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Article

A Model for Green Supply Chain Management in the South African Manufacturing Sector

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Abstract: Green supply chain management (GSCM) is fundamentally growing as a key component of sustainability, owing to its ability to improve supply chain competitiveness and performance within firms. The body of literature on GSCM within the manufacturing sector in developing countries such as South Africa is still limited. The study examined the relationships between GSCM practices, dynamic capabilities, and supply chain performance in the South African manufacturing sector. The study was quantitative, involving a sample of 402 supply chain professionals drawn from the manufacturing sector across the four provinces of the country. Hypotheses were tested using structural equation modelling based on the SMART PLS technique. Eco-design Green distribution and green training impacted positively on dynamic capabilities, the latter of which in turn is linked to improved agility, reliability, and reduced supply chain costs. The study validates the importance of GSCM as a driver of dynamic capabilities and performance in manufacturing environments within developing countries such as South Africa.

Keywords: green supply chain management; dynamic capabilities; supply chain dynamic capabilities; supply chain performance; supply chain agility; supply chain costs; supply chain reliability

1. Introduction

The South African manufacturing sector is plagued with sustainability-related problems, despite its evident desire to transition to green manufacturing. The slow pace towards the implementation of sustainable measures has resulted in inefficiency and ineffectiveness at various levels, in addition to slowing down the competitiveness of the manufacturing sector [1]. To enhance the competitiveness of this sector, manufacturers need to develop operational efficiencies throughout their supply chain networks by improving their competencies and embracing practices that promote sustainability for achieving competitive advantages [2].

Despite the ratification of the Paris Agreement in 2015 by the world economies to reduce their carbon emissions, as well as the efforts of the South African Government to reinforce the implementation of the accord in its various economic sectors, environmental sustainability still remains the "grand" challenge for the South African manufacturing sector [2]. By itself, this sector contributed almost 20 per cent to the total emissions in South Africa between 1999 and 2020, making it one of the most important polluters in the country [3]. If the sector continues to act under the business-as-usual scenario, its gas emissions will contribute to increasing the global temperatures to between three and four degrees Celsius [2,3]. This indicates the urgent need to put in place mitigatory measures such as green supply chain management (GSCM) practices that promote cleaner production. This challenge not only affects all sectors of the South African economy, the manufacturing sector in particular but also the well-being of the population [1,2]. Consequently, the manufacturing sector has been encouraged to contribute to the conservation of the environment by prioritising sustainable development.

To improve their performance and the levels of competitiveness of their products in both the local and global markets, South African manufacturing firms need to integrate green practices in their supply chains. These firms face the challenge of streamlining their production activities, which requires the implementation of sustainable supply chain practices [4]. An understanding of sustainability challenges can help firms to improve their global competitiveness. From a competitiveness viewpoint, the South African manufacturing sector is faced with immense and increasing pressure to improve its productivity to survive within the global market [5]. Improving productivity will require the manufacturing sector to enhance its processes and reduce its production costs while maintaining the quality of its products [6]. Measuring competitiveness depends mainly on the firms' capacity and ability to innovate and upgrade their existing production processes which highlights the importance of GSCM and dynamic capabilities (DCs) [7]. Innovation through green practices can be a driver of performance in terms of productivity, effectiveness and efficiency, and profitability [6,7]. To this end, the South African manufacturing sector has to embrace the shift towards sustainable supply chain practices. The practices can help reduce the impact of manufacturing operations on the environment and improve its processes and competitiveness.

The current study examines the relationship between GSCM practices, dynamic capabilities (DCs) and supply chain performance (SCP) in the South African manufacturing sector. In the past years, there has been a growing interest in research and the strategic significance of implementing GSCM in manufacturing firms around South Africa [5,8,10]. Various studies have investigated the effect of GSCM practices on SCP in South African organisations However, there appears to be a paucity of studies that have considered all GSCM practices and their impact on the DCs and SCP in the South African manufacturing sector as attempted by the current study. Additionally, although it is well established in research that the concepts of GSCM practices lead to higher DCs and superior SCP [e.g., 5,8,9,10], there is still a dearth of literature in South Africa concerning the adoption and the implementation of GSCM to achieve sustainable development. Moreover, the area of GSCM is still at an emergent stage in most developing nations such as South Africa and the rest of Africa [11]. This low-level implementation of GSCM requires that more research be conducted to enable SCM professionals to develop strategies suitable for their organisations.

Within South Africa, various studies [2.5,11,12] on GSCM have been conducted using different topics. However, limited evidence exists of research on GSCM, DCs and SCP in the South African manufacturing sector. The study, therefore, is intended to address these gaps.

2. Literature review

The next sections summarise the primary interest of the study.

2.1. Green supply chain management

The practices of GSCM have become the backbone for many organisations as competition increases in the marketplace and consumers are becoming more and more environmentally conscious [13]. GSCM is fundamentally growing as a key component of sustainability within the SCM in that its adoption and implementation improve the competitiveness of the supply chain [14]. GSCM is an important piece of the puzzle concerning sustainability and decreasing the carbon footprint. GSCM is a process of integrating environmental thinking into the supply chain to achieve a sustainable competitive advantage [13–15]. It is the process of managing the environmental impact of the supply chain [14]. A more sustainable supply chain is a less wasteful supply chain and reducing waste can lower costs while also improving the industry's reputation [14,15]. This is just one of many reasons why green supply chain management is important. It goes without saying that greening a supply chain will make it more resource efficient. After all, one of the key objectives of GSCM is to reduce waste and optimise processes [15].

2.2. Green supply chain management practices

Green supply chain management practices are activities performed by firms in their supply chains to minimise their impact on the environment [16]. Given the fact that sustainability is multidimensional in its scope, firms should select practices that are deemed necessary for them to improve the performance of their supply chains [17]. The study focussed on eight GSCM practices, namely: green purchasing (GP); eco-design (ED); green manufacturing (GM); green distribution (GD); reverse logistics (RL); product returns (PR), regulations, and legislation (LR); and green training (GT). Green practices are of great importance for manufacturing organisations to achieve their strategic goals and maintain the sustainability required for their operations [16,17].

2.2.1. Eco-design

Eco-design is perceived as the design of new products in such a way as to reduce their impact on the environment throughout their entire life cycle from the procurement of raw materials to their disposal [18]. ED is a very important stage of manufacturing as it improves efficiency and facilitates the recycling of materials [11,18]. The design phase has the potential to reduce waste and improve manufacturing costs [11,13]. Liu [18] et al further report that 80 per cent of environmental burdens and costs are fixed during the design process. Moreover, the scope of ED includes environmental risk management, product safety, pollution prevention, ecology, material conservation, accident prevention and waste management [16,18].

2.2.2. Green distribution

Green distribution is a process of "integrating environmental concerns into packaging, transportation and logistics activities" [19]. GD includes all activities that promote the reduction of environmental damage and waste during shipping [20]. It emphasises the consumption of fuel by vehicles transporting products, the frequency of transportation activities, the distance to consumers and the packaging characteristics that affect GD performance.

2.2.3. Green Manufacturing

Green manufacturing (GM) is a set of activities designed at improving the efficiency of the supply chain and reducing waste during the process of converting raw materials into finished products [20]. The process aims at producing environmentally friendly products to satisfy the needs of consumers, meet environmental requirements and increase profitability and sustainability. GM incorporates various strategies, drivers and techniques that make the manufacturing processes more efficient and generate products that are safe for consumption and recyclable [21].

