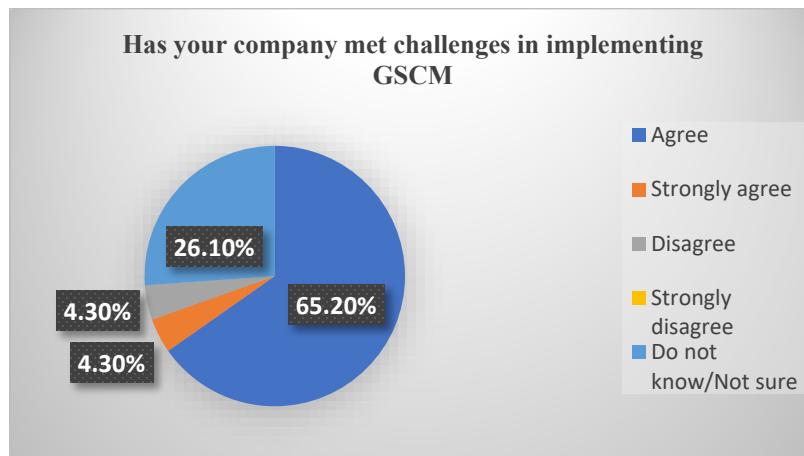


Figure 7. identify barriers and challenges of GSCM implementation in the manufacturing industry

#### **Objective 5: To identify benefits of implementing GSCM practices in the manufacturing industry**

Respondents were asked about how their company have benefited from GSCM practices. A total of 8 benefits were mentioned as indicated in figure 8 below, 27.78% mentioned was improved operational/environmental performance, which was the highest mentioned, followed by company compliance, which was mentioned 16.67%. Both satisfied customers, and competitive advantage were mentioned 11.11%. The least mentioned were company growth, staff morale/satisfied employees, and educated and trained employees, all of which were mentioned at 5.56%.



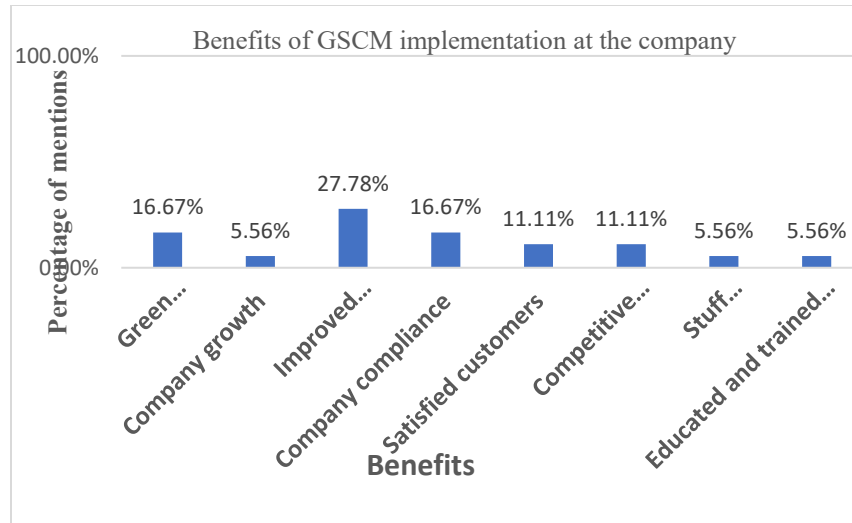


Figure 8. Benefits of GSCM implementation at the company

## 6. Discussion

### Objective 1: Evaluate manufacturing industry's awareness of its environmental impact

The findings indicated that respondents agreed that companies in the manufacturing industry are aware of their environment impact and that there are measures taken to reduce the impact. The results also indicated that companies require their suppliers to meet international environmental management standards. This finding shows to be consistent with the finding that there are measures taken to reduce the impact, it also shows that management is behind and supporting the reducing of the environmental impact.

Most respondents agreed that their company is complying with relevant environmental legislation and agreed that they have environmental certification. It can be concluded that the manufacturing industry is aware of their environmental impact and aims to reduce the impact by putting relevant measures.

