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Management Innovation, Green Product Innovation, Green Process Innovation Influence On Financial Performance. A Study Of South African Manufacturing Firms

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Abstract

This research aims to evaluate the nexus of green innovation on registered companies' financial performance on the Johannesburg Stock Exchange (J.S.E.). The paper followed the content analysis approach in evaluating green products, green processes, management innovation ability, and green image variables on 64 manufacturing firms from 2011 up to 2018. This article adopted Smart PLS-SEM 3 analyses to check the models suggested for the study empirically. The findings reveal that management innovation ability had a significant favorable influence on the green process; however, the relation with financial performance was insignificant. Green process innovation had a significant negative association with enterprise financial performance. Again, the effect of green process innovation on green products was enormously significant. Green products did not have a considerable influence on financial performance. Finally, the moderating variable green image was introduced into the model, green product, and green process; both indicated an insignificant positive effect on the enterprise financial performance. The conclusion of this research supports the theoretical assertation that mutually green products and green processes are complementary.

Keywords: *green product, green process, green image, management innovation ability, PLS-SEM*

1. Introduction

Green innovation, environmental issues, and the firm's performance are quickly emerging as one of the most critical strategic company subjects, leadership knowledge, manufacturing methods, and product development choices. Many researchers have based their attention on the impact of excessive use of environmental assets on the atmosphere (Singh & El-Kassar, 2019). The growing world population highlights the need to develop new ways to use these products more effectively to balance needs for demand and sustainability. This objective can be accomplished by promoting the introduction of green technologies by institutions and nations, especially in sectors with major environmental impacts in terms of emissions and water and energy use, such as in manufacturing, construction, and mining (Tariq, Badir, & Chonglerttham, 2019); (Gao, Shih, Pan, Chueh, & Chen, 2018). The South Africa green innovation Barometer 2018 shows that the country is classified as a shift to a fair green economy. The economy of South Africa relies excessively on energy and transport systems based on fossil fuel and carbon-intensive sectors. Green process innovation relates to improving current manufacturing procedures or adding new environmental impact reduction mechanisms. Green process innovation involves steps to decrease polluted air and water emissions, improve resource and energy efficiency, decrease water consumption, and move from high carbon and hydrogen content fuels to clean energy. Green process innovation assists manufacturing sectors not only by enhancing their compliance with the environment but also by offering differentiation benefits and even improving their financial performance. (Y.-S. Chen, S.-B. Lai, & C.-T. J. J. o. b. e. Wen, 2006b); (Xie, Huo, & Zou, 2019); (Delgado-Verde,

Amores-Salvadó, Martín-de Castro, & Navas-López, 2014). Green product innovation was acknowledged as one of the significant variables for achieving development, the sustainability of the environment, and improved quality of life (Xie et al., 2019) and (Singh & El-Kassar, 2019). GPDI, as a consequence of the interaction between innovation and a firm's financial performance, has become a strategic concern for explanation and practice. (Walker, Chen, & Aravind, 2015) characterize management innovation as new ways to devise the organization's plans and structure, modify and inspire the enterprise's management practices. New administrative structures, organizational processes, supervisory procedures, developments, and systems that could create value for the company are managerial novelties ((Birkinshaw, Hamel, & Mol, 2008)). (Rodrigues, Gohr, & Calazans, 2020) the internal absorption capacity, internal knowledge resources, and capabilities, (Y. S. Chen, Chang, & Wu, 2012) environmental leadership, culture, and environmental capabilities, (Huang & Li, 2017) found out that when managers consider natural environment problems as an advantage, the constructive environmental approach is more likely to be taken, which can boost the environmental efficiency and financial performance of the business.—focusing on Johannesburg Stock Exchange-listed manufacturing firm. Following the studies of (García-Granero, Piedra-Muñoz, & Galdeano-Gómez, 2018)stated that many types of research on eco-innovation, sustainability, and green innovation are done in Europe, with Spain leading the rank in the article. The research investigation conducted in Sub-Sahara Africa will fill literature gaps in companies' innovation and practice. Also, it will attract other researchers' attention to the need to research in Africa. In conjunction, this is the first-time green innovation has been implemented (green process innovation, green product innovation, green image, and management innovation) in Africa to enable innovation efficiency as a novel financial performance measure. Second, we're going deeper into understanding the connection between green innovation and efficiency in innovation and sustainability. In particular, we demonstrate the beneficial impact of green innovation on the company's performance. Third, we offer new intuitions into how green innovation link to financial performance. Finally, this article adopted the content analysis method of data collection. It employed the Smart PLS-SEM approach to analyze the affiliation between green innovation and financial performance, unique to other studies in innovation.

2. Literature Review

The key purpose of this section is to create building blocks to construct the analytical viewpoints that are essential to addressing the primary questions asked. The key hypotheses and contemporary methods that form the basis for the hypothesized model of study. Some theorertical reviews are explained to support the varibles and article objectives.

2.1 Theorertical review

The Resource-Based View

Firms earn varing performance as a result of difference in available resources which result to a great competitive edge (Amores-Salvadó, Martín-de Castro et al. 2014). Hart (1995) recommends a natural resource-based view of competitive advantage oriented on firms' benefits concerning the natural environment and points out that firms can create distinctive assets by improving their social credibility in the social demand for clean technology. In particular, green process innovation can help companies in production sectors create their green image and green product, which can be considered environmental capacities that provide valuable and rare resources. In reaction to the

social demand for clean technology, manufacturing firms can then improve their competitive advantage by adopting environmental procedures.

