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Green supply chain management: An empirical study in enhancing green economic performance

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Background: South Africa has successfully enhanced its manufacturing sector by incorporating green technologies and fostering sustainable job opportunities, demonstrating the importance of material transformation in supplying necessities and promoting economic growth. The manufacturing sector's rapid economic growth has led to environmental concerns, prompting a push for green supply chain management (GSCM). This study explores green purchasing (GP), manufacturing and distribution practices.

Objectives: By examining how GSCM techniques affect green economic performance (GEP) in Gauteng province's industrial sector, the current study aims to close this gap. Green supply chain management techniques were examined in this study in the areas of green distribution (GD), manufacturing and purchasing.

Method: The study surveyed 450 manufacturing companies in Gauteng province using a quantitative approach. Data were analysed using Statistical Package for Social Science (version 28.0) and SMART PLS (version 3.0) (using confirmatory factor analysis and structural equation modelling path analysis) to test research hypotheses.

Results: The results of the study showed that in the manufacturing industry GSCM practices through GP, green manufacturing and GD greatly influence GEP. In addition, GD has the strongest effect on GEP compared to GP and GD.

Conclusion: To enhance GEP and safeguard the environment, the industrial sector must implement GSCM strategies.

Contribution: This study is significant for South African manufacturing companies because it offers opportunities for achieving GEP by adopting and comprehending GSCM practices. The findings will aid in the implementation of these practices in Gauteng province's manufacturing firms.

Keywords: green purchasing; green manufacturing; green distribution; green economic performance; manufacturing industry.

Introduction

The manufacturing sector is a part of the industry sector that involves producing food, chemicals, metals and minerals; it usually makes up a large part of energy consumption in nations and is essential for the economy (Levinson 2017). The manufacturing sector is crucial for supplying necessities, creating jobs and promoting economic growth through innovation and technological advancements (Gray Group International 2024). It drives innovation, provides necessities, boosts productivity and offers stable, better-paying and less susceptible positions (Sagar 2023). Previous studies highlight the central idea that the manufacturing sector represents a crucial foundation for national economies, contributing to job creation, gross domestic product (GDP) growth and development (Kruse et al. 2023; Wan, Kazmi & Wong 2022). Countries like South Africa have successfully improved their manufacturing sector, incorporated green technologies and created sustainable job opportunities (Macpherson 2018). Furthermore, Haraguchi et al. (2017) point out that the industry also stimulates economic growth through higher productivity and capital, ensuring a high standard of living and sustainable development.

The manufacturing sector, along with other sectors like construction and agriculture, has caused global warming and ecological disasters because of faster economic activities and improved living conditions (Lynch et al. 2021). The global sustainability crisis is escalating because of

changing biodiversity, prompting a collaborative effort among scholars, researchers and practitioners to promote environmental sustainability and green supply chain management (GSCM) (Tseng et al. 2019). This has led to a growing concern for environmental sustainability, with GSCM being considered as a solution (Dos Santos, Godoy & Campos 2019; Jing et al. 2019). This has prompted companies to continuously improve their green practices to protect the environment and enhance business performance (Kaur et al. 2018). Teixeir et al. (2016) emphasise the importance of GSCM practices in supply chain professionals for economic sustainability and environmental friendliness, including green purchasing (GP), manufacturing and distribution. This study looked at three sets of GSCM practices: GP, green manufacturing (GM) and green distribution (GD). These practices give an extensive combination of positive actions that organisations broadly use. Incorporating these practices into the manufacturing industry enhances both environmental and financial consequences, providing a competitive advantage for the firms.

The concept of GSCM is one of the latest innovations to improve the capabilities of supply chain management (SCM) (Assumpção et al. 2019; Chopra 2017; Singh & Trivedi 2016). According to Phạm and Phạm (2017), GSCM plays a significant role in the present economic world, particularly in manufacturing. The recent tendency of environmental consciousness indicates a need to modify manufacturing philosophy and implement vital changes in the present fabrication system. Likewise, Ashton, Russell and Futch (2017) argue that corporations are reevaluating their effectiveness by promoting good corporate citizenship and justifying their negative societal impacts. Manufacturers now need to be well-equipped to cope with a variety of pressures related to the environment, such as carbon dioxide emissions, water scarcity, pollution and unsustainable farming methods (Zhaolei et al. 2023) to enhance the effectiveness of their products, at the same time, looking for ways to cut costs.