2.2.4. Green Purchasing

Green purchasing (GP) is a process of integrating environmental thinking into the procurement of materials [20]. It influences the supply chain upstream as the buying organisation communicates to its suppliers the specifications ordered products must meet [18]. This entails that the supplier's selection plays a critical role in helping to achieve organisational goals. The buying organisation and its suppliers must strive to preserve their common interests, minimise the impact of their business activities on the environment and improve SCP.

2.2.5. Green Training

Green training (GT) is a process of on-the-job training and continued education intended to achieve corporate environmental management targets and purposes [22]. It enables personnel and top management to think green in exercising their functions to improve the performance of their organisations [23]. GT provides firms with means that can help to achieve innovative development and improve their competitive position. In addition, GT also provides a firm with the ability to

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incorporate dynamic capabilities into its internal processes contributing to building essential elements in the models of competitiveness [22,23].

2.2.6. Legislation and Regulations

Legislation and regulations refer to laws, policies and rules that are usually promulgated by governments and other regulatory bodies to promote the preservation of the environment [11]. Firms are highly likely to adopt and implement green practices because of the role LR play in fostering the implementation of sustainable practices [24]. LR provide a roadmap for firms to adapt their strategies and business activities to effectively create harmony in the implementation of sustainable practices and mitigate discrepancies [25]. This entails that firms should pursue the quest towards sustainability, share common values and norms and over time the implementation of green practices can become similar.

2.2.7. Product returns

Product returns (PR) is the set of processes used for tracking returnable packaging or for returned products for some specific reason at some point within the supply chain [26]. If PR is well managed, it can help cut costs and increase profit margins [27]. Moreover, it can result in higher financial returns, improved customer satisfaction and increased public perception as a result of handling product returns efficiently and incorporating customer feedback [26].

2.2.8. Reverse logistics

Reverse logistics is a process of retrieving used products from the point of consumption to the point of origin for possible reusing, recycling, and remanufacturing [19,26]. RL includes collection, inspection, selection, cleaning, sorting, recycling, recovery, redistribution, and disposal of products [28,29]. This process in itself helps to achieve ecological balance in supply chains. RL provides numerous sustainable benefits through the return to resell, refurbish, recondition, remanufacture, cannibalise parts, or recycle products to minimise landfill waste [19,29].

2.3. Supply chain dynamic capabilities

In this study, SCDCs and DCs are used interchangeably. DC is the ability of an organisation to integrate and organise its internal and external resources [30]. The competitiveness of a firm is related to its ability to possess unique DCs, which explains the difference in performance among organisations [31]. DCs are necessary to improve the performance of the supply chains as world economies turn towards the use of digital technologies. Organising resources allows firms to create value through mechanisms that are not replicable [30]. Furthermore, DCs can enable firms to adjust and adapt to the ever-changing market environment making them an enabler of market dominance through continued implementation of strategies based on environmental changes [30,31]. DCs increase the flexibility and agility of an organisation regarding the quick response to market conditions, especially at times of uncertainty and one can suggest that this provides a valuable link with the performance of the supply chain.

2.4. Supply chain performance

Measuring the performance of an organisation is very important to determine the direction the firm is taking. This process allows management to develop a strategic emphasis on their operations and their implementation [32]. SCP is an orderly planned process that enables an organisation to measure the effectiveness and efficiency of supply chain operations [33]. This study used three constructs to measure the level of performance of the supply chains in the South African manufacturing sector, namely supply chain agility (SCA), supply chain reliability (SCREL), and supply chain costs (SCC),

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3. Research framework and hypotheses development

Figure 1 outlines the research framework that guides the current study. The model postulates that the implementation of GSCM in the manufacturing sector positively influences DCs, which, in turn, significantly impacts the SCP of manufacturing firms through SCA, SCREL, and SCCs.

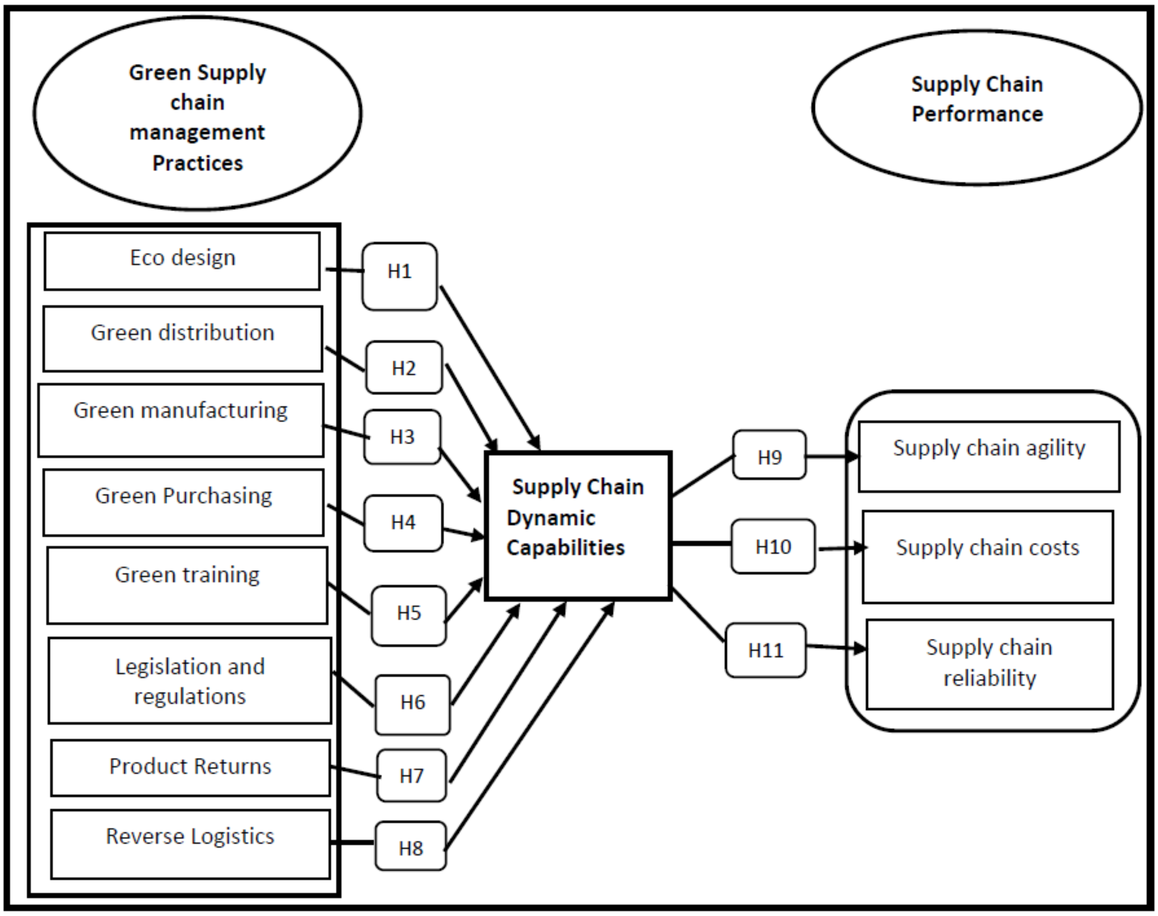

Figure 1. Research framework. Source: Authors' compilation.

3.1. Hypotheses development

The arguments below illustrate the justification of the hypotheses developed.