The Capability Approach

The company's capacity-based view of the company indicates that businesses require Ordinary Capability (OC) to improve competitive advantage, which enables them to successfully run their chosen business outlines, and Dynamic Capability, which lets them promote current OCs or build new ones (Karna, Richter et al. 2016). Organizational capabilities can be explained as the willingness of the corporation to use its method or all of its collective energy to accomplish a given outcome. The capability methodology is the fundamental way of explaining variation and sustainable competitive edge in inter-organizational alliances as a source of value production for an enterprise. From the studies on green innovation, it can be inferred that an enterprise that engages in green innovation can increase its firm's performance through the capabilities that the organization holds.

Business Process Reengineering Theory

Business process reengineering (BPR) is usually referred to as a revolutionary approach to an organization's transformation. BPR typically leads to a substantial change in the whole organization's main performance measures (KPIs), and it creates a desire to make some changes in the plan. It typically begins in rethinking the main structures and redesigning each of them, along with the organization's strategic priorities. Consequently, a network methodology that allows one to identify and manage diverse organizational systems consisting of a mix of connected but separate resources (material, person, financial, and information) is a fantastic tool for modeling multi-level tasks and role chains within an enterprise (Lake, 2013). A firm that integrates this model in its green process innovation strategy will improve its production process and performance over time.

Reputation Theory

Economists consider a reputation for being a characteristic of an institution. The game theory defines reputation as a character that extricates institutions' categories and justifies their corporate conduct. Reputation is a term linked to the business's reputation and the appraisal of a company's efficiency by a third party that originates from the company's success in the past. The firm's prestige is established over many times and is described as a coherence of its intrinsic values (Roger and Helen, 2001). Because much of a company's characteristics and goods are shielded from view, reputation is an indicator of knowledge that enhances consumers' trust in company goods and services. (Suka 2016) looks at the efficacy of environmental reporting in rising company interest. The findings suggest environmental success, as well as environmental transparency, affect the firm's valuation. The association of environmental disclosure and firm worth and the indirect influence of firm value environmental results were found to have a different outcome on institutional reputation.

2.2 Hypothesis development

Management innovation ability and financial performance.

The management of an organization falls on the top-level managers through to the lower rank staff. Top-level managers are the key contributor to numerous green innovation practices and

environmental issues. According to (Bansal, 2003), businesses face immense pressure from the government, consumers, media, environmental N.G.O.s, and other stakeholders to integrate quality assurance and environmental management into their business practices (Li, 2014a). M.I.A. as novel methods to develop strategy and structure in the organization, change the enterprise management procedures and motivate and recompense. (Rodrigues et al., 2020) found out that management innovation is negatively linked with the firm's performance but mediated by performance management. Quality assurance initiatives such as ISO 9001 include "hard" and "soft"' components, which aligned with the organization's opposing mechanistic versus ecological views. In China, (Tang, Walsh, Lerner, Fitza, & Li, 2018) reported that GPRI and GPDI both predict athletic success substantially (positively) while not considering ecological management issues. When managerial considerations were considered, the findings showed that green process innovation's positive influence on firm efficiency was amplified but not on product innovation, which no longer explains exceptional variance in firm performance. Management directors in South Africa are developing much interest in green innovation. This management involves government environment decisions, training on a new course leading to environment protection, and integrating their knowledge into the organization. Following the works of (Li, 2014a); (Tang et al., 2018), (Bansal, 2003), the below hypothesis relating to management innovation was developed.

H1a. Management innovation is directly affiliated with the firm's financial performance.

H1b. Management innovation is positively linked with the green process.

Green process innovation, green product innovation, and enterprise performance

Green process innovation is the proper way by which an organization adopts to reduce the harmful effect of production in the company. These are the internal means of production rather than external. Though green process innovation is expensive to practice, the benefit outweighs the cost. According to Huang and (Li, 2014a), who studied the influence of green innovation on financial efficiency, industry capacity, and social reciprocity indicated that GPRI and GPDI vital influenced the company's financial performance. The empirical work of literature has shown that GPRI can view two angels; a) clean technologies and b) end-of-pipe technologies. Clean technologies, as defined by scholars, strive to minimize or eliminate pollutant generation during manufacturing processes and can, therefore, be considered as an operational investment in activities involving fundamental adjustments to an essential product or primary process (Lu, Weng, & Change, 2018). Clean technologies are a means by which an organization reduces the negative impact of its process during production or prevents the start of a harmful cycle of production. Also, end-off pipe technologies are the results of an organization's process. (Frondel, Horbach, & Rennings, 2007) stated that specific environmental issues and legislative stipulations often influence technology choices. End-of-pipe techniques are, therefore, helpful instruments to implement ecological practices in green process innovation. This paper claims that the green innovation processes of an organization are beneficial to enhancing its economic efficiency. Innovation in the green process strengthens existing processes, or adds innovative techniques to minimize harmful environmental consequences, enhance environmental enforcement of an organization and offer advantages of specialization. Following the above studies, the second hypothesis was established;

Hypothesis 2a. A firm's green process innovation is positively affiliated with its financial performance.

Hypothesis 2b. The level of a firm's green process innovation is positively affiliated to its green product innovation.