Several studies on GSCM in South Africa (Langton, Mafini & Maotoawe 2023; Machete 2019; Rukuni et al. 2022) have provided a gap that needs to be addressed; this study was conducted by an unrelated manufacturing industry such as the automobile sector rather than the cement sector. As an alternative, this study was conducted over a longer time frame, 8 months. Mafini and Loury-Okoumba (2018) proposed a research agenda incorporating other GSCM activities such as GP, GM and green training and sustainability performance to increase operational and supply chain performance. The current study addressed the research calls of previous researchers (Chinomona & Bikissa-Macongue 2022; Kot 2018; Rukuni et al. 2022) with special emphasis on exploring other activities of GSCM such as GP, manufacturing and distribution in achieving sustainability in supply chain and economic green performance. These studies have examined the relationship between GSCM practices and firm performance under normative, coercive, and mimetic pressures, highlighting organisations' essential responses for survival and competitiveness. In other words, these studies found that GSCM procedures have a substantial impact on the logistical performance of construction organisations. The study aims to expand the knowledge base on GSCM and green economic performance (GEP) in South Africa, focusing on successful factors that lead to green performance in the manufacturing sector, despite previous studies focusing on American, Asian and European contexts. This discovery is significant, as there have been few studies conducted in Gauteng province to verify it and it also examined if these green practices can result in improving GEP which is still an open gap that needed to be attended.

Literature review

This section discusses the literature review on Ecological Modernisation Theory (EMT) and the study's constructs.

Ecological modernisation theory

Martin Janicke and Joseph Huber, pioneers of EMT, developed a theory in Europe, particularly in Germany, in the 1980s, focusing on how organisations incorporate environmental practices into their operations and relationships (Howes et al. 2010; Jorgenson 2016). In other words, research indicates that strategic environmental management, deeply ingrained in technology and policy, drives environmental innovation in the supply chain at both macro-level (government regulation) and micro-level (Assumpção et al. 2019). The theory suggests that government and industry must recognise, develop, approve and adopt technological innovations to tackle ecological issues without causing harm to the environment (Bergendahl, Sarkis, & Timko 2018). Further, Szarka (2012) and Jorgenson et al. (2019) state that EMT links economic performance with environmental protection, proving a strong relationship between GSCM activities and GEP. Describing EMT in South Africa, Hector and Lambrechts (2024) explained that ecological modernisation strives to harmonise the environment and economy by promoting green production using market mechanisms, emphasising recycling, technological advancements, and ecological pricing, in order to decrease external economic impacts on the environment. This enables researchers in the study to approach the issues caused by the manufacturing industry's impact on the environment with a new perspective and find a holistic solution.

Green supply chain management

Green supply chain management is an initiative aimed at reducing environmental impacts in supply chain operations (Famiyeh et al. 2018). It integrates environmental management into procedures, involving collaboration with suppliers, customers and logistics providers (Ahmad et al. 2022). Implementing GSCM practices demonstrates corporate image and social responsibility, including GP, manufacturing and distribution (Zhang et al. 2019). In other words, this study focused on GSCM practices because it has the ability to

balance environmental sustainability and economic growth by minimising waste, cutting emissions, saving resources and safeguarding ecosystems at every stage of the supply chain. The increasing competition in green is compelling companies to implement environmentally green procedures in their supply chain procedures to address demands and uphold product standards (Abbas 2024). For that GSCM is a green approach to the supply chain, aiming to minimise environmental impacts from production, logistics, warehousing and product delivery (Ba Awain, Al-Ansi & Jaboob 2023). While it has the potential to transform waste management and green environmental, it is still a new idea in many industries. In other words, the goal of GSCM is to preserve energy resources and avoid wasteful material use in every stage of the product's life cycle – from design to disposal. Numerous scholars have viewed GSCM practices as key assets or skills for establishing a competitive edge. For instance, Zhan and Thoo (2024) discovered that GSCM can support companies in achieving a successful green transformation. This research highlights the significance of incorporating GSCM practices into manufacturing industry for companies in order to develop GEP and gain green competitive benefits through creative GP, GM and GD.

