

Predictors of Environmental Performance: Mediating Role of Green Supply Chain Management Practices

Kittisak Jermsittiparsert^{#1,2*}, Parinya Siriattakul^{#3} Nuanluk Sangperm^{#4}

¹Department for Management of Science and Technology Development, Ton Duc Thang University, Ho Chi Minh City, Vietnam

²Faculty of Social Sciences and Humanities, Ton Duc Thang University, Ho Chi Minh City, Vietnam

Corresponding author: ¹kittisak.jermsittiparsert@tdtu.edu.vn

³Political Science Association of Kasetsart University, Bangkok, Thailand

³siriattakul@hotmail.com

⁴Faculty of Management Science, Kasetsart University Si Racha Campus, Chonburi, Thailand

⁴nuanluk.sp@hotmail.com

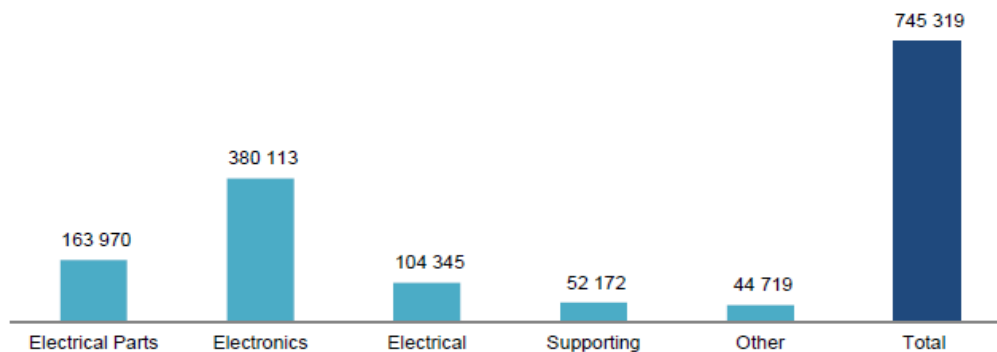
Abstract---Eco-friendly concerns has changed the way businesses are being carried out across the globe. The rising environmental concerns have triggered the need for the businesses to consider the impact of their action of the environment which has led to the emergence of the 'green supply chain management practices'. In this regard this study was conducted to identify the antecedents and outcomes of the green supply chain management. Study identified green knowledge management capability and internal environment management as antecedents and environmental performance as an outcome. 166 procurement managers working in the electronics industry in Thailand gave responses in the study. The results pointed out that green knowledge management capability internal environment management are positively and considerably related with green supply chain management practices. Further results also highlighted that green supply chain management practices are significantly and positively related with environmental performance. Finally the results proved that the green supply chain management is positive significant mediator between relationships of green knowledge management capability, internal environment management and environmental performance.

Keywords--- Green supply chain management practices, internal environment management, Environmental performance, Smart PLS, SEM, CFA, Thailand, Electronics

1. Introduction

Integration of sustainability concerns in the supply chain management practices has appeared to be a topic of interest among researchers. Public awareness is increasing and in presence of strict regulations regarding the environment and sustainability, green supply chain management practices have appeared to be a vital factor in the Thai organizations [1]. The concern for the environment in the developed countries it is obvious from the strict regulations such as "WEEE and RoHS directives". Thus, it made it impossible for the businesses to ignore their supply chain impact on the environment [2]. Electronics manufacturers' supply chain is directly influenced by the environmental guidelines especially in emerging countries. Electric and electronics is ranked among the largest manufacturing sectors in Thailand and it primarily exports goods to other countries. Which provides employment to 745319 employees approximately. Thus, the industrial importance and contribution in exports make it a major contributor in economic growth of Thailand.

Figure 1.



Source: [3]

Firms have employed certain green practices in their supply chains and they are striving hard for its improvement.

Therefore, it makes it important to study how the firms' knowledge and environmental capabilities contributes in the sustainable supply chains and finally its influence on the environment. Employees employed across electric and electronics subsectors in Thailand (September 2016)

Organizations are working on environmental concerns due to their processes and in this regard they have addressed the certain issues and adopting the environment friendly supply chain philosophy. Whereas at the other end, organizations are also striving hard to get their supply chain integration into business process which results in minimum cost and provide the customers with optimal services while also dealing with pressure to survive in competitive pressure [4].