Green product innovation and financial performance

Due to its growing significance, a study on green product innovation has risen significantly over the previous few decades (Tariq et al., 2019). Following the studies of (Y.-S. Chen et al., 2006b), green innovation was defined as "efficiency in product development linked to environmental innovation, including product innovation involving energy-saving, pollution prevention, waste reprocessing, no toxicity or design of green products." In Taiwan, (Y. Chang, Chen, Shu, & Trade, 2018) research the inward and outward capability of service and manufacturing companies to determine the influence of green service and green products on the firms. The result from a sample of 363 questionnaires suggested if a service firm wants to develop a green service, they must consider both the environmental scanning capability and the lotus of planning. However, a manufacturing company only has to improve its environmental scanning capability to develop green product innovation. Following the works of (Tariq et al., 2019), employing the hierarchical regression investigation on 202 Thai manufacturing enterprises. The article results indicated that higher green product innovation performance significantly influences the firm's financial profitability. Higher green product innovation performance leads to a lower risk. Investing in green product innovation will help a company to avoid government sanctions and legal costs. In the short and long period, companies that produce green innovation goods will achieve a competitive advantage, positively impacting enterprise returns. (Albino, Ardito, Dangelico, & Petruzzelli, 2014) who reviewed 63 documents on green innovation, find out that both internal and external forces drive green product innovation. Among the most important internal factors are the internal data, including the possibility of competitive advantage, cost savings, market advantages, enhanced reputation, and innovation possibilities. Eco-friendly laws–current and anticipated market demand are among the most significant external factors. Empirical studies have shown that cost savings, competitive advantage accomplishment, enhanced market share, enhanced sales, turnover improvement, more significant revenues, better reputation, enhanced exports, and greater productivity are of the utmost importance. Finally, other research scholars have also stated that green product innovation was developed due to resource and capability enhancement, knowledge flow, and strategic management commitments. From the empirical works of literature, we developed the hypothesis.

Hypothesis 3. Green product innovation has a positive affiliation with financial performance.

The moderating effects of a green image.

Scholars have mostly researched the importance of corporate image links with the financial performance of companies, following the studies (Delgado-Verde et al., 2014), who investigated the green corporate image as a moderating effect on GPDI and financial efficiency. The article examines hat the 157 metal industries' green image in Spain has a significant favourable influence on the companies' financial performance. Following (Lin, Tan, & Geng, 2013) research work in Vietnam, 208 questionnaires were gathered from four major overseas motorcycle companies. The study results indicate that market demand was strongly affiliated with both green product development and company efficiency. The efficiency of GPDI is also strongly affiliated with company performance. A green image was seen as a significant determinant of customer fulfilment. Companies investing in enhancing their green image prevent future environmental demonstrations,

penalties, and lawsuits and increase consumer expectations of environmental friendliness and green product innovation. A study on the impacts on purchaser-based brand equity creation of greenways at restaurants on 512 American restaurants found that implementing two green practice elements, meals oriented and environmentally concentrated, affected client views of green brand image and environmental intentions (Namkung & Jang, 2013). A green image is a means of winning customer loyalty and competitive advantage in an industry. According to (Rehfeld, Rennings, & Ziegler, 2007) and (Dangelico & Pujari, 2010), a negative association between green image and firms' financial performance, stated that customers are not willing to pay the above-average price for green image product and in turn affect the company's performance. A company's green image may be a significant criterion for assessing the value of a new item. It may result in enhanced customer confidence and, in turn, a more substantial influence on purchaser buying choices ((Peng, Sun, Pinkham, & Chen, 2009). A green image may also cause customers to feel a greater affinity for a business or a particular item, leading to enhanced brand loyalty. As a result, the green image of a company may rise above all client satisfaction, connotation the more favourably a client perceives the green image of a company, the more strongly they view the company (Abimbola et al., 2010). Because customer trustworthiness and corporate status are key variables influencing future returns (Albino et al., 2014), a company with a more robust green image can obtain more financial performance from green product development. The preceding arguments lead to the following hypothesis, stated in the null form:

Hypothesis 4a. A green image moderates the connection between a firm's green process innovation and its financial performance.

Hypothesis 4a. A green image moderates the connection between a firm's green product innovation and its financial performance.

Conceptual framework

A green innovation model incorporating four key concepts is built in this study: green product, green process, green image, and management. We aimed to categorize green innovation practices' influence on the firm's performance. Figure 1 shows hypothesis model designed.