Green purchasing

Green purchasing is defined as a company's environmentally responsible buying practices intended for the preservation of natural resources, maintaining the eco-system quality, the minimum usage of water and energy resources, pollution avoidance, reduced disposal of wasted materials to dumping grounds and the motivation of suppliers for the development of environment-friendly products (Choi, Min & Joo 2018). Islam et al. (2017) suggest that GP promotes environmental consciousness by purchasing eco-friendly materials or components with desirable environmental features like recyclability and reusability. Despite being costly, green products can lower disposal expenses, promote sustainable development, reduce environmental impact and boost an organisation's reputation and image (Govindan, Khodaverdi & Vafadarnikjoo 2015). Green purchasing incorporates sustainability into input purchasing, ensuring sustainable practices in supply chain partners (Mallikarathna & Chathurani Silva 2019). Green purchasing is steadily gaining traction in numerous developing countries, especially when compared to Europe and other developed nations worldwide (Siddiqui et al. 2024). To illustrate that the governments impose strategies and standards, along with the effort of manufacturers and consumers, which are primarily responsible for the success achieved by implementing changes in procedures. For that, GP is seen as a key method to improve environmental performance in the different industries while also meeting green objectives and boosting GEP (Yap et al. 2024). In this regard, Ngubane (2024) emphasised that the adoption of GP includes incorporating environmental factors into the purchasing process to reduce negative environmental effects and enhance sustainability selecting environmentally green products and services that prioritise green criteria, such as energy efficiency, recyclability and reduced carbon footprint, and is a crucial factor in adopting GP. By including these factors in purchasing choices, companies can help the environment by cutting down on resources used, reducing waste produced, improving resource efficiency and decreasing greenhouse gas emissions. With that being recognised, the current research views GP as the acknowledgement, blending and execution of green practices throughout the purchasing procedure.

Green manufacturing

The growing global concern for environmental conservation has made GM a vital aspect for all companies, determining the long-term green of a company (Siddiquee, Shaha & Hasin 2024). Green manufacturing aims to reduce manufacturing's environmental impact by incorporating ecological aspects into design, re-design and reducing material and energy waste because of unsuitable design and defects (Tricoire 2019). However, it is not possible to accomplish this without green practices and technologies, well-trained employees and environmental awareness. To illustrate this point, Cheng et al. (2024) state that, GM assists companies in achieving sustainable development and promoting a more environmentally friendly planet. Green manufacturing utilises advanced methods such as waste reduction, recycling and enhanced resource utilisation to minimise environmental effects (Ijaz et al. 2024). This research looks into GM through green technology, policy, environmental management and SCM with the aim of achieving GEP. While for Primandaru, Kusuma and Nasution (2023), GM highlights the adoption of the best resources, thus leading to long-term competitive advantages through the production of high-quality products at the lowest cost. From this it is clear that GM does not only reduce the impact on the environment but also enhances operational efficiencies and long-term profitability of businesses. Green products and manufacturing require environmental friendliness, non-toxic materials, restricted use of genetically modified organisms and environmentally friendly packaging (Liobikienė, Mandravickaitė & Bernatonienė 2016). Green manufacturing benefits supply chain professionals by reducing raw material costs, increasing productivity and minimising environmental and occupational safety expenses (Rostamzadeh et al. 2015).

Green distribution

According to Caniëls, Cleophas and Semeijn (2016), GD embraces activities that reduce carbon dioxide, which is economically feasible and will bring about a better quality of life for upcoming generations. Implementing greater transparency because of the variety of GD practices when moving goods from one place to another improves the quality of human life and the environment (Mwaura et al. 2016). Green distribution incorporates environmental considerations into packaging, transportation and logistics operations, aiming to decrease waste and minimise environmental impact during the shipping process (Epoh, Langton & Mafini 2024). In the same path, Siddiqui et al. (2024) add that GD involves

implementing green approaches to minimise environmental effects of traditional logistics by transforming procedures, infrastructure and transportation fleets to harmonise ecology and economy, with an emphasis on green environment. On the other hand, this decrease in idle time and unnecessary trips results in improved efficiency. When making choices on how to use vehicles, businesses can increase efficiency and reduce their carbon footprint. Moreover, Phonthanukitithaworn et al. (2024) suggest that implementing GD can result in better waste management results, including higher rates of recycling and decreased packaging waste. However, the difficulty rests in maintaining a balance between operational efficiency and environmental objectives (Maurya et al. 2023). Keeping in mind the above need and challenge, this research aims to investigate how GD can help businesses grow while maintaining a balance of GEP in order to ensure compliance with regulations and minimise the possibility of incurring fines.