### Objective 2: Provide insight on the suitable GSCM practices to be adopted in the manufacturing industry

The questionnaire indicated that nine GSCM practices that companies in the manufacturing industry are familiar with. As presented in the findings green design, recycling/reuse of products, green manufacturing, green distribution/logistics, green procurement/purchasing, green packaging, energy conservation, water management and lastly green marketing are the 9 practices mentioned. This indication shows that manufacturing companies are familiar with GSCM practices as respondents were able to name 9 different GSCM practices with green packaging as the most mentioned one among respondents.

However, the respondents also revealed the practices that they feel need to be prioritized at their companies. Five (5) practices were mentioned. The most frequent mentioned was green manufacturing. This shows that even though green packaging is the most familiar GSCM practice among manufacturing companies as indicated in the findings, the one that respondents feel needs to be prioritized is green manufacturing. This finding is consistent, the GSCM practice respondents indicated that the most suitable practice for the manufacturing industry in SA is green manufacturing. It can be concluded that based on these findings, green packaging and green manufacturing are the answers to the second research objective and question.

### Objective 3: Identify the approach taken in implementing GSCM practices in the manufacturing industry

The findings in the literature review of this study revealed the GSCM planning dimensions significant to the achievement of successful GSC implementation as identified by Zhu et al (2019), namely customer collaboration, supplier collaboration, green purchasing/promotion of green products, internal environmental management, and end of life product management. Majority of the respondents revealed that they agree and strongly agree that customer collaboration is applied at their company, however a small percentage disagreed, and another indicated that they did

not know. Seeing that majority agrees, it can be concluded that manufacturing companies incorporate customers in their planning for GSCM practices.

The finding also indicated that their company incorporate supplier collaboration in the GSCM planning as respondents agreed and strongly agreed. Based on these findings it can be concluded that manufacturing companies incorporate supplier collaboration in their GSCM planning.

Under the green purchasing/promotion of green products the findings indicated that majority of the respondents agreed that green purchasing/promotion of green products is applied at their company, however a concerning 30.40% indicated that they did not know/not sure, this shows that employees are not aware or are not involved in the process of promotion of green products at their company. It is significant for management to involve all employees in the promotion of green products in order for GSCM implementation to be successful. Looking at this finding, it can be concluded that although management incorporates green purchasing/promotion of green products at their company, they do not involve the employees.

Most respondents strongly agreed that internal environmental management and end-of-life product management are applied at their company. These findings indicate that GSCM dimensions identified by Zhu et al (2019) are applied at manufacturing companies.

The findings indicate that the most popular first step in implementing GSCM is "strategic planning for implementation by top management". This step however requires top management to support the implementation, the second popular first step is understanding the company's contribution to environmental burden/issues

Respondents revealed five company approaches to implementing GSCM, the majority of the approach mentioned was educating employees on GSCM practices and coming up with innovative ways for GSCM implementation, looking at the results, it can be concluded that the approach taken in GSCM implementation is to understand the impact, strategically plan innovative ways for implementation. This approach requires a top bottom approach in the company.

#### **Objective 4: To identify barriers and challenges of GSCM implementation in the manufacturing industry.**

A significant percentage of the respondents indicated that they agree that their companies have met challenges in implementing GSCM. Resistance, increasing costs, strict laws, pressure from customers and lack of specialists were the challenges. These findings indicate that the implementation GSCM is not easy and should be strategically planned before implementation. Respondents indicated ways in which these challenges are overcome in their companies, prioritizing the environment and training employees were the most mentioned followed by hiring specialists, investing in continuous improvement and having a strategic plan. From these finding, it can be concluded that challenges are met when implementing GSCM in the manufacturing industry and there are ways to overcome them.

However, a considerable percentage of the respondents indicated that they did not know/not sure whether their companies met any challenges. This finding indicates that some of the challenges met might not be communicated with the employees.

The literature review revealed that lack of advanced technical expertise is one of the barriers of GSCM implementation, the results revealed that majority of the respondents strongly agreed that the latest technology would assist in implementing GSCM in their company. A high percentage indicated that motivation is important in implementing successful GSCM. This indicates that motivation can hinder the implementation of GSCM if employees do not feel motivated enough. Lack of GSCM Knowledge was also among the barriers mentioned to be a barrier on the implementation.