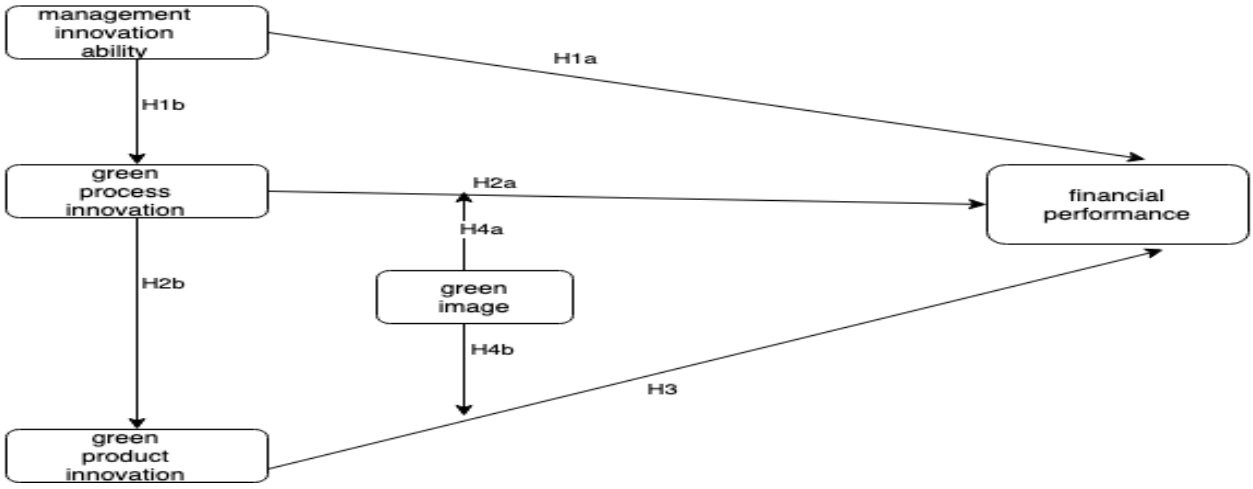


Figure 1: Theoretical frmawork

3. Methodology

The industrial firms registered on the Johannesburg Stock Exchange were selected purposely according to the industry classification. The article targeted companies that meet the following requirements: companies that have obtained green sector certification or have obtained green label products certification; companies that have advertised on their websites their participation in environmentally friendly projects; and enterprises that are certified ISO 14001. Therefore, 64 companies from listed companies met the above requirements for the period 2011 up to 2018. Data for financial performance was selected from the annual financial statements of the firms. However, data on green innovation were assembled from the established firms' corporate social responsibility and sustainability reports. The variable construct for this study was done mainly through content analysis. For the calculation model and the structural models, the Smart PLS-SEM approach was used to immediately test and monitor the convergence of the measure and distinguish validity. By employing Cronbach's Alpha reliability check, the reliability of all structures in the content analysis was validated. The constructs' reliability value of coefficient was high, with an outcome of 0.889, which is above 0.7 (Hair Jr, Hult, Ringle, & Sarstedt, 2016). A measurement model was tested in phase one and the structural model in phase two. The relations among apparent variables and the latent variable were calculated by the measurement model, which was evaluated from the side – side estimation.

3.1 Regression model development.

For hypothesis testing, other theories, and empirical studies, the article developed the below regression model.

$$FP = a + \beta_1 GPDI_{it} + \beta 2\ GPRI_{it} + \beta 3 MIA_{it} + \beta 4 GM_{it} + \varepsilon_{it} \ldots\ldots. (1)$$

$$FP = a + \beta_1 GPDI_{it} + \beta_2\ GPRI_{it} + \beta_3 MIA_{it} + \beta 4 GMit * GPDIit + \varepsilon_{it} \ldots\ldots (2)$$

$$FP = a + \beta_1 GPDI_{it} + \beta_2\ GPRI_{it} + \beta_3 MIA_{it} + \beta_4 GM_{it} * GPRI_{it} + \varepsilon_{it} \ldots\ldots. (3)$$

Where FPit = Corporate financial performance; β= beta coefficient; GPDI = green product innovation; GPRI = green process innovation; MIA = management innovation ability; GM = green image. εit = error term.

3.2 Variables Measured

a) Financial performance

The financial performance of the study was measured by return on equity (R.O.E.). Which is a common measurement used in research studies? In (Singh & El-Kassar, 2019) works and (Xie et al., 2019) also adapted the same variable to estimate the impact of green innovation on enterprises performance. ROE = Net income / total equity

b) Green product innovation (GPDI).

Green products evaluated the company's non-toxic, simple to recycle and decompose, and non-polluting, environmentally friendly materials. Following the research work ((Bigliardi, Bertolini, & Wong, 2012); (Chiou, Chan, Lettice, Chung, & Review, 2011); (Xie et al., 2019). Three items were developed to measure green product innovation. First, making changes to output designs to avoid polluting or toxic amalgams within production

developments. Second, improving and designing environmentally-friendly packaging for existing and new products. Third, making product design alterations intended to improve energy efficiency during usage.

c) **Green Process Innovation (GPRI).**
Innovation in the green process refers to a modern production process that expansively considers the effect on the energy and resource efficiency on the basis of ensuring the purpose, quality, and value of the item (Singh & El-Kassar, 2019) and (Xie et al., 2019). First, it was measured by four factors, improving resource and energy efficiency, reducing consumption of harmful resources, and energy. Secondly, implementing recycling techniques, recycling materials, and environmentally friendly technologies. Thirdly, implementing, and adapting equipment that controls pollution. Finally, lower water, electricity, gas, and gasoline consumption during manufacturing/usage/disposal.

d) **Green image (G.M.).**
A green image is seen as offering customers a fulfillment of satisfaction when similar products are produced in the market. (Delgado-Verde et al., 2014) and (Xie et al., 2019) used products linked to a company's knowledge of environmental hazards and accomplishments to capture its green image. Thus, three things will be used to measure the green image in this research—next, compliance with environmental protocols and high knowledge of the threats to the environment. Second, showing intensity through corresponding eco-friendly results in improving energy quality. Third, offering the potential to minimize waste through associated ecological efficiency.

e) **Management innovation ability (M.I.A.).**
Top management assurance plays a crucial role in assigning resources, building capabilities, and helping the firm gain competitive lead (Sirmon, Hitt, & Ireland, 2007); (Song, Wei, & Wang, 2015). Following the research studies, three factors are used to measure management innovation ability. 1.CEOs qualification. 2. Networking of C.E.O.s and 3. C.E.O.s with dual responsibility in another firm. All the green innovation variables were measured with a content analysis method with a coding score of 1, 2, and 3. By manually adopting the content analysis technique, information on GPRI, GPDI, G.M., and M.I.A. will be acquired. The report will then code by two coders.

4.0 Empirical analysis and discussion

The Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed to estimate the exploration model using Smart PLS 3.0. The critical clarifications behind picking S.E.M. as an accurate strategy for this investigation is that S.E.M. offers a synchronous examination which prompts gradually exact evaluations) The alpha of the individual Cronbach, the composite reliability (C.R.), the average variance extract (AVE), and the loading factor exceeded the specified value as illustrated in Table 1. To investigate the estimation model's discriminant legitimacy (Fornell & Larcker, 1981) was used. Table 2 demonstrates the outcome of the use of Fornell-Larcker for discriminatory validity. It was observed that the square root of the AVEs on the diagonals is greater than the association grows; this shows great discriminant legitimacy. In addition, exogenous constructs have a relation of less than 0.85. Subsequently, both figures had their racist authority acceptably fulfilled.