Green economic performance

The green economy acts as a catalyst for green development in three areas which are economic, social and environmental focusing on improving quality of life and ensuring equity while reducing environmental risks (Chaaben et al. 2024). To support this point, Borel-Saladin and Turok (2013) argue that GEP is mainly imperative in South Africa for two fundamental aims: Firstly, the excellent level of unemployment that the country is facing and secondly, the high carbon impact of the economy. This means that GEP empowers job creation. In the understanding of Zhu, Sarkis and Lai (2013), GEP is one of the reasons why supply chain professionals seek to adopt GSCP practices now and in the future. Furthermore, it presents a structure to be more resource efficient, lowers carbon and is less environmentally damaging and more socially acceptable. Abbasi, Farsijani and Raad (2016) say that any supply chain will not survive for long without GEP. The green economy, therefore, plays a very important role in the success of any type of organisation, big or small. The concept of GEP is closely linked to the green development model and entails economic development that considers the wise use of natural resources (Wani, Loganathan & Esmail 2024). It reduces pollution, prevents it and promotes social welfare by setting up a carbon-neutral economy. Based on that, Han and Gao (2024) claim that through green economy countries are making a promise to protect biodiversity and use renewable energy sources. To support this, a study conducted by Phan (2024) showed how the role of GEP through the utilisation of clean energy, and green bonds contributes to tracking climate policies, economic advancement and international investments. For this study, the researchers assume that GEP involves optimising profits and guaranteeing a favourable outcome for companies and customers through efficient resource management; for this reason, it is important to make sure that customers receive good value for their money and are happy with their purchases by concentrating on both short-term and long-term objectives.

Conceptual framework and hypotheses development

A framework is conceptualised to study the relationship between four constructs; GP, manufacturing and distribution are the predictor variables while GEP is the outcome construct as presented in Figure 1. The hypothesised relationships investigated in the study are displayed.

Hypothesis statements

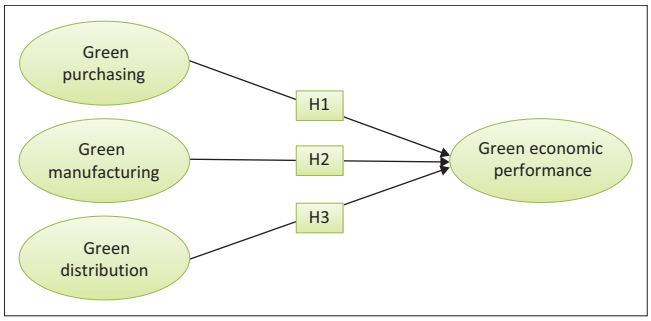
Based on the above conceptual framework, the following hypotheses are put forward:

- **H1:** There is a positive relationship between green purchasing and green economic performance.
- **H2:** There is a positive relationship between green manufacturing and green economic performance.
- **H3:** There is a positive relationship between green distribution and green economic performance.

Research methodology

Methodology refers to the rationale and the philosophical assumptions that underlie any natural, social or human science study, whether articulated or not (Bairagi & Munot 2019). This study was subject to a cross-sectional design, defined as research involving a sample of units such as people or firms and products selected from the population of interest (Feinberg, Kinnear & Taylor 2013). The study utilised a cross-sectional design, as it is ideal for estimating the frequency of behaviour in a population. This study used quantitative research to test hypotheses and collect numeric data from supply chain professionals in South Africa's Gauteng province, employing a sample size of 450 respondents. This study used a non-probability sampling method through the convenience technique because it is a quick, simple and affordable technique of gathering data which does not require a whole survey frame. Additionally, this sampling technique was used because it involves selecting respondents who are frequently and conveniently available. Moreover, a non-probability convenience sampling technique was selected for this study because the population is not well-defined. This sampling approach is considered less expensive, less difficult and easier to implement.

Moreover, in this study, a questionnaire was utilised to gather quantitative data because it is inexpensive, allows information



H, hypothesis.

FIGURE 1: Conceptual framework.

to be collected from a wide audience and allows respondents to remain anonymous. Furthermore, using questionnaires in this study enabled respondents to complete the survey under less pressure and at their own time. The response rate of this study was 90%. The gathered quantitative data were analysed using Statistical Package for Social Science (version 28.0) and SMART PLS (version 3.0) (using confirmatory factor analysis and structural equation modelling path analysis) to test research hypotheses.