3.1.1. Green supply chain management and supply chain dynamic capabilities

The practices of GSCM and DCs are both vital for the success of the supply chain as they allow organisations to achieve flexibility and improved performance [34]. Other authors postulate that the implementation of sustainable practices is dictated by the size of an organisation [24,30]. It is indicated that large organisations are likely to adopt green practices because they possess resources and capabilities that small organisations do not have [24]. This suggests that DCs play a mediating role in the adoption and implementation of environmental sustainability. Moreover, a mere reaction to environmental pressures may not lead to better DCs [35]. Combining sustainable supply chain practices (SSCPs) such as GSCM practices with DCs makes organisations more flexible to changes in a dynamic environment while providing at the same time a competitive advantage [34]. Furthermore, DCs can positively affect the ability of a firm to commit to green practices [30]. Introducing green practices into a supply chain allows the change of existing technologies, processes, or routine activities [35]. Given this background, the following hypotheses were formulated:

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H1: *Eco-design exerts a positive influence on supply chain dynamic capabilities in the South African manufacturing sector.*

H2: *Green distribution exerts a positive influence on supply chain dynamic capabilities in the South African manufacturing sector.*

H3: *Green manufacturing exerts a positive influence on supply chain dynamic capabilities in the South African manufacturing sector.*

H4: *Green purchasing exerts a positive influence on supply chain dynamic capabilities in the South African manufacturing sector.*

H5: *Green training exerts a positive influence on supply chain dynamic capabilities in the South African manufacturing sector.*

H6: *Legislation and regulations exert a positive influence on supply chain dynamic capabilities in the South African manufacturing sector.*

H7: *Product Returns exert a positive influence on supply chain dynamic capabilities in the South African manufacturing sector.*

H8: *Reverse logistics exerts a positive influence on supply chain dynamic capabilities in the South African manufacturing sector.*

3.1.2. Dynamic Capabilities and supply chain performance

There is evidence of a positive relationship between DCs and organisational performance, which is linked to SCP in several previous studies [34–36]. On the other hand, the role of DCs in increasing the performance of an organisation is still questionable as there are still unidentified drawbacks and a lack of grounded evidence to support the idea [37]. Correspondingly, some studies [38,39] argue that DCs need to be strong to influence organisational performance, thereby improving the SCP. This suggests that possessing DCs is not enough to achieve enhanced SCP. DCs allow firms to sense uncertainties and seize opportunities in their supply chains, thus improving the performance of the supply chains [39]. Based on the research studies above, the present study argues that DCs may enable the success of a supply chain in terms of SCA, SCC, and SCREL. Thus, the study hypothesises that:

H9: *Supply chain dynamic capabilities exert a positive influence on supply chain agility in the South African manufacturing sector.*

H10: *Supply chain dynamic capabilities exert a positive influence on supply chain costs in the South African manufacturing sector.*

H11: *Supply chain dynamic capabilities exert a positive influence on supply chain reliability in the South African manufacturing sector.*

4. Materials and Methods

4.1. Research approach and design

A quantitative approach was used as the method of data collection and data analysis. The rationale behind this choice was that the investigation was predictive and causal as it tried to explain the relationships among research constructs. To maximise the response rate, a combination of correlational and survey research designs using a questionnaire for data collection was employed in the empirical part of the study.

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4.2. Research sample and sampling method

The questionnaire was administered to a subset of the population of interest-supply chain, operations, and quality management professionals of the South African manufacturing sector in Gauteng, Free State, Mpumalanga, and Limpopo provinces. A sample size of n=402 was deemed adequate, based on the recommendations from [40] that sample sizes of between 150 and 500 cases are adequate for multivariate studies, and prevent limiting the statistical significance of the results as would the case if a small size is used. To ensure that supply chain professionals from various provinces around the country were represented in the final sample, non-probability purposive sampling was used to select respondents.

4.3. Measurement Items

Existing scales were used to develop the measurement items. Items measuring GSCM practices were adapted from [13,20,41] while those for DCs were adapted from [13,20]. The SCP scale was adapted from [42]. All measurement scales were validated in previous studies, having scored Cronbach alpha values above 0.7. Each item in the measurement scales was designed for response using a five-point Likert scale in which 1 corresponds to "strongly disagree" and 5 to "strongly agree." A self-administered online survey questionnaire was used in the data collection process. Data were collected between April and September 2022. The extended period of six months was attributed to the number of questionnaires distributed.

4.4. Statistical Analysis

Data were analysed using descriptive and inferential statistics. The SMART partial least square (PLS version 3.0) was employed as a tool to achieve the complete analysis of data.

4.5. Ethical considerations

The study was conducted after permission to collect data had been obtained from relevant authorities in manufacturing firms in South Africa. Respondents were made aware that their participation in the study was on a voluntary basis and that they were free to withdraw from the study at any time without reprisals. Respondents remained anonymous, and their confidentiality was maintained by ensuring that their identities were not mentioned anywhere in the study. Respondents were not given any monetary incentives for participating in the study.

4.6. Results.

4.6.1. Respondents' characteristics

From 500 questionnaires that were sent, 402 questionnaires were successfully completed and deemed valid for analysis thus making an overall response rate of 80.40%. Several studies [40,43,44] recommend 60% as the minimum acceptable criterion for response rate in surveys. Much of the sample was constituted of black Africans (59%, n = 237). In terms of gender, 77.1 % (n = 310) and 30 % (n = 22.9) were male and female, respectively. The majority age group was 36-40 years representing 30% (n = 119). Regarding the level of education, the majority of the respondents held diplomas (39.3%, n=158). In terms of work experience, Respondents with 6 to 10 years of work experience made up the majority of the total respondents (36.3%, n=146). Companies with 51-100 employees were mostly represented with 24.6% (n=99). The province with the largest proportion of respondents compared to the other three provinces was Gauteng with 71% (n=285). Concerning the industry classification, the Metals, fabricated metal products, machinery and equipment industry was mostly represented by more than half of the total respondents 63.4% (n=255). Lastly, the majority of the respondents were working in the logistics and supply chain department (42.5%, n=171).

4.6.2. Measurement Properties of the constructs

4.6.3. Analysis of reliability and validity

In testing for scale reliability, item-to-total correlations were above 0.3, suggesting a reasonable fit of the latent factors to the data collected. Cronbach's alpha values for all factors were greater than 0.80, which ensure the internal consistency of the constructs as they were well above the suggested value of 0.70 [45,46]. Alternatively, composite reliability (CR) scores were computed to assess construct reliability. A CR greater than 0.80 would imply that the variance captured by the factor is significantly more than the variance indicated by the error components [47]. As shown in Table 1, all factors showed CRs greater than 0.841, which confirms the reliability of all constructs. To test for convergent validity, item factor loadings were all acceptable, i.e., all were much greater than 0.5. Additionally, all of the average variance extracted (AVE) estimates of constructs were greater than the cut-off point of 0.5 [45], thereby exhibiting convergence validity. To test for discriminant validity, the correlation coefficients between two latent constructs were used [46]. According to this test, discriminant validity exists where there are correlation coefficients less than 1.00 between the constructs. As shown in Table 2, inter-construct correlations were all less than 1.0, thus providing evidence of discriminant validity among the constructs.

Table 1. Constructs and measurement items.