Table 1. **Loading for latent constructs**

Variables	**Construct**	**Loadings**	**Cronbach's Alpha**	**CR**	**Rho_A**	**AVE**
Management Innovation Ability			**0.855**	**0.909**	**0.955**	**0.770**
	MAI1	**0.780**				
	MAI2	**0.907**				
	MAI3	**0.892**				
Green process innovation			**0.931**	**0.951**	**0.945**	**0.828**
	GPRI 1	**0.768**				
	GPRI 2	**0.818**				
	GPRI 3	**0.765**				
	GPRI 4	**0.845**				
Green Product Innovation			**0.834**	**0.900**	**0.899**	**0.750**
	GPDI 1	**0.939**				
	GPDI 2	**0.913**				
Green image			**0.806**	**0.867**	**0.898**	**0.828**
	GM 1	**0.908**				
	GM 2	**0.823**				
	GM 3	**0.755**				

Table 2. Discriminant validity (Fornell-Larcker)

	FP	GM	GPDI	GPRI	M.I.A.
FP	1.00				
GM	**0.577**	**0.831**			
GPDI	0.320	0.533	**0.926**		
GPRI	0.141	0.602	0.668	**0.800**	
MIA	0.393	0.844	0.647	0.803	**0.862**

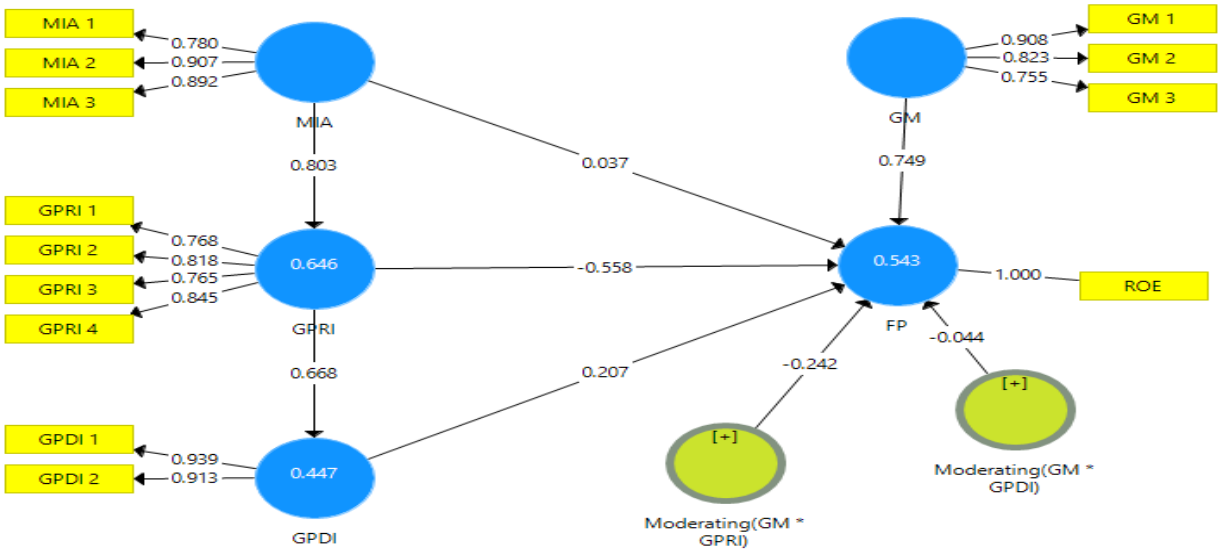


Figure 2: Presenting the final path model

4.2 Structural Model Assessment

Endogenous latent variables and goodness of fit authenticate the Smart P.L.S. model. The proposed fit quality is 0.620 (RMS-Theta), which exceeds the GoF>.36 recommended. In the structural model, the results of the path coefficient (table 3 and figure 3) are used, showing the effect of the R-square value nexus. Computing beta (ß), R2, and the equivalent t-values of bootstrap with a resample of 5,000 and $p < 0.05$ was employed to test the structural model (Hair Jr et al., 2016). The result of the structural model is summarized in table 3 and figure 3.

Table 3: Path Coefficients along with their bootstrap values and 'T' Values

Factors	Original samples (0)	Sample means	Standard deviation	T statistics(lO/stdevl)	Decision	Prob
Management innovation ability -> financial performance	0.037	0.039	0.286	0.130	H1a = Not supported	0.897
Management innovation ability -> green process innovation	0.803	0.801	0.060	13.457	H1b =supported	0.000
Green process innovation -> financial performance	-0.558	-0.502	0.235	2.373	H2a = Supported	0.018
Green process innovations -> green product innovation	0.668	0.680	0.079	8.458	H2b =supported	0.000
Green product innovation -> financial performance	0.207	0.185	0.169	1.224	H3 = Not supported	0.221
Green image -> financial performance	0.749	0.747	0.223	3.353	Supported	0.001
Moderating effect (GM * GPDI) financial performance	-0.044	-0.033	0.173	0.257	H4a = Not supported	0.797
Moderating effect (GM * GPRI) financial performance	-0.242	-0.256	0.148	1.632	H4b = Not supported	0.103

***Path coefficient bootstrapping. T Statistic > 1.96 for 5%; p< .005*

The nexus amongst management innovation ability and financial performance was not accepted and insignificant with the sample (β) = 0.037, statistics = 0.130, and confidence value 0.897, (p)>0.05 indicates management innovation ability had an indirect affiliation with financial performance. The nexus among management innovation ability and green process innovation was positively accepted, with the initial (β) = 0.803, T vale = 13.457, and probability figure at 0.000, (p)< 0.05 indicates that proper green process innovation is directly impacted by management innovation ability. The affiliation between GPRI and financial performance was supported with β = -0.558 and t = 2.373, signifying that a firm's green process innovation had an adverse impact on the enterprise's financial performance. The link between a green process innovation and green product innovation stood as second highly accepted, with (β) = 0.668, statistics (t) = 8.458, and probability value (p)<0.000 depiting that the green product innovation is favorable and stimulus by GPRI, meaning the two are complementary to each other.