Measurement instruments

This study collected data using a structured questionnaire adapted from previous studies. Three questions on GP were used adapted from Awuni and Du (2016) while four items to measure GM were used and adopted from Wu and Lin (2016). Moreover, there were three measurements instruments based on GD provided by Mwaura et al. (2016). Green economic performance (GEP) using a scale calibrated from 1 to 5 adapted from Zhu et al. (2013). Response options were anchored on a five-point Likert scale: 1 = strongly disagree to 5 = strongly agree to express the degree of agreement.

Data analysis

The study used SPSS (version 28.0) and SMART PLS (version 3.0) through confirmatory factor analysis, structural equation modelling path analysis, to analyse and test hypotheses.

Measurement and scale accuracy

The reliability and validity of the scale in this study were assessed to attain confirmation and accuracy of the observed variables. For that reason, the results of the CFA, which was designed to assess the psychometric properties of the measurement scales used in this study, are presented in this section through reliability and validity. Table 1 displays the results of the analysis through descriptive statistics, Cronbach alpha, composite reliability (CR) average variance extracted (AVE) and factor loadings.

Psychometric properties of the measurement scale: Table 2 demonstrates that all of the constructs of this study (GP = 0.854; GM = 0.722; GEP = 0.690) have a Cronbach's alpha value above the recommended threshold except for GD = 0.525. These values exceeded the estimated threshold of 0.6 used by previous literature. In other words, this means that three values out of four are deemed reliable as all their Cronbach's alpha coefficients were above the recommended 0.6. The study found that the CR of all constructs ranged from 0.762 to 0.911, which is above the recommended threshold of 0.7 as suggested by Ab Hamid, Sami and Sidek (2017); these indicate a satisfactory CR level for the measurement constructs and good internal reliability. Average variance extracted values greater than 0.5 are estimated to be acceptable (Azam et al. 2022). For this study, as shown in Table 1, three values out of four ranging from 0.523 to 0.775 are greater than the recommended value of 0.5. In light of the foregoing, it can be said that these AVE values offer a satisfactory or acceptable level of internal dependability

TABLE 1: Accuracy assessment and descriptive statistics.

Research constructs	Descriptive statistics		Cronbach's alpha test test (α value)	CR	AVE	Factor loading
	Mean	SD				
Green purchasing (GP)						
GP3	-	-	0.890	-	-	0.806
GP4	0.257	0.048	-	0.911	0.775	0.954
GP5	-	-	-	-	-	0.874
Green manufacturing (GM)						
GM1	-	-	0.722	-	-	0.751
GM2	0.252	0.055	-	0.827	0.546	0.773
GM3	-	-	-	-	-	0.777
GM4	-	-	-	-	-	0.647
Green distribution (GD)						
GD2	-	-	0.525	-	-	0.693
GD3	0.273	0.044	-	0.762	0.523	0.868
GD4	-	-	-	-	-	0.578
Green economic performance (GEP)						
GEP1	-	-	0.690	-	-	0.660
GEP2	-	-	-	-	-	0.746
GEP3	-	-	-	0.799	0.447	0.723
GEP4	-	-	-	-	-	0.672
GEP5	-	-	-	-	-	0.516

CR, composite reliability; AVE, average variance extracted; SD, standard deviation.

TABLE 2: Inter-construct correlation matrix.

Research constructs	GD	GEP	GM	GP
GD	0.723	-	-	-
GEP	0.481	0.668	-	-
GM	0.396	0.456	0.739	-
GP	0.427	0.471	0.397	0.880

GD, Green distribution; GEP, Green economic performance; GM, Green manufacturing; GP, Green purchasing.

for the research constructs. However, through GEP with an AVE value of 0.447, the study found that AVE may range between 31% and 40% below the recommended threshold of 0.5 for GEP, with a CR value much higher than the recommended level, indicating appropriate internal reliability of the measurement items, despite more than 50% of the variation being because of error; the AVE may be a more conservative estimate of the measurement model's validity based on CR alone (Fornell and Larcker, 1981). The study confirms adequate convergent validity, demonstrating internal reliability of measurement items, as indicated by Cronbach's alpha, CR and AVE values, accurately representing latent variables.