Construct	Item code	Mean	SD	Item-to-item correlation	Cronbach's alpha	CR	AVE	$\sqrt{AVE}$
Green Purchasing	GP2	3.764	0.604	0,850	0.818	0.843	0.574	0.758
	GP3			0,645				
	GP4			0,764				
	GP5			0,784				
Eco-design	ED1	4.002	0.442	0,868	0.907	0.917	0.728	0.853
	ED2			0,870				
	ED3			0,871				
	ED4			0,859				
	ED5			0,796				
Green Manufacturing	GM1	4.009	0.406	0,787	0.834	0,849	0.602	0.776
	GM2			0,829				
	GM3			0,691				
	GM4			0,845				
	GM5			0,714				
Green Distribution	GD2	3.869	0.529	0,749	0,867	0.902	0.647	0.804
	GD3			0,765				
	GD4			0,803				
	GD5			0,850				
	GD6			0,849				
Reverse Logistics	RL1	4.269	0.445	0,908	0.835	0.882	0.714	0.845
	RL2			0,831				
	RL3			0,793				
	RL4			0,589				
	RL5			0,796				
	RL6			0,905				
Product Returns	PR4	4.109	0.49004	0.589	0.786	0.839	0.600	0.775
	PR5			0.796				
	PR6			0.905				
Legislation and Regulations	LR1	2.442	0.922	0,852	0.835	0.900	0.749	0.865
	LR2			0,893				

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	LR4			0,851				
Green Training	GT1	3.965	0.628	0,852	O,931	0.948	0.785	0.886
	GT2			0,900				
	GT3			0,915				
	GT4			0,910				
	GT5			0,850				
Supply chain Dynamic Capabilities	SCDC1	4.184	0.439	0,842	0.864	0.893	0.646	0.804
	SCDC2			0,848				
	SCDC3			0,719				
	SCDC4			0,861				
	SCDC5			0,738				
Supply Chain Agility	SCA1	3.947	0.402	0,808	0.811	0.842	0.555	0.745
	SCA2			0,805				
	SCA3			0,792				
	SCA4			0,649				
	SCA5			0,653				
Supply Chain Reliability	SCREL1	3.961	0.416	0,826	0.882	0.891	0.678	0.823
	SCREL2			0,835				
	SCREL3			0,825				
	SCREL4			0,819				
	SCREL5			0,813				
Supply Chain Cost	SCC1	3.988	0.4143	0,819	0.929	0.933	0.779	0.882
	SCC2			0,916				
	SCC3			0,889				
	SCC4			0,907				
	SCC5			0,878				

Source: Authors' Compilation.

Table 2. Inter Construct Correlations.

	ED	GD	GM	GP	GT	LR	PR	RL	SCA	SCC	SCDC	SCREL
ED	1.000											
GD	0,440	1.000										
GM	0,808	0,492	1.000									
GP	0,613	0,609	0,672	1.000								
GT	0,499	0,339	0,633	0,593	1.000							
LR	0,193	0,144	0,277	0,424	0,442	1.000						
PR	0.539	0.421	0.599	0.411	0.447	0.316	1. 000					
RL	0,338	0,215	0,454	0,210	0,266	0,237	0.440	1.000				
SCA	0,517	0,532	0,473	0,394	0,411	0,188	0.481	0,210	1.000			
SCC	0,551	0,377	0,512	0,367	0,450	0,146	0.467	0,263	0,683	1.000		
SCDC	0,490	0,403	0,503	0,445	0,542	0,278	0.471	0,297	0,452	0,440	1.000	
SCREL	0,555	0,434	0,479	0,378	0,380	0,124	0.531	0,226	0,789	0,775	0,482	1.000

Source: Authors compilation.

4.6.4. Path analysis

In this study, path analysis was used to test the hypotheses based on the results obtained from PLS analysis. The study utilised the two main criteria under the PLS model to validate and confirm each hypothesis. The first criterion in the application of path analysis included checking the path coefficients, which are represented by a beta (β). For a hypothesis to be supported and significant, the path coefficient must be positive or negative [45,46]. The second criterion constitutes the significant influence of the constructs. The significant influence constitutes three levels, which are represented by stars also known as p-values. The levels of influence include values with at least three stars (***), which represent p-values less than 0.001, two stars (**) represent p-values less than 0.05, and one star (*) denotes a p-value less than 0.1.

The results from Figure 2 show path coefficients ranging between -0.005 and 0.452, demonstrating the existence of relationships between the constructs. DCs have a significant influence on SCREL (β = 0.452), SCA (β = 0.434) and SCC (β = 0.415). However, GP, LR RL, GD and GM have an insignificant influence on DCs.

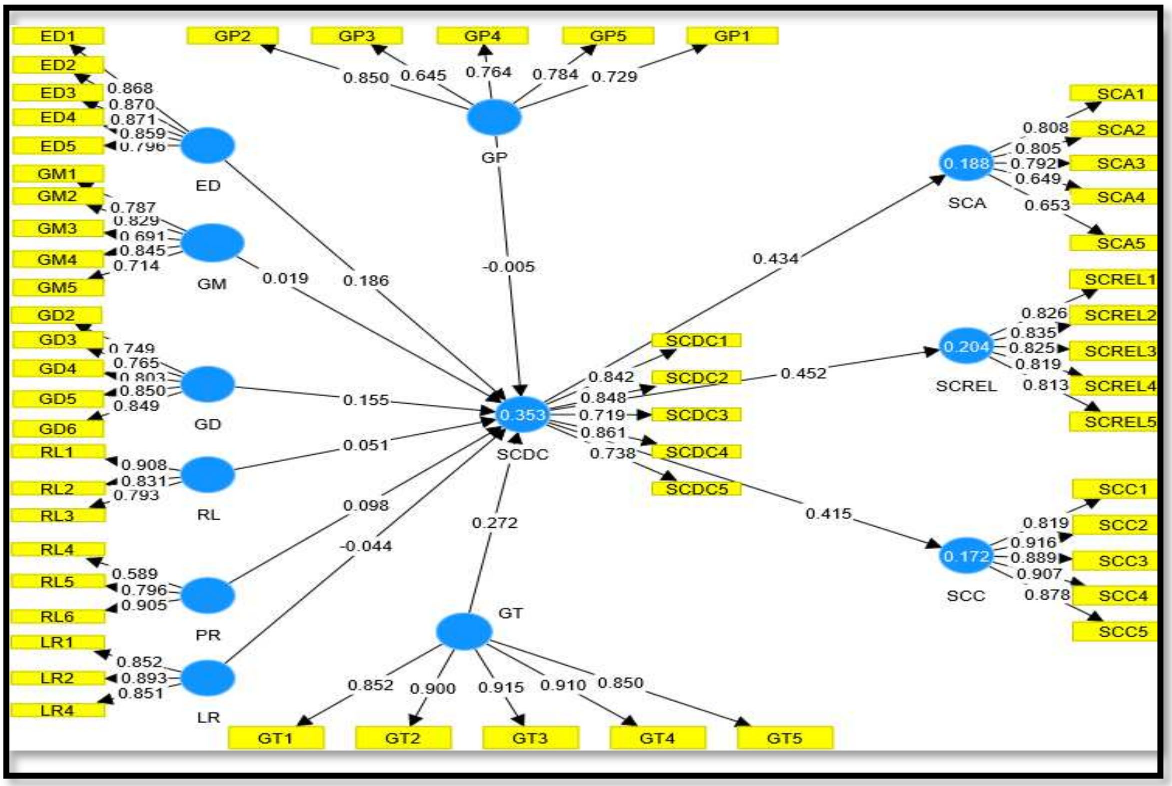

Figure 2. Path coefficients. Source: Authors' compilation based on data analysis results.