The affiliation between green product innovation was not accepted and negligible with β = 0.207 and ststistic = 1.224, revealing that an enterprise green product innovation has no material influence on the registered enterprise's financial performance. It means that green product innovation does not have a strong influence on performance. The findings above shows management investment in green product innovation doesn't directly improve financial performance. The connection between the enterprise's green image and financial performance was supported, indicating when a company green image is managed well, it will improve its financial performance. When the moderating result of the green image is introduced to the model, the nexus between GM and GPDI was not accepted and dinky with β = -0.044, and T - statistic = 0.257, indicating that an enterprise green image has not much influence on the green product developed by an organization. The second moderating impact was the affiliation between green image and GPRI was not accepted and insignificant with β = -0.242, and t – statistics = 1.632, indicating that a firm's green image doesn't have an influence on GPRI and the performance of the enterprise reults on the J.S. E. Below is the diagram show the bootstrapping of the construct variables.

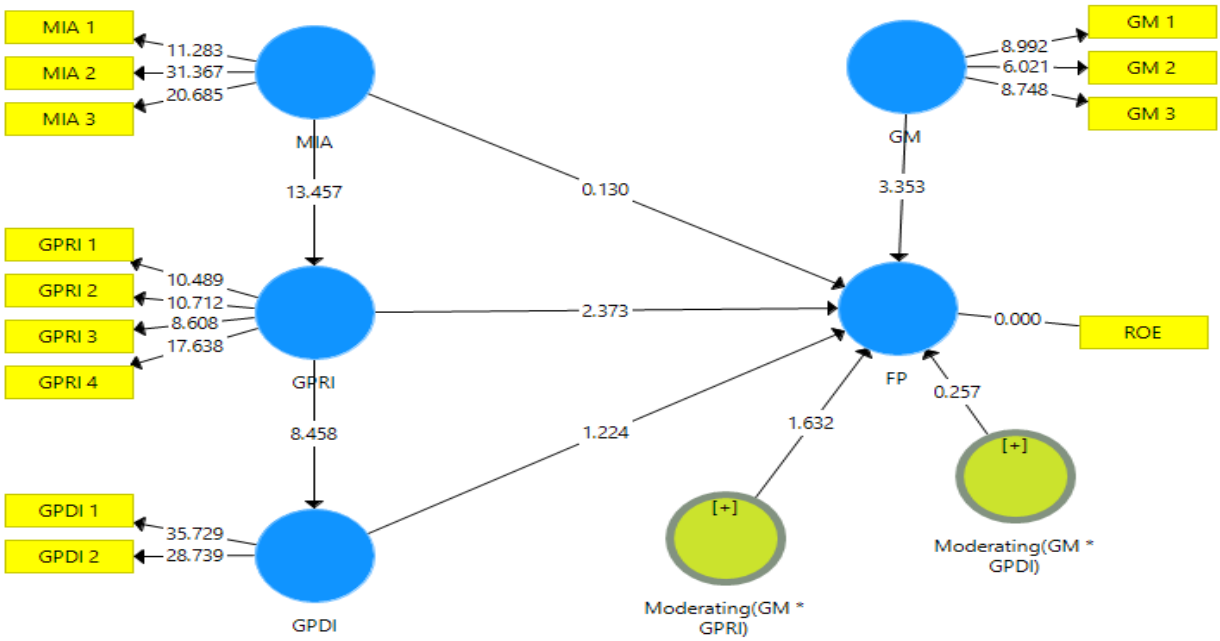


Figure 3: Showing the Bootstrapping Diagram

4.3 Discussions

From the content analysis of 64 manufacturing industries in South Africa, this research studied the influence of green innovation on the financial performance for the period 2011-2018. This research learns from RBV that a company's strengths and abilities are the paramount determinants of its competitive edge and performance. Consequently, optimal resource use is of great value to businesses. GPRI can promote GPDI; businesses can continue with GPRI when adopting eco-friendly tactics to use its resources. Product innovation classically refers to finished goods that can be marketed to a customer readily, while process innovation produces new goods or increases the cost or customer experience of prevailing commodities.

This research developed some hypotheses to test the impact of green innovation on enterprise financial performance. The study adopted the *SMART PLS 3 model*. The completeness of green product innovation relies on sustainable business activities (Lin et al., 2013) (Y. Chang, Chen, & Shu, 2018). Green technology creation is such a process in which all elements undergo profound change, starting at the core, intending to reduce development's environmental impact. As a positioning strategy, GPDI will help companies to develop new projects, capture green opportunities, and retain their markets (Y. Chang, Chen, & Shu, 2018) (Xie et al., 2019). Green process innovation can help organizations advance greater skills when progress required industrial methods for the development of new green products.