#### **Objective 5: To identify benefits of implementing GSCM practices in the manufacturing industry**

The study revealed the benefits of GSCM implementation in manufacturing companies. It is indicated the benefits as mentioned by respondents, the highest mentioned benefit was to improved operational environmental performance, followed by company compliance, satisfied customers, competitive advantage, and company growth.

On top of the benefits identified, the findings also revealed the value of GSCM as mentioned by respondents. Good reputation and enhanced environment performance were the top mentioned values, followed by compliance to environmental regulations.

It is indicated that significant number of respondents did not know/not sure of any increased profitability and savings since the implementation of GSCM in their company, this is a concern because it can either indicates that other benefits of GSCM may not be communicated or indicate that there is no advantage in terms of increased profitability and savings hence most of the respondents do not know/not sure.

## 7. Conclusion

It was found that companies in the manufacturing industry are aware of their impact to the environmental issues and have taken measures to reduce the impact. Implementing GSCM is one way of reducing this impact, practices such as green design, green manufacturing, green logistics and packaging were found to be the most GSCM practices companies were most familiar with. This study revealed employees' views on the practices that they feel need to be prioritized in the manufacturing industry, the most common practice mentioned among the respondents was green manufacturing. An approach taken to implement GSCM in the industry was identified, there are different approaches mentioned, however the most common was strategic planning, this was the most popular "first step of implementation".

The value of GSCM in the manufacturing industry was uncovered by this study. It was found that GSCM add value by allowing compliance to environmental regulations enhancing environmental and operation performance and contribute to a good company reputation. Apart from the value of GSCM, benefits of GSCM were also identified as company growth, competitive advantage, green image among others.

## References

- Ahmady, G.A., Mehrpour, M., & Nikooravesh, A. Organizational Structure. *Procedia - Social and Behavioral Sciences* 230 pp 455 – 462, 2016
- Ali, A., Bentley, Y., & Cao., G. The Influence of Supplier Collaboration on Green Supply Chain Management Practices and Firm Performance in UK SMEs, 2016
- Bhool R & Narwal M.S. An analysis of drivers affecting the implementation of green supply chain management for the Indian manufacturing industries. *International Journal of Research in Engineering and Technology* 2(11) pp 242-254. 2013.
- Diabat, A., & Govindan, K. An analysis of the drivers affecting the implementation of green supply chain management. *Resources, Conservation and Recycling*, 55(6) pp 659-667, 2011
- Gandhia, S., Manglab, S., Kumarc, P., & Kumard, D. Evaluating factors in implementation of successful green supply chain management using DEMATEL: A case study. *International Strategic Management Review*, 3 pp 96–109, 2015
- Khan, S., & Qianli, D. Impact of green supply chain management practices on firms' performance: an empirical study from the perspective of Pakistan. *Environmental Science and Pollution Research*, 24(20) pp 16829 – 16844, 2017
- Khiewnavawongsa, S., & Schmidt, E. K. Barriers to green supply chain implementation in the electronics industry. *Proceedings of 2013 Industrial Engineering and Engineering Management*. pp. 226-230, 2013
- Khushbu, V., & Shah, H. Barriers of Green Supply Chain Management: A Literature Review. *International Journal of Engineering Research & Technology*, 3 (5), pp 1657 – 1665, 2014
- Kumar, R & Chandrakar, R Overview of green supply chain management: operation and environmental impact at different stages of the supply chain, *International Journal of Engineering and Advanced Technology*, 1, pp 1-6. 2012
- Kumar, S., Luthra, S., & Haleem, A. Customer involvement in greening the supply chain: an interpretive structural modeling methodology. *Journal of Industrial Engineering International* 9(6) 2013
- Lui, Z., Sun, L., & Wang, H. The Impact of Top Management Commitment on Companies' Performance in Green s [https://www.researchgate.net/publication/331287739\\_The\\_Impact\\_of\\_Top\\_Management\\_Commitment\\_on\\_Companies'\\_Performance\\_in\\_Green\\_Supply\\_Chain\\_Management/comments](https://www.researchgate.net/publication/331287739_The_Impact_of_Top_Management_Commitment_on_Companies'_Performance_in_Green_Supply_Chain_Management/comments), 2019.
- Luthra, S., Kumar, V., Kumar, S., & Haleem, A. Barriers to implement green supply chain management in automobile industry using interpretive structural modeling technique-An Indian perspective. *Journal of Industrial Engineering and Management*, (4)2, pp 231-257, 2011.
- Mwirigi, P. *Drivers of adoption of green supply chain strategy by manufacturing firms in Kenya*. Nairobi: PhD Business Administration, Jomo Kenyatta University of Agriculture and Technology, 2016.
- Niemann, W., Kotze, T., & Adamo, F. Drivers and barriers of green supply chain management implementation in the Mozambican manufacturing industry. *Journal of Contemporary Management*, 13. pp 977-1013, 2016