5. Discussion

The results indicate that ED has a significant positive influence on DCs. (*β* = 0.186; *t* = 2.729; *p* = 0.007). This suggests that the implementation of ED in the South African manufacturing sector strengthens the ability of firms to innovate. This is confirmed by Hartmann and Germain [47], who found that ecological product design (ED) relates positively to technology integration capabilities. Furthermore, Habib [16] et al revealed a positive and significant relationship between environmental management which included ED and product innovation through DCs. Bag [5] et al also suggested that ED is one of the key resources for the adoption of the fourth industrial revolution innovation in the South African manufacturing sector as they provided evidence of a positive relationship between ED and innovative technologies. Li and Liu [26] postulate that the implementation of green strategies requires firms to possess appropriate resources and capabilities. This may suggest that South African manufacturers had aligned their organisational strategies in a way that fits their existing resources and capabilities and thus contributed to the successful adoption and implementation of green design strategies.

Table 3. Results of PLS hypotheses testing analysis.

Path (from-to)	Direct effect	T statistics	P values	Hypothesis Test result
H1: ED -> SCDC	0,186	2.729	0.007**	Supported
H2: GD -> SCDC	0,155	2.749	0.006**	Supported

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H3: GM -> SCDC	0,019	0.251	0.802	Not Supported
H4: GP -> SCDC	-0,005	0.092	0.927	Not Supported
H5: GT -> SCDC	0,272	5.002	0.000***	Supported
H6: LR -> SCDC	-0,044	1.024	0.306	Not Supported
H7: PR -> SCDC	0,098	1.484	0.138	Not Supported
H8: RL -> SCDC	0,051	0.863	0.388	Not supported
H9: SCDC -> SCA	0,434	8.962	0.000***	Supported
H10: SCDC -> SCC	0,415	7.928	0.000***	Supported
H11: SCDC -> SCREL	0,452	8.010	0.000***	Supported

Source: Authors ‘compilation.

Green distribution was found to have a significant positive influence on DC (β = 0.155; t = 2.749; p = 0.006). This outcome indicates that the implementation of GD exhibits greater DCs in the South African manufacturing sector. This outcome complements the discourse of Subramanian and Abdulrahman, [48] which concluded that carbon-efficient practices which include transportation operations positively affect the product redesign capabilities of manufacturing firms in China. Similarly, a study by Çankaya and Sezen [20] emphasised how GSCMPs which include GD positively influence environmental performance through strategic resources and capabilities in the Turkish manufacturing sector. Moreover, Novais [49] et al found that cloud logistics which included transportation and distribution positively influence supply chain integration through DCs.

This outcome may be a result of well-coordinated supply chain operations from up to downstream the supply chain using appropriate routing systems and technologies. Adequate coordination and cooperation among supply chain partners may have contributed to easing the timely response to customer demands as well as the distribution of products at correct quantities, scheduled time, and right locations with minimum pollution of the environment. Moreover, the cooperation may have facilitated the improvement of supply chain capabilities for a better GD. Finally, manufacturers may have been able to integrate effective and efficient handling of supply chain resources to respond to customers’ needs.

Green manufacturing has an insignificant influence on DCs (β = 0.019; t = 0.251; p = 0.802). This result is not consistent with extant literature which indicates that GM has a positive effect on DCs. Prior studies evidenced a relationship between the two constructs [50,51] in which it was reiterated that the adoption of green technology (GM) helps to achieve product innovation in the manufacturing sector. However, this result is consistent with Nkrumah [52] et al, who found no relationship between GM and DCs. This result may be justified by the inability of South African manufacturing companies to establish collaborative mechanisms that promote cooperation and collaboration among supply chain partners in matters that advance innovation and green technologies. This outcome may also imply that manufacturers were unable to develop new competencies and redeploy resources and capabilities adequately for a sustainable competitive advantage. Furthermore, this result may suggest the complexity associated with the implementation of GM. GM strategy involves complex techniques and systems that require the deployment of resources and appropriate capabilities [13]. This was probably lacking for South African manufacturers.

The results further indicate that there is an insignificant relationship between GP and DCs (β = -0.005; t = 0.092; p = 0.927). This result implies that the implementation of GP in the South African manufacturing sector has no influence on the DCs of any given firm. The result contradicts prior studies [13,53] which found a positive association between GP and DCs. The reason behind this unconventional result may be the cost associated with the implementation of green technology. This statement is consistent with Fang and Zhang [18] argument which suggests that the implementation of GP comes with extremely complex challenges that include higher cost, lack of corporate commitment, insufficient knowledge, lack of alternatives and reluctance to change. Furthermore, Liu [13] et al. point out that incorporating GP into a supply chain is a complicated process since it requires not only to consider traditional factors such as a supplier’s cost, quality, lead time and flexibility but also environmental responsibility. It is evident that South African manufacturers may

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have perceived that they do not possess the capabilities required to engage in sustainable activities. Moreover, integrating suppliers into a supply chain requires exercises such as coaching, training and monitoring all of which consume a considerable number of resources that often companies do not possess. Another possible explanation may have been that GP does not seem to be an issue for customers due to the lack of awareness on matters related to environmental sustainability.

Hypothesis (H5) suggested a positive significant relationship between GT and DCs was established ($\beta = 0.272$; $t = 5.002$; $p = 0.000$). This suggests that GT exerts a significant positive influence on DCs in the South African manufacturing sector. The result aligns with Aslam [54] et al and Joshi and Dhar [55], who proposed a positive relationship between GT through supply chain learning orientation and DCs. The result may indicate that South African manufacturers supported the emergence of novel capabilities through their ability to change and abandon obsolete supply chain practices. Manufacturers may have committed sufficient resources to promote GT and creativity. These capabilities may have allowed employees to better match work with their particular strength (which is environmental sustainability). GT is necessary to improve conditions for better DCs through knowledge creation, skills, and new capabilities. Aslam [54] et al postulate that learning is a fundamental part of capability development in SCM that allows firms to tackle supply chain challenges and capture niche markets.

The expected result in this study, a statistically significant positive relationship between LR and DCs, did not materialise, and not supporting Hypothesis (H6) ($\beta = -0.044$; $t = 1.024$; $p = 0.306$). One can conclude that the South African manufacturing sector does not believe that the implementation of LR influences DCs. The result of the study suggests that the ability of South African manufacturers to integrate government policies and regulatory requirements on green technology into their supply chains may not affect their ability to enhance competencies and innovate. This result contrasts the findings by Fernando [27] et al who revealed a positive and significant relationship between RL and DCs. While previous studies may suggest the role played by LR in improving DCs [56,57], the result of the study claims otherwise. One possible explanation may be that manufacturers may have felt that there are too many regulations that are difficult to comply with or the proposed LR does not target manufacturing companies specifically. Moreover, the South African Government may have been less stringent regarding the implementation of GSCM because of the lack of financial support for businesses. Moreover, it may mean that manufacturers were not able to adjust their competencies and bring some effective changes to their processes as well as changes in their organisational culture.

An interesting result revealed that PR has an insignificant influence on DCs ($\beta = 0.098$; $t = 1.484$; $p = 0.138$). This result suggests that despite the implementation of the PR strategy by South African manufacturers, they did not perceive any improvement in their ability to recapture value from returned products. It appears clear that the relationship between PR and DCs stands in dissonance with previous works which suggests that there is an association between the two constructs. For example, the result of the study is contrary to that of Shaharudin [58] et al which suggested that PR promotes DCs through closed-loop supply chains. Another study by Shaharudin [59] et al found a significant influence of PR on closed-loop supply chain adoption capability under the lens of DCs in the Malaysian manufacturing sector. This outcome may have been the consequence of inadequate environmental guidelines not supportive of the PR strategy. It is important to point out that a poorly implemented PR strategy may hamper the prospect of green innovation through DCs. South African manufacturers may have been unable to recognise the value associated with PR and develop systems and mechanisms that exploit returned products. Shaharudin [59] et al point out that the ability of a firm to recapture value from PR is of great importance since a failure to exploit product returns may lead to the proliferation of industrial wastes and the depletion of natural resources. It is important that South African manufacturers invest in remanufacturing capabilities to handle PR effectively since it could facilitate the leverage of their capabilities and help improve their competitive advantage.