Competing in competitive environment and taking care of the environment calls for the attention towards the strategies which can make the supply chain strategies better and contribute towards the better environmental performance. Organizations compete on their resources and knowledge is one of the core resources organizations do have [5]. It is regarded as the strategic resource which helps an organization to survive, being stable, grow and improve. [6], argued that it is also serves the basis to boost the performance of an organization. Further, it

can also makes sure the smooth sharing of information and support among employees which further translates into efficiency and creativity [7]. Knowledge management helps an organization to develop approaches which do assist the acquisition of right knowledge at right time. [8], argued that it is one of the main facets of an organization and knowledge management is regarded as an important capabilities of firms which an organization successful and these are regarded as asset which assists the integration between all supply chain partners. [9], made an argument that scarce studies are available on the association between knowledge management and supply chain practices. Further do they impact a company's performance? Empirical evidence is present which states that the green practices in supply chains assist an organization to outperform in fiscal and environmental performance. In this regard, [10], argued that it is much needed to pinpoint the drivers require to employee the green supply chain management practices. Further it was also argued that even though these practices have gained much attention in recent two decades, still there is need to study the construct to get more insights in future studies [11].

Customer awareness regarding the environment has increase as compared to previous decade, firms' practices embed its image in mind of customers. So to manage the sustained competent Thai electronics industry it has become essential to create a good image of organizations. Thus, this research study

aims to consider the antecedents of green supply chain management practices and how do they influence the environmental performance. Later sections of the study mentions literature review, methods, results and potential areas for future studies.

2. Literature

2.1 Environmental performance

Generally speaking how do the firms actions impact the environment can be regarded as the environmental performance of that firm. The environmental performance can be positive or negative based on its impact on environment. [12], argued that the environmental performance denotes to the impact of activities of an organization on the environment. In order to get the better environmental performance it is necessary for an organization to point out the sources for the environmental problems such as logistics, procurement and production etc. From supply chain management practices perspective [13], argued that environmental performance measure the organizations' ability to lessen the emission of CO₂, SO₂, NO_x and other dangerous gases which results due to overall activities in a supply chain of an organization. It can be stated as a relationship between the firm and the environment which contains the outcomes of usage of resources, impact of organizational activities, goods and services on environment and meeting the legal requirements. According to [14], during the production process businesses often use bundle of resources which are already limited. Thus, they results in environmental problems by releasing the waste into water, air and cause the pollution. [12], argued that actually environmental performance assesses the capability of an organization to lessen the waste, pollution, prevention of hazardous chemicals and reduce its impact on the environment. Similarly, it was argued that the rising environmental concerns have made it necessary for the organizations to reconsider their impact on environment and address the concerns regarding the environmental performance [11].

1.1 Green knowledge management capability

Recent, decade has seen an increasing research trend on how do the knowledge management contributes towards the supply chain management. Considerable research has concluded that the knowledge management results in improved supply chain management [15]. Further [16], argued that the

knowledge management capability of the organizations help them to improve their performance. Organizations through their knowledge management capabilities can exploit the new knowledge, gain the new knowledge which will contribute towards the competitiveness of organization. It is the organizational capability which addresses the firm's ability to gain, create, and transfer, integration, sharing and application of resources regarding the knowledge and activities across the functional boundaries to produce new knowledge. Further the implementation of knowledge management in organizations provide them with the ability to cope with the ever rising competition in the corporate world. Some researchers has regarded the knowledge management capability as set of knowledge process and include some aspects such as knowledge attainment, distribution and employment [17], documenting, acquiring [18] and documenting the knowledge, transfer and protect it [19]. Based on the above conceptualizations and different perceptions of the researchers it is argued that "the green knowledge management capability denotes the firm's ability to gain, create, and transfer, integration, sharing and application of resources regarding the knowledge and activities across the functional boundaries to produce new knowledge related to go green concept". Which is ultimately aimed for the betterment of the organizations' performance in an environment.