As illustrated in Table 2, the correlations of all the variables are below the standard level of 1.0, as recommended by Chinomona (2011). As a result, these findings support the existence of discriminant validity. In other words, Nikolopoulou (2022) stated that because the intercorrelation coefficients were less than 1, the results showed a perfect positive correlation.

Hypothesis testing

The Smart PLS 3.0 software was used for this study to generate these results. The research hypotheses suggest a positive relationship between GP, manufacturing,

distribution and economic performance. Structural equation modelling was used to evaluate and validate the hypothesis, with results including path coefficient, *t*-statistic, *p*-value and final decision.

Path modelling outcomes

For a relationship to be deemed significant, path coefficient values greater than 0.1 are significant and directly proportional (Lehner & Haas 2010), and the *t*-statistics threshold should be greater than 1.96 (Ghasemi & Zahediasl 2012). The regression path estimate is statistically significant, with values ranging from 0.245 to 0.274, and *t*-statistics showing positive correlations with values range from 4.465 to 6.198 as presented in Table 3 and Figure 2. The study's results suggest a strong and satisfactory correlation between the constructs and the measuring variables.

Figure 2 shows Smart-PLS results for four constructs, item loadings and pathway coefficients. Arrows illustrate relationships between constructs and measurement items. The structural model presents path coefficients and factor loadings, with *r*-square values placed within each construct. All relationships are in a favourable direction, suggesting positive relationships.

Discussion of results

The study examined the influence of GP, GM and GD on GEP in South Africa's Gauteng province's industries. Hypothesis (H1) with these results (β = 0.257; t = 5.236; p = 0.000) is supported, demonstrating that GP significantly impacts GEP. These results demonstrate that in the industrial sector, an increase in GP corresponds to a notable increase in GEP of about 25%. In order to improve their GEP, manufacturing organisations must maximise their GP as a strategic resource, as this study shows. Recent studies conducted by Liu et al. (2024) confirmed a strong relationship between GP and GEP. These results show that incorporating GP into manufacturing companies significantly affects their GEP. The findings of this research align with Abbas's (2024) study, which found that adopting GP positively and substantially influences the GEP of companies. Additionally, Ahmad et al.'s (2022) emphasised that the incorporation of green purchases in an economy's practices can moderate its economic development by encouraging innovative methods, such as GP, which all organisations striving to be eco-friendly can adopt. This is why the researchers see this correlation as significant and advantageous.

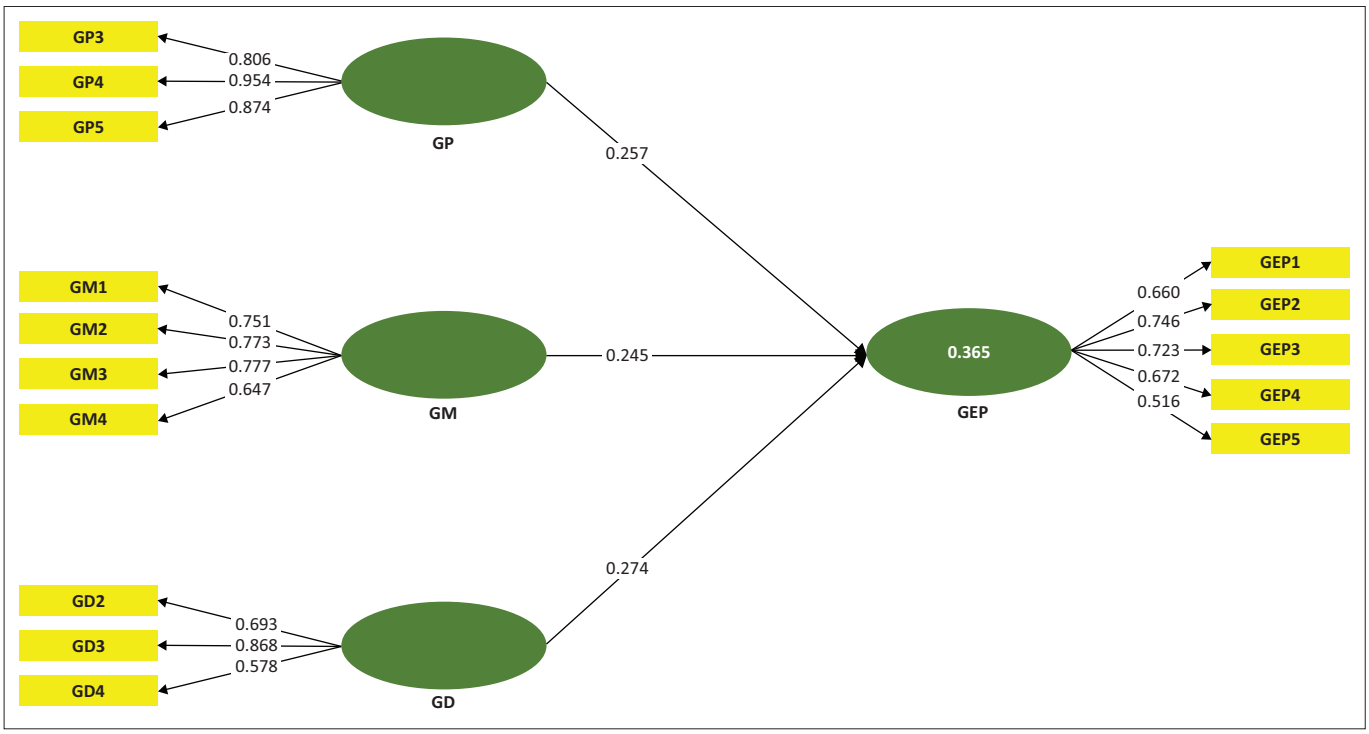
Moreover, the results of hypothesis (H2) show a positive and significant relationship between GM and GEP (β = 0.245; t = 4.465; p = 0.000). The results suggest that GM has the power to impact or steer GEP. The findings imply that GEP in the manufacturing sector derives from an increase in GM of almost 24%. Green production enhances