The results show that there is no significant positive relationship between RL and DCs ($\beta = 0.051$; $t = 0.863$; $p = 0.388$). The result indicates that RL did not have a relatively greater effect on DCs in the South African manufacturing sector. This result does not espouse the work of Richey [60] et al who

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assert that committing resources to RL has a positive impact on the firm's ability to innovate. Additionally, Li and Liu [26] indicated that firms that pay attention to their RL competency are more likely to achieve enhanced efficiency, and effectiveness throughout their processes compared to those who forego RL. Bag [5] et al also suggest that RL adoption positively influences operations performance. A non-significant relationship between RL and DCs may be due to the lack of utilisation of RL resources, competencies, and collaboration with supply chain partners on strategic issues. It is important to point out that RL requires the exchange of goods and in this regard collaboration with the supply chain is essential. Moreover, this outcome may mean that RL decisions were not appropriately taken, resulting in increased costs and financial losses to manufacturers. It is important that South African manufacturers possess competitive collaborative skills, build strong relationships with their suppliers and strategic partners, and sought to develop and reconfigure their competencies in both information technology and RL.

The outcome of the path analysis and *t*-test demonstrates effectively that DCs has a positive and significant impact on SCA ($\beta = 0.434$; $t = 8.962$; $p = 0.000$). The result of the study suggests that DCs is more like to improve the agility of supply chains in the South African manufacturing sector. This result corroborates the findings of Aslam [54] et al who found a positive relationship between DCs and SCA. A similar result was obtained by Irfan [61] et al in the garment manufacturing industry in Pakistan. The outcome of the study may be the result of improved efficiencies through DCs within the South African manufacturing sector. Manufacturers may have been well prepared by developing structures, technologies and policies that allowed them to respond to customer demands with effectiveness and efficiency. In addition, manufacturers may have been able to respond timeously to market changes and seize opportunities by adapting their resources. Aslam [54] et al posit that firms with well-developed DCs are more likely to improve their SCA since managers have a better understanding of operations within the supply chains. The understanding of their processes may have effectively contributed to anticipating changes through the development of proactive strategies.

Another interesting result illustrates a positive and significant link between DCs and SCC ($\beta = 0.415$; $t = 7.928$; $p = 0.000$). This result is in line with previous studies [54,62] which establish a positive relationship between DCs and SCC. Furthermore, Chen [63] suggested that DCs enables product improvement through cost reduction, capital investment reduction and low business risks. This result demonstrates that DCs has allowed South African manufacturers to effectively manage their labour costs, material costs, management, and transportation costs, hence improving the overall cost of their supply chain. Dewi [64] et al) postulate that firms that compete on cost have the ability to use their resources more efficiently and reap the benefits of a low-price strategy. South African manufacturers may have been able to design products and processes in a way that consumed fewer resources by enhancing efficiency. Moreover, they may have been able to effectively coordinate resources with their supply chain partners. This result may also demonstrate that manufacturers were able to refine their processes, create and innovate for better performance through cost efficiency.

Lastly, a positive and significant relationship was found between DCs and SCREL variables ($\beta = 0.452$; $t = 8.010$; $p = 0.000$). The result of the study discloses that appropriate DCs can improve the overall supply chain through reliability in the South African manufacturing sector. The result aligns with Fernando [27] et al who assert that DCs improves the SCP through SCREL as well as other performance measures such as flexibility, responsiveness, and customer service. Consistently, Yusuf [65] et al established a positive association between DCs and operational performance which included SCREL. The rationale behind this result may have been that South African manufacturers were able to adhere strictly to customer requirements and deliver the correct products to their customers within the prescribed timeframe. Moreover, they may have been able to prepare, respond and recover from uncertainties such as the Covid-19 pandemic and maintain a steady state of operations in an acceptable time and cost. This assertion is supported by Yusuf [65] et al who ascertain that firms that do not deliver products to their customers as per the established schedule, are likely to encroach on trust and loyalty, thus resulting in reduced competitive advantage. Finally, South African manufacturers may have been able to eliminate in effective ways non-value-added activities within their processes as well as supply chains.

6. Conclusion

This study aimed to investigate the relationship between green supply chain management practices, dynamic capabilities, and supply chain performance in the South African manufacturing sector. The study confirms the view that the implementation of GSCM practices positively contributes to DCs in the South African manufacturing sector. The study further concludes that ED, GD, and GT positively influence on DCs. Moreover, DCs are vital for the improvement of SCA, SCC and SCREL. However, the implementation of some of the GSCM activities (i.e., GM, GP, PR, RL and LR) have an insignificant influence on the DCs in the South African manufacturing sector.

The results of this study have significant implications for understanding the connections between the factors considered and how they can be used to enhance the South African manufacturing sector. Moreover, these results, which show significant relationships, provide an essential part of empirical evidence for GSCM, DCs and performance research. The study also validates comparable research conclusions from other environments to the South African manufacturing sector. The input of this study is important because it is one of the rare empirical research projects that used the measurement scales and items for appraising GSCM activities implementation among South African manufacturing companies and bid to improve the measurement items with adjustments. The study, therefore, is a reference work for future researchers on GSCM, DCs and SCP in similar environments elsewhere.

To the management and leadership in the manufacturing sector, the study suggests that the implementation of GSCM activities (particularly ED, GT, and GD) is vital in influencing the DCs. Correspondingly, it is imperative to implement GSCM activities in tandem with SCDCs if gains in SCP are to be realised. Management of manufacturing firms that apply GSCM activities must confirm that both the employees and the organisation achieve inclusive organisational objectives, such as cycle time reduction, cost reduction, enhanced environmental quality, and overall greater customer values as well as individual goals of the employees. As the results of the study show, an inconsiderate approach to GSCM could actually diminish rather than improve the available financial resources and could put pressure on the external stakeholders to adopt the same GSCM practices.

To enhance the execution of IGSCM practices, modern technological resolutions should be considered. The use of such technology resolutions may provide several benefits such as a reduction in paperwork, the accuracy of information, easy integration with other functions and data access, which enables improved sustainability. Training and development programs focusing on GSCM should be offered to all the staff in to raise awareness within the manufacturing sector. A budget should be provided by firms for implementing the GSCM initiatives so that funds can be supplied when required.

It is important for management in manufacturing firms to adopt GSCM sustainability as a strategic essential and to modify existing enterprise information processes to monitor the systems and results linked to the organisation's sustainability wits prior to the implementation of the GSCM activities. Once GSCM sustainability has become strategic attention, manufacturers can instigate to implement GSCM practices with some assurance that the activities will produce not only enhanced capabilities but improved SCP. Therefore, the adoption of GSCM activities improves the firm's capabilities to sustain the environment and support the firm's SCP.

6.1. Limitations and future research needs

This study has some limitations that would offer opportunities for further studies. Firstly, the survey instrument should be refined and reinforced. Studies on GSCM are still at their nascent stages in developing specific measurement items and scales on GSCM practices and SCP. Developing exclusive measurement scales on GSCM practices is significant, particularly for manufacturing firms. Manufacturing firms need self-diagnostic measurement scales to monitor their environmental management capabilities and performance. Further research should offer such indicative scales and items to support the firms in identifying their problem areas and creating solutions. To this end, we will continue this research to refine the survey instrument and correct any measurement errors.