2.2 Internal environment management

According to [20], internal environmental management refers to the firms' policies to safeguard the environment and targets to ensure the environment safety. All the policies and targets are made by organizations. Internal environment management practices makes sure the support from all managerial managers regarding the practices related to environment management. It also makes sure the cooperation between the different departments regarding the environmental improvements and building a system [21]. All the practices mentioned earlier falls under broad domain of internal environment management. Similar term such as green internal management has also been used to conceptualize this construct which denotes the practices of an organization which are employed with the primary aim to lessen the impact of an organization on the environment. These practices includes the policies, internal awareness and

regulatory compliance of an organization with the environment [22].

2.3 Green supply chain management practices

The rising environmental issues such as global warming, resource depletion, change in biodiversity has put the sustainability at danger. Individuals from diverse areas such as professionals, scientists, academicians and scholars are working to recommend the possible ways to keep the environmental sustainability [11]. In this regard it is argued that the unexpected and reckless industrial actions carries a possible danger to the sustainability. Which has resulted in an attempt to develop sustainable practices in every industry. It can be termed as "Green practices". The word green implies that performing the actions by considering their impact on environment and ecology [2]. Therefore, the environmental concerns have triggered the move to redesign the supply chain to be sustainable [11]. Being a significant component of operations management, supply chain has viable impact on the environment in form of emissions, pollutions etc. [1] argued that environment related concerns have become part of the organizations as an effort to lessen their environmental impression. Furthermore, [23], argued that the application of green concept (environment related concerns) in the supply chain management practices is termed as green supply chain management practices. [24], has defined the GSCMPs as "integrating environmental thinking into supply-chain management, including product design, material sourcing and selection, manufacturing process, delivery of end-of-life management of the product after its useful life". Further, [25], proposed GSCM as "an integration of concerns regarding the environment into the internal practices of an organization which are linked with the sustainable supply chain". Green supply chain management practices have been defined by different researchers differently. [11], argued that "it is the broad concept and there is no single clear definition to define it". Regardless of definitions and different conceptualizations green supply chain management practices are focused on the following aspects: environmental issues should be kept in mind while designing a product, what is the impact of organization on the environment, green procurement, production, distribution and also the green reverse logistics. It also focuses on the five practices such as reduction of waste, remanufacturing, recycling, and alternatives disposal which is primarily focused to reduce the waste generation inside the supply chain [26]. It also improves the operational performance of

business and environmental performance of an organization [12].

2.4 Green knowledge management capability and green supply chain practices

[15], conducted a study by collection of 165 responses from food industry companies they reported that KMC of an organization significantly impact the supply chain management practices. Previously it is argued that when knowledge is shared, integrated and applied between the supply chain members it leads towards the significant benefits for an organization which include the cost and cycle time reduction, improved quality and good customer services [27]. Therefore, the knowledge management between the supply chain members led towards the productive processes involved in supply chain [26]. It ultimately increases the chances to survive in competitive environment. Similarly, [28], conducted a study which included 195 USA based SMEs. This study conclude that supply chain knowledge management capabilities are dynamic capabilities which lead towards the productive decision making. Which ultimately improves the supply chain performance. There is insufficient empirical evidence available regarding the link between knowledge management capabilities and supply chain management practices [9,15]. Based on the previously mentioned literature review it is hypothesized that:

H1: Green knowledge management capability and green supply chain management practices are significantly related.

2.5 Internal environment management and green supply chain management practices

Green supply chain management practices ask for greater coordination such as for developing a new product aligned with green concept requires collaboration with customers for the integration of their demands while product is in design process. Internal extensive environmental management ask for great deal of coordination. This can be attributed to the internal environment management [29]. TQM and JIT are the factors of internal environment. In this regard [10], concluded that JIT and TQM both are significantly related with the green supply chain management practices and both of them advances the green practices of an organization. Based on the literature it is hypothesized that:

H2: *Internal environment management and supply chain management practices are significantly related.*

2.7 Green supply chain management practices and environmental performance

An organization's performance in environment can be significantly improved by green supply chain management practices as it is focused to eradicate all kinds of environmental wastes. These practices also do decrease the ecological impact as these are focused for better environmental performance by decreasing the emissions and release of solid wastes in water [10]. Similarly other study by [12], conducted a study and collected data from the companies dealing in chemicals, automotive and electronics companies [4]. The results reported a significant positive relationship between internal environment management and green supply chain management practices. Regarding the green practices it is argued that these lead towards the improved environmental performance by decreasing the wastes resulted due to the businesses. Conclusively the environment is positively influence by green supply chain practices. So it is hypothesized that:

H3: *Green supply chain management practices and environmental performance are significantly related.*

2.6 Green supply chain management practices as a mediator

Previously various studies have reported a significant positive link between the knowledge management capability and supply chain management practices [9, 15, 27]. Which asserts that when the organization is successfully acquiring, sharing and implementing the knowledge related to green practices throughout the supply chain then it lead towards the green supply chain management practices. Similarly when firms also do maintain their internal environmental it will also lead towards the green supply chain management performance. Which finally will improve the environmental performance of a firm. It has been supported by previous study which argued that manufacturing firms which do follow the JIT and TQM improves their green supply chain performance as JIT are focused to reduce the waste and TQM are focused at to provide with optimal quality products and services. Thus, it ends up in improved environmental performance [10]. Green supply chain management practices are broad in context and are inclusive of every effort which is aimed to reduce the organizational adverse effect on the environment [12]. Based on the previously available empirical evidence it is hypothesized that:

H4: *Green supply chain practices are significant mediator between green knowledge management capability and environmental performance*

H5: *Green supply chain management practices are significant mediator between internal environmental management and environmental performance*

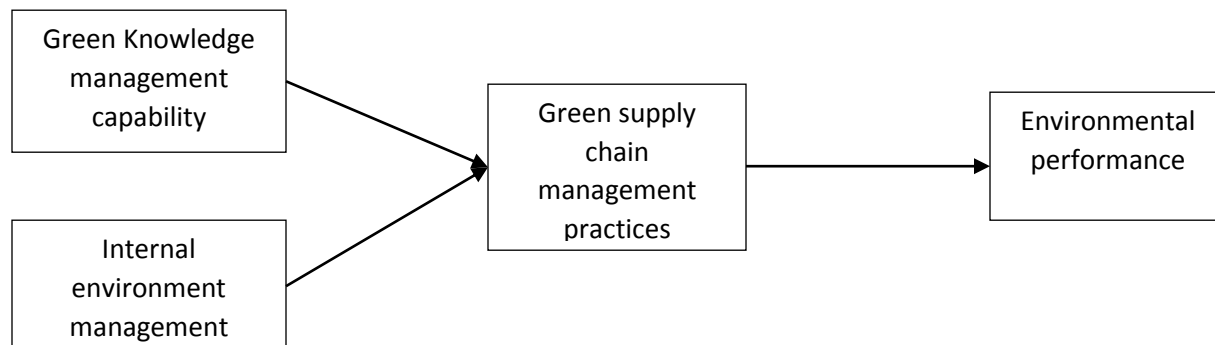


Figure 2.

3. Methodology

The model and hypothesis were tested in electronics industry of Thailand. The electronic sector of Thailand has been recognized as 2nd largest producer regarding the air conditioning units in the world. 2017 marked the Thai electronics exports at 23.7 billion USD. Approximately 750000 individuals are employed in Thai electronics and electric sector. Which makes it an important sector to study [30]. Approximately there are 2300 firms which fall under the category of electronic and electric manufacturing industry. [31], developed a table to select an appropriate sample size. According to which sample size for the study was 332.

Questionnaire was used for data collect and it consisted of two sections which are as follows: *First section* consisted upon the demographic information of the respondents. *The second section* consisted upon the questions regarding the variables under study. Following are the details of the measures adapted for the present study. To measure the green knowledge management capability of the organization 20 items scale was adapted [9, 32, 33]. Internal environmental management was measured

by using 7 items scale, green supply chain management practices were measured by using 23 items scale and 6 items scale was used to measure the Environmental performance [34]. 332 questionnaires were sent to the procurement managers working in the electronics and electric manufacturing factories with the prior email to fill up the questionnaire. The data collection resulted in 166 valid responses which were further used in data analysis [21].

4. Findings

Convergent validity ensures that each item measure its own variable and not the other variable. Regarding the convergent validity measurement [10] proposed factor loadings, composite reliability and average variance extracted as a criteria to assess convergent validity. Following table 1 is representing the indicators' loadings for each construct of the present study. According to [15] all the values for the indicators if greater than 0.50 then it indicates the convergent validity.