TABLE 3: Results of structural equations model analysis.

Suggested path	Hypothesis	Path coefficients	*p*	*t*-statistics	Decision on hypothesis
GP → GEP	H1	0.257	0.000	5.326	Supported and significant
GM → GEP	H2	0.245	0.000	4.465	Supported and significant
GD → GEP	H3	0.274	0.000	6.198	Supported and significant

Note: Significance level < 0.001***; significance level < 0.05***.

GD, Green distribution; GEP, Green economic performance; GM, Green manufacturing; GP, Green purchasing.



GD, Green distribution; GEP, Green economic performance; GM, Green manufacturing; GP, Green purchasing.

FIGURE 2: Path modelling outcomes.

manufacturing adaptability to unexpected changes, identifies organisational issues, devises clever solutions and reduces monitoring costs, ultimately improving economic outcomes. A study conducted by Liu et al. (2024) demonstrated that GM positively impacts GEP of a business, indicating that firms participating in various GM activities will see greater benefits compared to those who engage in fewer activities. Therefore, this evidence should continue to motivate companies to incorporate GM into their operations. Additionally, the results of this study support Zhaolei et al.'s (2023) claim that incorporates GM into business operations influence and improves GEP. This demonstrates that this practice aids in the reduction of waste, emissions, energy cost and environmental damage. Following correct disposal and recycling methods is in line with green performance.

Lastly, the third hypothesis (H3) postulated that GD influences GEP firms in Gauteng province. Thus, the findings in Table 3 show that GD has a positive and significant effect on GEP ($\beta = 0.274$; $t = 6.198$; $p = 0.000$). Green distribution can increase GEP by 27%, enhancing profitability by improving transportation system efficiency. The validity of the hypothesis test was indicated by the study's confirmation of all hypotheses and finding that all measuring instruments were significant based on path coefficient and *t*-statistics results. Khan et al. (2024) confirm these findings by demonstrating that GD has a beneficial impact on GEP. Moreover, the outcomes of the study reveal that GD has a positive and significant impact on GEP, indicating that manufacturing companies are increasingly adopting GD practice to enhance ecological planning, optimise space usage and reduce fuel consumption and emissions (Amjad et al. 2022). The results of this study are in accordance with Hector and Lambrechts (2024) who stated that the main emphasis of EMT is achieving a harmony between the environment and the economy. Hence, it is thought that employing market mechanisms such as GP, manufacturing and distribution would incentivise producers to utilise more green production methods. Additionally, the research is in accordance with EMT, indicating that integrating environmental issues into supply chain operations benefits economic, social and environmental growth (Antwi, Agyapong & Owusu 2022). This includes integrating GSCM practices into manufacturing, guaranteeing and reinforcing green economic benefits. On the other hand, the practice-based view (PBV) theory backs the relationships between GSCM practices and GEP as positive and thus enabling the examination of green practices across various performance results (Siddik, Yong & Rahman 2023). In simpler terms, PBV encourages businesses to adopt green practices like GP, manufacturing and distribution in order to attain GEP. Thus, through PBV businesses will gain significant benefits from adopting green practices.