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Moreover, the study chose manufacturing firms in four provinces of South Africa for data collection and analysis as this industry operates under strict environmental rules. Consequently, the outcomes may lack solid external validity. To ascertain the generalisability of the study, repeating this study for comparative analysis in diverse industries and in other developing countries can be another study direction. Furthermore, the study assessed SCP using rather general factors such as agility, reliability, and costs. In future research, more specific performance measures should be utilised to assess performance that is, innovation, responsiveness, financial indices, environmental performance factors, and the like. This study has made an initial attempt to explain the direct and indirect effects of DCs on the relationship between GSCM activities and SCP for manufacturing companies in South Africa. Since GSCM practices are progressively playing a significant part in nourishing competitive advantage, organisations should begin investigating how to leverage GSCM practices to promote capabilities and relational competencies and ultimately gain better competitiveness in the ever-changing global marketplace.

References

1. Maama H, Doorasamy M, Rajaram R. Cleaner production, environmental and economic sustainability of production firms in South Africa. Journal of Cleaner Production. 2021 May 20; 298,126707.
2. Fatoki O. Drivers and barriers to sustainability manufacturing practices by small and medium enterprises in South Africa. Academy of Entrepreneurship Journal. 2019 Sep 1;25(3), 1-2.
3. Kan K, Mativenga P, Marnewick A. Understanding energy use in the South African manufacturing industry. Procedia CIRP. 2020 Jan 1; 91:445-51.
4. Garbie I. Identifying challenges facing manufacturing enterprises toward implementing sustainability in newly industrialized countries. Journal of Manufacturing Technology Management. 2017 Sep 4. 28(7), 928-960.
5. Bag S, Dhamija P, Bryde DJ, Singh RK. Effect of eco-innovation on green supply chain management, circular economy capability, and performance of small and medium enterprises. Journal of Business Research. 2022 Mar 1; 14, 60-72.
6. Gaglio C, Kraemer-Mbula E, Lorenz E. The effects of digital transformation on innovation and productivity: Firm-level evidence of South African manufacturing micro and small enterprises. Technological Forecasting and Social Change. 2022 Sep 1; 182, 121785.
7. Nyam YS, Bahta YT, Oduniyi OS, Matthews N. Smallholder sheep farmers' perception of production constraints and competitiveness strategies in South Africa. Scientific African. 2022 Jul 1;16, e01192.
8. Rukuni TF, Maziriri ET, Booysen K, Zondo MP. Examining factors influencing green supply chain management implementation in the cement manufacturing industry in South Africa. Journal of Contemporary Management. 2022 Aug 1;19(2, 157-85.
9. Shetty SK, Bhat KS. Green supply chain management practices implementation and sustainability–A review. Materials Today: Proceedings. 2022 Jan 1; 5, 735-40.
10. 10.. Niehaus G, Goedhals-Gerber L, Feiboth H. Investigating supply chain sustainability in South African organisations. Journal of Transport and Supply Chain Management. 2018 Feb 1;12(1), 1-1.
11. Epoh LR, Mafini C. Green supply chain management in small and medium enterprises: Further empirical thoughts from South Africa. Journal of Transport and Supply Chain Management. 2018 Feb 1;12(1), 1-2.
12. Bag S, Wood LC, Xu L, Dhamija P, Kayikci Y. Big data analytics as an operational excellence approach to enhance sustainable supply chain performance. Resources, Conservation and Recycling. 2020 Feb 1; 153, 104559.
13. Liu J, Hu H, Tong X, Zhu Q. Behavioural and technical perspectives of green supply chain management practices: Empirical evidence from an emerging market. Transportation Research Part E: Logistics and Transportation Review. 2020 Aug 1; 140, 102013.
14. Aityassine F, Aldiabat B, Al-rjoub S, Aldaihani F, Al-Shorman H, Al-Hawary S. The mediating effect of just in time on the relationship between green supply chain management practices and performance in the manufacturing companies. Uncertain Supply Chain Management. 2021;9(4), 1081-90.
15. Sahoo S, Vijayvargy L. Green supply chain management practices and its impact on organizational performance: evidence from Indian manufacturers. Journal of Manufacturing Technology Management. 2021 Apr 27;32(4), 862-86.
16. Habib MA, Bao Y, Nabi N, Dulal M, Asha AA, Islam M. Impact of strategic orientations on the implementation of green supply chain management practices and sustainable firm performance. Sustainability. 2021 Jan 1;13(1), 340.

17. Khan MT, Idrees MD, Rauf M, Sami A, Ansari A, Jamil A. Green supply chain management practices' impact on operational performance with the mediation of technological innovation. Sustainability. 2022 Mar 13;14(6),3362.
18. Fang C, Zhang J. Performance of green supply chain management: A systematic review and meta-analysis. Journal of Cleaner Production. 2018 May 10; 183:1064-81.
19. Ricardianto P, Kholdun A, Fachrey K, Nofrisel N, Agusinta L, Setiawan E, Abidin Z, Purba O, Perwitasari E, Endri E. Building green supply chain management in pharmaceutical companies in Indonesia. Uncertain Supply Chain Management. 2022;10(2), 453-462.
20. Yildiz Çankaya S, Sezen B. Effects of green supply chain management practices on sustainability performance. Journal of Manufacturing Technology Management. 2019 Jan 7;30(1), 98-121.
21. Seth D, Rehman MA, Shrivastava RL. Green manufacturing drivers and their relationships for small and medium (SME) and large industries. Journal of Cleaner Production. 2018 Oct 10; 198, 1381-405.
22. Umar M, Khan SA, Yusoff Yusliza M, Ali S, Yu Z. Industry 4.0, and green supply chain practices: an empirical study. International Journal of Productivity and Performance Management. 2022 Feb 15;71(3), 814-32.
23. Nureen N, Xin Y, Irfan M, Fahad S. Going green: how do green supply chain management and green training influence firm performance? Evidence from a developing country. Environmental Science and Pollution Research. 2023 Mar 25,1-2.
24. Huang YC, Huang CH, Yang ML. Drivers of green supply chain initiatives and performance: Evidence from the electrical and electronics industries in Taiwan. International Journal of Physical Distribution & Logistics Management. 2017 Oct 2;47(9),796-819.
25. Davis-Sramek B, Omar A, Germain R. Leveraging supply chain orientation for global supplier responsiveness: the impact of institutional distance. The International Journal of Logistics Management. 2019 Feb 12;30(1),39-56.
26. Li M, Liu Y. Beneficial product returns in supply chains. Production and Operations Management. 2021 Nov;30(11),3849-55.
27. Fernando Y, Ahmad Jasmi MF, Wahyuni-TD IS, Mergeresa F, Khamis KA, Fakhrorazi A, Omar R. Supply chain integration and halal frozen meat product returns. Journal of Islamic Marketing. 2023 Apr 4;14(5),1369-95.
28. Ye Y, Lau KH. Competitive green supply chain transformation with dynamic capabilities—an exploratory case study of Chinese electronics industry. Sustainability. 2022 Jul 14;14(14),8640.
29. Wijewickrama MK, Chileshe N, Rameezdeen R, Ochoa JJ. Information sharing in reverse logistics supply chain of demolition waste: A systematic literature review. Journal of cleaner production. 2021 Jan 20; 280,124359.
30. Siems E, Land A, Seuring S. Dynamic capabilities in sustainable supply chain management: an inter-temporal comparison of the food and automotive industries. International Journal of Production Economics. 2021 Jun 1; 236,108128.
31. Gupta S, Modgil S, Gunasekaran A, Bag S. Dynamic capabilities and institutional theories for Industry 4.0 and digital supply chain. In Supply Chain Forum: An International Journal 2020 Jul 2; 21(3),139-157). Taylor & Francis.
32. Asamoah D, Agyei-Owusu B, Andoh-Baidoo FK, Ayaburi E. Inter-organizational systems use and supply chain performance: Mediating role of supply chain management capabilities. International journal of information management. 2021 Jun 1; 58,102195.
33. Xie Y, Yin Y, Xue W, Shi H, Chong D. Intelligent supply chain performance measurement in Industry 4.0. Systems Research and Behavioural Science. 2020 Jul;37(4),711-8.
34. Isnaini DB, Nurhaida T, Pratama I. Moderating effect of supply chain dynamic capabilities on the relationship of sustainable supply chain management practices and organizational sustainable performance: A study on the restaurant industry in Indonesia. International Journal of Supply Chain Management (IJSCM). 2020;9(1),97-105.
35. Yu W, Jacobs MA, Chavez R, Yang J. Dynamism, disruption orientation, and resilience in the supply chain and the impacts on financial performance: A dynamic capabilities perspective. International Journal of Production Economics. 2019 Dec 1; 218,352-62.
36. Lambourdiere E, Corbin E. Blockchain and maritime supply-chain performance: Dynamic capabilities perspective. Worldwide Hospitality and Tourism Themes. 2020 Feb 7.
37. Kareem MA, Kummitha HV. The impact of supply chain dynamic capabilities on operational performance. Organizacija. 2020 Nov 1;53(4),319-31.
38. Teece DJ. Business models and dynamic capabilities. Long range planning. 2018 Feb 1;51(1),40-9.
39. Manzoor U, Baig SA, Hashim M, Sami A, Rehman HU, Sajjad I. The effect of supply chain agility and lean practices on operational performance: a resource-based view and dynamic capabilities perspective. The TQM Journal. 2022 Nov 24;34(5),1273-97.