Table 1. Confirmatory factor analysis

Constructs	Items	Loadings	Alpha	AVE	CR
Environmental Performance	EP1	0.785	0.776	0.85	0.554
	EP2	0.827			
	EP3	0.840			
	EP4	0.829			
	EP5	0.275			
Green Knowledge Management Capability	GKMC1	0.675	0.885	0.898	0.565
	GKMC10	0.433			
	GKMC11	0.504			
	GKMC12	0.736			
	GKMC13	0.703			
	GKMC14	0.687			
	GKMC15	0.757			
	GKMC2	0.717			
	GKMC3	0.683			
	GKMC4	0.648			
	GKMC5	0.402			
	GKMC6	0.530			
	GKMC7	0.682			
GKMC8	0.474				

	GKMC9	0.438			
Green Supply Chain Management Practices	GSCMP1	0.692	0.903	0.915	0.524
	GSCMP2	0.717			
	GSCMP3	0.589			
	GSCMP4	0.718			
	GSCMP5	0.764			
	GSCMP6	0.759			
	GSCMP7	0.728			
	GSCMP8	0.705			
	GSCMP9	0.715			
	GSCMP10	0.694			
	GSCMP11	0.698			
	GSCMP12	0.465			
	GSCMP13	0.462			
	GSCMP14	0.455			
	GSCMP15	0.462			
Internal Environment Management	IEM1	0.791	0.845	0.884	0.526
	IEM2	0.807			
	IEM3	0.723			
	IEM4	0.463			
	IEM5	0.748			
	IEM6	0.782			
	IEM7	0.704			

Table 1 is presenting the values for ‘factor loadings’, ‘composite reliability (CR)’ and ‘average variance extract (AVE)’. If factors loadings are greater than 0.50 it adds to the convergent validity of measurement [35]. Table 1 and figure 2 is showing that all the factor loadings are in acceptable range. For convergent validity the values for CR and AVE should be greater than 0.8 and 0.5 respectively [36] and all the values for CR and AVE are within acceptable range which established the convergent validity.

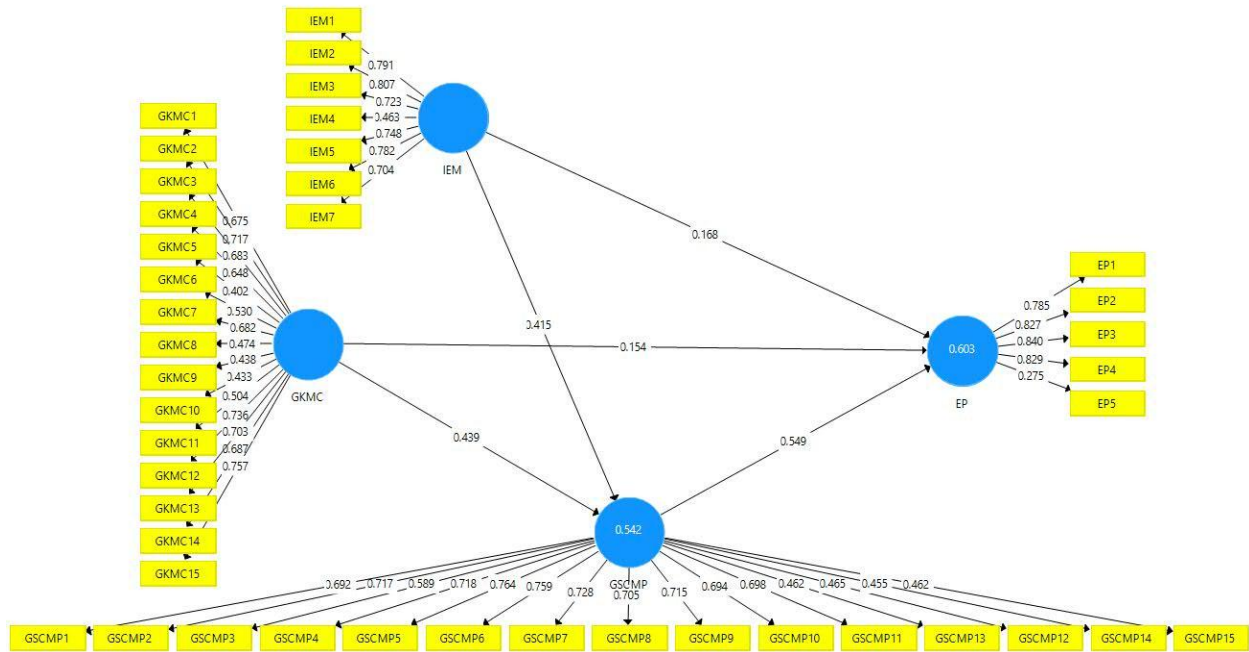


Figure 3. Factor loadings

4.1 Discriminant validity

It is the extent to which the measurement items are not a reflection of other variables under study. This study has used followed the ‘Heterotrait-Monotrait