Many studies have been done on the effect of management novelty on process innovation development. Green process innovation is means implementing a proper method of clean technology and end-off- pipeline technology (Xie, Huo, Qi, & Zhu, 2015) (Y. Chang, Chen, & Shu, 2018) (Amores-Salvadó, Martín-de Castro, & Navas-López, 2014) (Li, 2014b). To test for *H1a,* study the nexus between management innovation ability and financial performance of the companies. This study's finding doesn't support the null hypothesis developed (Table 3 and Figure 3). To find the integration role of management innovation on the nexus between a green process innovation and enterprise financial performance. Our finding is in agreement with the findings of (Lee & Min, 2015); (Horváthová, 2010), both find an adverse affiliation. However, this finding is not in support of the results (Wong, Lai, Shang, Lu, & Leung, 2012) (Tang et al., 2018). Interestingly, management innovation ability significantly influenced GPRI *(H1b- Table 3 and figure 3).* The finding of this study confirms that (Hahn, Preuss, Pinkse, & Figge, 2014) (Papagiannakis & Lioukas, 2012; Papagiannakis, Voudouris, & Lioukas, 2014).

The article developed two hypotheses for the relatio(Tang et al., 2018)n between a GPRI, GPDI, and companies' financial performance (*H2a and H2b).* The studies hypothesis *(H2a)* was supported as a nexus between a green process innovation and enterprise efficiency. However, the relationship is negative, meaning the more a company invests in GPRI, the lower the financial performance. The results of this investigation are in support of studies by (Y.-S. Chen, S.-B. Lai, & C.-T. Wen, 2006a) (Sezen & Cankaya, 2013) (Li, 2014a) (Xie et al., 2015), whose article find a favorable and significant relationship between a GPRI and organizations' financial performance. Also, hypothesis *(H2b)* GPRI and GPDI positively linked. Hypothesis *(H2b) was supported (table 4 and figure 3).* The findings of (Maine, Lubik, & Garnsey, 2012) (Y. Chang, Chen, & Shu, 2018) (Lin et al., 2013) indicated that a greener process helps improve the development of greener product that is environmentally friendly. To test the connection between GPDI and financial performance of firms *(H3).* Cheng et al. (2014) a greener product development is the manufacturing of a product that has less or zero environmental impact. An enterprise that invests in greener product improves

their financial performance and safe them from environmental lawsuits. The findings indicated a negative and insignificant connection among the variables (*Table 4 and figure 3)*

This research introduced a green image's moderating role in the model to test the nexus between GPDI, GPRI, and organizational financial performance (hypothesis H3a & H3b). First, the affiliation between the green image and financial performance was supported. The moderating effects of the G.M. on GPDI and enterprise performance were negative and insignificant. This research doesn't support the finding of (Xie et al., 2019). For an innovative product to be brand into a green image, it needs much time and resources to implement such a strategy for consumers to accept the product ((Delgado-Verde et al., 2014); (Liu, Chen, Chu, & Zhu, 2018); (N.-J. Chang & Fong, 2010). This article moderated the relation between a green process innovation and financial performance. H3b in the model was also doesn't supported the research null hypothesis, indicating a negative and insignificant relationship when the green image was introduced. The findings could be because the two-green innovation, product, and process are complementary. South African manufacturing companies are new to integrate green innovation into their business activities, even though the environmental agents continue to advocate for greener novelty.