40. Hodge SR. Quantitative research. In Routledge Handbook of Adapted Physical Education 2020 Jan 21 (pp. 147-162). Routledge.
41. Jasmi MF, Fernando Y. Drivers of maritime green supply chain management. Sustainable cities and society. 2018 Nov 1; 43,366-83.
42. Peng H, Shen N, Liao H, Wang Q. Multiple network embedding, green knowledge integration and green supply chain performance—Investigation based on agglomeration scenario. Journal of Cleaner Production. 2020 Jun 20; 259,120821.
43. Bauer GR, Churchill SM, Mahendran M, Walwyn C, Lizotte D, Villa-Rueda AA. Intersectionality in quantitative research: A systematic review of its emergence and applications of theory and methods. SSM-population health. 2021 Jun 1; 14,100798.
44. Cortina JM. On the whys and hows of quantitative research. Journal of Business Ethics. 2020 Nov; 167,19-29.
45. Forbes MK, Greene AL, Levin-Aspenson HF, Watts AL, Hallquist M, Lahey BB, Markon KE, Patrick CJ, Tackett JL, Waldman ID, Wright AG. Three recommendations based on a comparison of the reliability and validity of the predominant models used in research on the empirical structure of psychopathology. Journal of Abnormal Psychology. 2021 Apr;130(3),297.
46. Sürücü L, Maslakci A. Validity and Reliability in Quantitative Research. Business & Management Studies: An International Journal, 8 (3), 2694–2726.
47. Price PC, Jhangiani RS, Chiang IC. Reliability and validity of measurement. Research methods in psychology. 2015 Oct 13...
48. Subramanian N, Abdulrahman M. An examination of drivers and barriers to reducing carbon emissions in China's manufacturing sector. The International Journal of Logistics Management. 2017 Nov 13;28(4),1168-95.
49. Novais L, Maqueira Marin JM, Moyano-Fuentes J. Lean production implementation, cloud-supported logistics and supply chain integration: interrelationships and effects on business performance. The International Journal of Logistics Management. 2020 Sep 3;31(3),629-63.
50. Yusr MM, Salimon MG, Mokhtar SS, Abaid WM, Shaari H, Perumal S, Saoula O. Green innovation performance! How to be achieved? A study applied on Malaysian manufacturing sector. Sustainable Futures. 2020 Jan 1; 2,100040.
51. Afum E, Sun Z, Agyabeng-Mensah Y, Baah C. Lean production systems, social sustainability performance and green competitiveness: the mediating roles of green technology adoption and green product innovation. Journal of Engineering, Design and Technology. 2021 Jul 26.
52. Nkrumah SK, Asamoah D, Annan J, Agyei-Owusu B. Examining green capabilities as drivers of green supply chain management adoption. Management Research Review. 2021 Jan 25;44(1), 94-111.
53. Brandon-Jones A, Knoppen D. The role of strategic purchasing in dynamic capability development and deployment: A contingency perspective. International Journal of Operations & Production Management. 2018 Feb 5.
54. Aslam H, Blome C, Roscoe S, Azhar TM. Dynamic supply chain capabilities: How market sensing, supply chain agility and adaptability affect supply chain ambidexterity. International Journal of Operations & Production Management. 2018 Jun 28.
55. Joshi G, Dhar RL. Green training in enhancing green creativity via green dynamic capabilities in the Indian handicraft sector: The moderating effect of resource commitment. Journal of Cleaner Production. 2020 Sep 10; 267, 121948.
56. Zeng H, Chen X, Xiao X, Zhou Z. Institutional pressures, sustainable supply chain management, and circular economy capability: Empirical evidence from Chinese eco-industrial park firms. Journal of cleaner production. 2017 Jul 1; 155, 54-65.
57. Clemens B, Douglas TJ. Do coercion drive firms to adopt 'voluntary' green initiatives? Relationships among coercion, superior firm resources, and voluntary green initiatives. Journal of business research. 2006 Apr 1;59(4), 483-91.
58. Shaharudin MR, Govindan K, Zailani S, Tan KC, 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. 2017 Apr 15; 149, 1144-56.
59. Shaharudin MR, Tan KC, Kannan V, Zailani S. The mediating effects of product returns on the relationship between green capabilities and closed-loop supply chain adoption. Journal of cleaner production. 2019 Feb 20; 211, 233-46.
60. Glenn Richey R, Genchev SE, Daugherty PJ. The role of resource commitment and innovation in reverse logistics performance. International Journal of Physical Distribution & Logistics Management. 2005 Apr 1;35(4), 233-57.
61. Irfan M, Wang M, Akhtar N. Enabling supply chain agility through process integration and supply flexibility: Evidence from the fashion industry. Asia Pacific Journal of Marketing and Logistics. 2020 Jan 14;32(2), 519-47.

 doi:10.20944/preprints202306.0924.v1

62. Singhry HB, Abd Rahman A. Enhancing supply chain performance through collaborative planning, forecasting, and replenishment. Business Process Management Journal. 2019 Jun 18;25(4), 625-46.
63. Chen IS, Fung PK, Yuen SS. Dynamic capabilities of logistics service providers: Antecedents and performance implications. Asia Pacific Journal of Marketing and Logistics. 2019 May 10.
64. Dewi DR, Hermanto YB, Tait E, Sianto ME. The Product–Service System Supply Chain Capabilities and Their Impact on Sustainability Performance: A Dynamic Capabilities Approach. Sustainability. 2023 Jan;15(2), 1148.
65. Yusuf Y, Menhat MS, Abubakar T, Ogbuke NJ. Agile capabilities as necessary conditions for maximising sustainable supply chain performance: An empirical investigation. International Journal of Production Economics. 2020 Apr 1; 222, 107501.