ratio’. According to [1] the HTMT ratio should be less than 0.85 for discriminant validity. All the values in table 2 are below 0.85 which asserts that there is no issue with the discriminant validity.

Table 2. Discriminant validity

	EP	GKMC	GSCMP	IEM
EP				
GKMC	0.675			
GSCMP	0.844	0.634		
IEM	0.686	0.52	0.659	

4.2 Structural Equation Modeling

Figure 4 is representing the path modeling reflecting the *t* values. Whereas table 3 showed the results and whether hypothesis are accepted or not. Results reported a significant positive relationship between green knowledge management capability and green supply chain management practices ($\beta= 0.439, t=16.74, f^2=0.322, VIF=1.308$). Thus supported the hypothesis H1. Further results also reported that internal environment management and green supply chain management practices are significantly related

($\beta= 0.415, t=15.133, f^2=0.287, VIF=1.308$) further direction for the relationship was positive which led to acceptance of hypothesis H2. Lastly, hypothesis H3 has also been supported by the results as the relationship between them is significant and positive ($\beta= 0.549, t=15.838, f^2=0.347, VIF=2.184$).

Table 3. Path coefficients

Hypothesis relationships	beta	SD	t values	Decision	R2	f2	VIF
GKMC -> GSCMP	0.439	0.026	16.74	Supported	0.542	0.322	1.308
GSCMP -> EP	0.549	0.035	15.838	Supported		0.347	2.184
IEM -> GSCMP	0.415	0.027	15.133	Supported		0.287	1.308