- Poore, R., & Mhelembe, K. Exploring the challenges associated with the greening of supply chains in the South African manganese and phosphate mining industry. *Journal of Transport and Supply Chain Management*, 2014.
- Reddy, A. Factors Affecting Green Supply Chain Management (GSCM) Initiatives: A Case Study at Cipla Medpro Manufacturing. Dissertation. University of KwaZulu-Natal. Available at: <https://researchspace.ukzn.ac.za/handle/10413/14767>. 2016
- Reddy, A., & Naude, M. J. Factors Inhibiting Green Supply Chain Management Initiatives in a South African Pharmaceutical Supply Chain. *Responsible, Sustainable, and Globally Aware Management in the Fourth Industrial Revolution*. pp. 306-336), 2019
- Sellitto, M.A, Bittencourt, S.A, & Reckziegel, B. I Evaluating the Implementation of GSCM in Industrial Supply Chains: Two Cases in the Automotive Industry. *Chemical Engineering Transactions*, 43, pp 1315-1320, 2015.
- Hermann, F.F. & Sellitto, M.A., Prioritization of green practices in GSCM: Case study with companies of the peach industry. *Management Production* 23 (04) pp 871-886, 2016
- Sithole, K.A. *Employee Perceptions Towards Green Supply Chain Management in Gauteng Starch and Glucose Processing Industries*. Dissertation. University of South Africa, 2019
- Shaharudin, M.R., Govindan, K., Zailani, S., Tan, K.C. and Iranmanesh, M., Product return management: Linking product returns, closed-loop supply chain activities and the effectiveness of the reverse supply chains. *Journal of Cleaner Production*, 149, pp.1144-1156, 2017
- Tat, H, Chin, T & Sulaiman, Z. Green supply chain management environmental collaboration and sustainability performance. *Procedia CIRP* 26(1) pp 695-699, 2015
- Tay, M., Rahman, A., Aziz, Y., & Sidek, S. A Review on Drivers and Barriers towards Sustainable Supply Chain Practices. *International Journal of Social Science and Humanity*, 5 (10). pp 892 – 897, 2015
- Toke, L., Gupta, R., & Dandekar, M. An empirical study of green supply chain management in Indian perspective. *International Journal of Applied Sciences and Engineering Research*, 1(2) pp 372 – 383, 2012
- Zhu, Q., Sarkis, J., & Lai, K. Choosing the right approach to green your supply chains. *Modern Supply Chain Research and Applications*. 1(1) pp 54-67, 2019

## Biographies

**Khathutshelo Mushavhanamadi** is a Senior Lecturer, highly Knowledgeable Academic and a Business Professional, an Esteemed Leader who's highly Focused and Committed with a Consistent track record. As an out of the ordinary dynamic individual, she appeals to an astute can-do positive attitude focused on creative solutions which always propels her to challenge convention. Dr Mushavhanamadi holds a PHD Degree in Engineering Management and possess extensive experience in the Academic, Research, Consulting & Advisory Industries. An Esteemed Leader in the Training & Development Space of ERP, Operations Management, Production Planning and Control & Project Management. Her research interests involve green supply chain management, operations management issues, production planning and control, operations management, and Quality.

**Boitumelo Masokoameng** is an excellent student who was on the Dean's list for outstanding academic excellence in 2017 in the Faculty of Engineering and Built Environment. She has a National Diploma in Management Services, an Advanced Diploma in Quality that she obtained with a distinction, and a Postgraduate Diploma in Operations Management. She plans to do her Master's in Operation Management. She is an ambitious young lady with leadership skills acquired on her third year at the University of Johannesburg as a Chairperson of a student non-profit organization called Remember and Give (RAG). She has started her career in Organizational Development field in the year 2019.