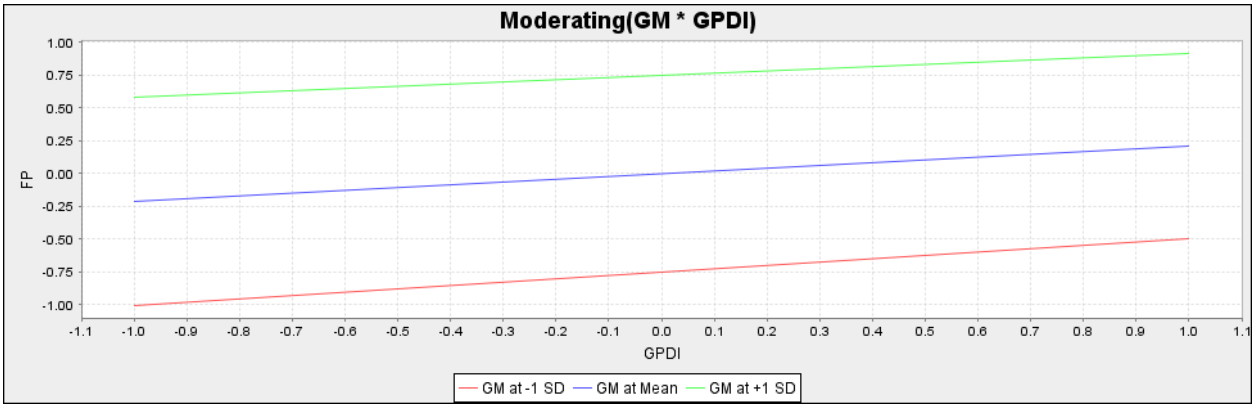
5 Conclusion and policy recommendation

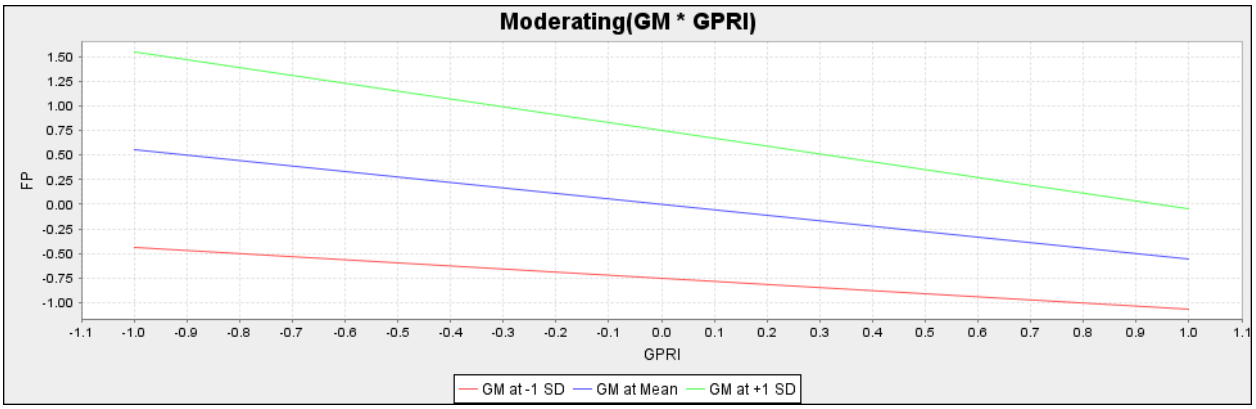
This study's conclusions showed that green products, green process technologies, management innovation ability, and green image lead to the growth of innovative new products and significantly influenced financial performance. It gives planning practitioners a strong signal that while only green innovations will require considerable financial and resource commitment, the initiative is worthwhile because, if well managed, green innovations can produce product success. This finding is important because green technology investment decisions have not always been focused on economic considerations or enforcement grounds. Ecological policies in Sub- Saharan African countries change regularly ((Dai & Zhang, 2017). Industrial companies can raise their green product awareness rather than rely heavily on external factors such as national aids. The second finding of the studies shows that the green image's moderating role on green innovation (green product and green process) had an insignificant influence on the enterprise. The investigation sends a signal to management that a green branding product will significantly contribute to the corporation's financial performance. Green branding will help set a company's product on top of other substitute products.

Theoretical contributions and policy recommendation This research has combined a study on the drivers of the enterprise's green innovation strategy. The paper adopted the content analysis method to investigate the critical factors directing the decision-making on green innovation. The paper recommends that the green product, green process, and management innovation ability have a comprehensive effect on financial performance and that green image serves a significant moderating role. This investigation discovery will help better understand the root causes of the enterprise's green innovation strategic choice and as a reference for the green innovation strategic model. Management should take percussion measures to safe-guard the green image as the results show a favourable moderating effect on green innovation and financial performance. The government environmental and other non-governmental agencies in charge of formulating rules and regulations should increase the education and awareness of green innovation. The government should support industries in subsidies, tax holidays, and other incentives to boost the firm's desire to go greener. Government environmental agencies should make laws that guard the environment against destruction.

There are shortcomings to the sample source for this study. Owing to resource limitations, the study firms come primarily from the manufacturing companies listed on J.S.E for a period from 2011-2018. In order to improve the generalizability of the study findings, knowledge can be gathered in a wider range. The green product, green process, management innovation ability, and green image data was gathered through the content analysis method in the sustainability report and corporate social responsibility report. Other means to gather and evaluate variables such as GMM, Multiple Regression, and Structural Equation (AMOS) may be used in future research. This article only moderated for the green image. Further studies can moderate the role of management on green innovation and financial performance. Finally, a future article could employed more variables to calcualte firm performance, measuring Tobin's Q ratio and net profit margin. Despite the shortcoming, this study is essential for enterprises and national environmental institutions. It seems likely that the yearning to have greener industries to protect the environment will continue relentlessly.

Appendix 1. Moderating effect of G.M. on the GPRI and GPDI





Appendix 2. **Definition of construct variables**

Construct variables	**Measurements**
GPDI 1 making changes to output designs to avoid polluting or toxic amalgams within production developments.	1. If no similar definition existed, 2. If only a direct definition existed without execution, 3. If a similar deployment has arisen
GPDI2.Improving and designing environmentally-friendly packaging for existing and new products.	1. If no similar definition existed, 2. If only a direct definition existed without execution, 3. If a similar deployment has arisen
GPDI3.Making product design modifications aimed to improve energy efficiency during usage.	1. If no similar definition existed, 2. If only a direct definition existed without execution, 3. If a similar deployment has arisen
GPRI 1. Improving resource and energy efficiency, reducing consumption of harmful resources and energy.	1. If no similar definition existed, 2. If only a direct definition existed without execution, 3. If a similar deployment has arisen
GPRI 2. Implementing recycling technique, recycling materials, and environmentally friendly technologies	1. If no similar definition existed, 2. If only a direct definition existed without execution, 3. If a similar deployment has arisen
GPRI 3. Implementing and adapting equipment that controls pollution.	1. If no similar definition existed, 2. If only a direct definition existed without execution, 3. If a similar deployment has arisen

GPRI 4. Lower consumption of, e.g., water, electricity, gas, and petrol during production/use/disposal.	1. If no similar definition existed, 2. If only a direct definition existed without execution, 3. If a similar deployment has arisen
M.I.A. 1. C.E.O.s qualification. C.E.O.s with environmental qualifications certificate.	1. PhD qualification and above 2. Masters 3. Any other qualification
M.I.A. 2. Networking of C.E.O.s. C.E.O.s who serve on other boards.	1. C.E.O.s serving on external boards only 2. C.E.O.s serving on internal board 3. C.E.O.s serving on both external and internal board
M.I.A. 3. C.E.O.s with dual responsibility in another firm.	1. C.E.O.s without part-time work in other firms 2. C.E.O.s with one Part-time job in different firms 3. C.E.O.s with more than one part-time position in other firms
GM1. Complying with environmental regulations and having a high awareness of environmental risks.	1. Products without green image logo 2. do not part-take in environmental program 3. involves in the environmental awareness programs
GM2. Demonstrating strength in improving energy efficiency and environmental performance.	1. Product that takes a long time to a decade. 2. Products that have a short period to a decade 3. products that decade easily
GM3. Indicating the ability to reduce waste and corresponding ecofriendly performance.	1. Products that cannot be reuse 2. Products can be reuse 3. products that serve as by-products for other firms

Conflict of interest

The authors declare no conflicts of interest in this paper.

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