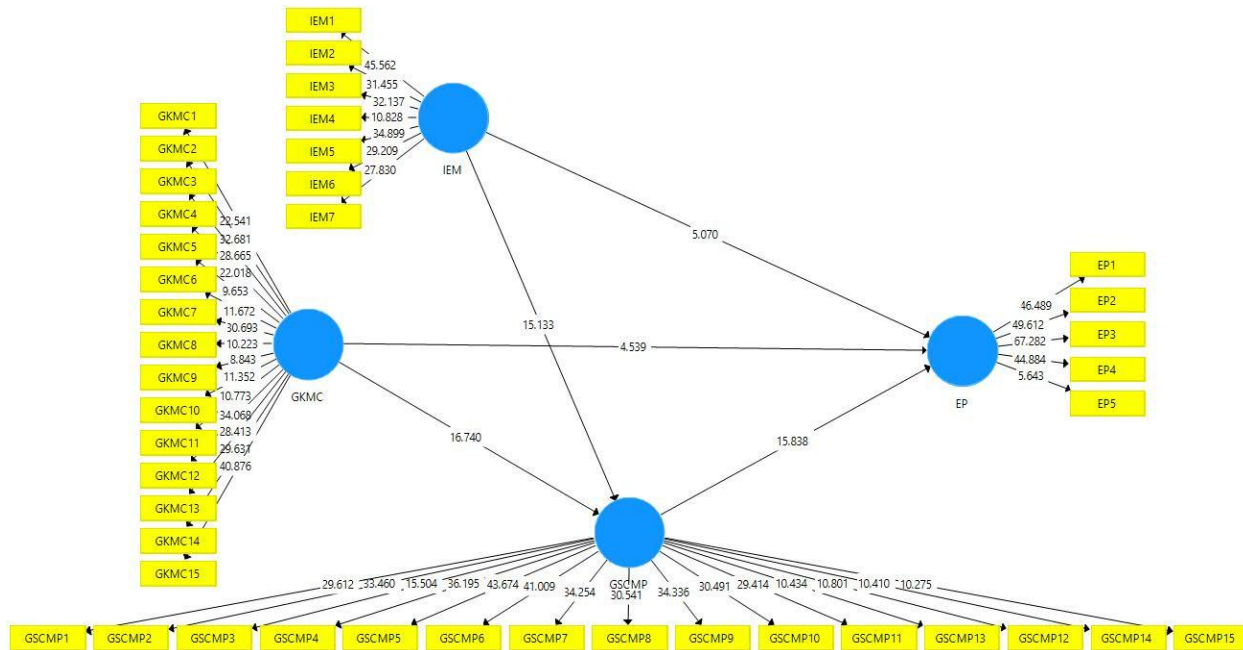


Figure 4. SEM path modeling

4.3 Indirect effects

Findings (Table 4) revealed the green supply chain management practices significantly mediates the link of green knowledge management capability, internal environment management and environmental performance which is valued at 0.241 and 0.228

respectively. Both of the hypothesis H4 and H5 are reinforced by the results of the study. It further asserts that in the presence of green supply chain management practices the overall impact of green knowledge management capability and internal environment management becomes more positive and significant.

Table 4. Specific indirect effects

Hypothesis relationships	beta	SD	t value	Decision
GKMC -> GSCMP -> EP	0.241	0.021	11.511	Supported
IEM -> GSCMP -> EP	0.228	0.02	11.66	Supported

5. Discussion

This section of the present study will elaborate the study findings, limitations and future directions. Due to increasing environmental concerns organizations

are continually focusing towards their impact on the environment in such scenarios the SCMP have attained much importance in an attempt towards an improved organizational performance on environment. In this regard present study has

investigated the impact of green knowledge management capabilities and internal environmental management on the environmental performance of an organization. Further the study also investigated the mediation role of green supply chain management practices which ultimately improves the environmental performance of an organization. The study argued that green knowledge management capability significantly influences the green supply chain management practices. Results reported a significant positive relationship between green knowledge management capability and green supply chain management practices ($\beta = 0.439$, $t = 16.74$, $f^2 = 0.322$, $VIF = 1.308$). Thus supported the hypothesis H1. The findings of the present study are in line with the previous study [15], which concluded that knowledge management capabilities do contribute towards the green supply chain management practices. When an organization is acquiring, sharing the green knowledge then it will improve the green supply chain management practices which finally lead towards the better environmental performance. This argument has been supported the previous study in which [27] made an argument that when knowledge is shared between supply chain members it can boost up the knowledge flow in the supply chain which improves productivity and makes sure the quickly response to dynamic customer needs. The study also proposed that internal environment management has significant relationship with green supply chain management practices. Results also reported that internal environment management and green supply chain management practices are significantly and positively related ($\beta = 0.415$, $t = 15.133$, $f^2 = 0.287$, $VIF = 1.308$) which led to acceptance of hypothesis H2. The study also proposed that there is significant relationship between green supply chain management practices and environmental performance of an organization. Lastly, hypothesis H3 has also been supported by the results as the relationship between them is significant and positive ($\beta = 0.549$, $t = 15.838$, $f^2 = 0.347$, $VIF = 2.184$).

Further the current study also proposed a mediation role of green supply chain management practices between relationships of green knowledge management capability, internal environment management and environmental performance. The results concluded green supply chain management practices as a significant mediator between relationships of green knowledge management

capabilities, internal environment management and environmental performance. Findings of present study are in line with the previous studies [10, 12, 15].

This study offers some valuable managerial implications for the managers in the electronics industry regarding how they can maintain and improve the green supply chain management practices and improve their overall environmental performance. This study has reported the role of managing knowledge to improve the supply chain and environmental performance. Furthermore, the managers will be able to [37-40] utilize the findings for the more deeply integration of green concept in the supply chain. It will also help the managers to reduce their organizations' impact on the environment. While the study has successfully accomplished its objectives though there are some limitations as well which must be taken under consideration while results interpretation. Firstly, this study only considered the electronic and electric industry so it serves as an opportunity for the future studies to segregate the study sample regarding their nature of business such as trading, manufacturing and supporting accessories of the electronics industry. It will provide a comparative view regarding the perceptions of managers/owners in the same industry with different nature of business regarding the green supply chain management practices. Further it is suggested that the data should be collected from more respondents in similar industry or other industry. Moreover, collection of data from different supply chain partners will provide more valuable insights regarding the green supply chain management practices.

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