Conclusion

The study concluded that adopting GSCM practices requires an open mind and consideration of ecological principles to achieve GEP. In other words, the study finds a positive association between GSCM practices and GEP in manufacturing enterprises, implying that integrating these sustainable practices throughout the supply chain improves economic performance while reducing environmental effects. Manufacturing companies that want to improve their GEP should take a holistic approach that incorporates GSCM procedures to assess environmental effects and investments in green logistics and transportation. Moreover, this study enhances knowledge on GSCM practices and green performance in the manufacturing industry by providing a conceptualised framework and insights into the relationship between these practices. It uses EMT to address the gaps in previous studies in South Africa's manufacturing sector.

Implication of the study

Managerial implications

The study aims to enhance manufacturing supply chain operations by providing a clear understanding of the dynamics influencing GSCM adoption, highlighting its potential to improve productivity, and economic performance, and encourages environmentally responsible behaviour, investment in green strategies and validation of innovative concepts. As predicted, the results support the hypotheses that GP, manufacturing and distribution positively affect GEP. Engaging in GP, manufacturing and distribution is seen as a key factor for the manufacturing industry to enhance GEP; this indicates that companies that can adjust and develop their green practices show better green financial results. Presently, implementing GSCM practices like GP, manufacturing and distribution is beneficial for today and the upcoming generation for achieving green performance and a healthy environment. Therefore, it is very important for managers in the manufacturing industry to adopt and implement them. Hence, it is important for manufacturing companies to adopt green practices that aim to satisfy the needs of all parties involved and comply with their established policies and agreements. Furthermore, this research has emphasised the significance of implementing GP, manufacturing and distribution practices across the manufacturing industry's supply chain. Organisations should integrate and continuously monitor the mentioned GSCM practices into their existing process to improve green performance.

Theorical implication

The research adds to the current theory by identifying critical GSCM activities in GP, manufacturing and distribution in promoting GEP. The study's finding confirms and reinforces the strategic nature of these practices as key determinants of GEP, as established by Khan et al. (2024) who pointed out GP, GM, eco-design, customer cooperation and green logistics as antecedents of green performance. Similarly, Sarwar et al. (2021) discovered that implementing GP and green production in addition to other GSCM practices can have a positive effect on green economic, social and environment performance. Given the presented discussion, the study's

theoretical contribution underscores the value contribution that GP, manufacturing and distribution have as key GSCM success factors in boosting GEP.

Policymakers' implication

The results of this research offer important insights for South African policymakers to create strategies that support GEP. South Africa leads in the understanding of green economies because of its significant impact on the global economy. Enhanced energy self-sufficiency, long-term GEP and the creation of new jobs can come from implementing new policies that promote and support GSCM practices. Additionally, to be more precise, the results indicate that GSCM practices have a positive effect on the GEP of the manufacturing industry in Gauteng province. Therefore, policymakers must enhance their strategies concerning GSCM practices. In this way, the whole country or even countries around South Africa must enhance their policies concerning GSCM practices.

Limitations and future research

The study, despite its significant theoretical and practical contributions and empirical findings, has some limitations that can be addressed in future research. The study's focus on the South African manufacturing industry lacks clarity on the research model's implications. Future research should investigate other industries, explore other provinces and use a longitudinal research design to enhance generalisability and explore the relationship between GSCM implementation and green performance. Moreover, management must support GSCM with rigorous standards to promote interest. Future research should explore GSCM's impact on business green performance, engage in in-depth discussions and use management's insights for appropriate decisions related to GSCM implementation.

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Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

C.N.M.N. contributed to the writing of the whole article while E.C. was responsible for the data analysis and review of the article. W.V.L.O. contributed to the review of the article.

Ethical considerations

The researcher acknowledges the importance of research ethics clearance for ensuring integrity, honesty and fairness in research and publishing results, and has obtained approval from the Faculty Research Ethics Committee and Faculty of Management Sciences of Vaal University of Technology. The reference number for ethical clearance for this study is FRECMS-21102020-047211041343.

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Data availability

The study generated its raw data which are available upon request from the corresponding author, C.N.M.N.

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