

Impact of Quality Management Techniques and System Effectiveness on the Green Supply Chain Management Practices

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Abstract--Nowadays organizations are facing multiple challenges such as survival in competitive dynamic and competitive environment, meet the customer needs and the impact of their action on the environment are the few ones to name. Sustainability has triggered the need for the companies to revisit their supply chains to cope up with the environmental needs and one of the major demand from the customers as well. In this regard the present study has examined the impact of quality management techniques and system on the green supply chain management practices. The study has explored the JIT, TQM and quality management system effectiveness as a potential driver for the green supply chain management practices. The data were collected from the procurement managers which were working in the auto parts manufacturing industry. Smart PLS was used for the data analysis. Results of the study revealed a significant link between all the independents (TQM, JIT and quality management system) and dependent variable (green supply chain management practices). The direction of all the relationships was positive. However, according to the results TQM was the strongest predictor for the green supply chain management practices.

Keywords: Total quality management, Just-in-time, Quality management system effectiveness, globalization, automotive, auto parts, procurement managers.

1. Introduction

Nowadays concerns regarding the environment are increasing which has triggered the importance of sustainability among the companies. Governments and companies are now focusing on the green practices in order to address the environmental

concerns and enhance the sustainability [1]. It has resulted in growing attention towards the green supply chain management practices in the field of research as well. Globalization has also broadened the scope of the green supply chain management practices. Now firms rely on their internal and external supply chain processes to gain the competitive advantage [2]. Having huge customer base is also a source of the competitive edge. Customers are now demanding for the companies to act proactively and save the environment. Firms which are engaged in manufacturing of the products are required to respond to the dynamic demands of the immediate and ultimate customers. They are asking the organizations to act environment friendly and provide them with eco-friendly products which do not harm the environment [3, 4]. It has triggered the application of green concept within the organizations for their supply chain practices.

Automotive sector is regarded as one of the major sector in a country in terms of trade economy and trade. It helps everybody in daily routine life and persistently used around the globe. The automotive is considered as an important sector it helps the other industries to move and contributes heavily in the economic growth of a country. It has become 2nd leading sector regarding the steel consumption which consumes almost 15% of the steel production. Other sectors which also have some considerable market in the automotive are the aluminum (5%) and petrochemicals (7%). Being a big giant it has created

a harm to the environment which asks for the further research to find out ways through which its impact on the environment can be reduced [5]. It was argued that lot of studies have been done in the automotive sector regarding different perspectives such as buyers and suppliers and their practices, design of product, how a product is manufactured, where it is stored and how it is transported. Meanwhile it is studied from numerous perspectives. But majority of the literature

is based in the North America and Europe. Which asserts that there is need to study the automotive sector in the context of emerging economies. By paying attention to this gap present study has selected the automotive sector of Thailand as primary sector for the study. According to Asean up [6], there more than 500000 employees working in automotive sector and this sector contributed almost 12% of Thai GDP. It is one of the major contributor in the economy.

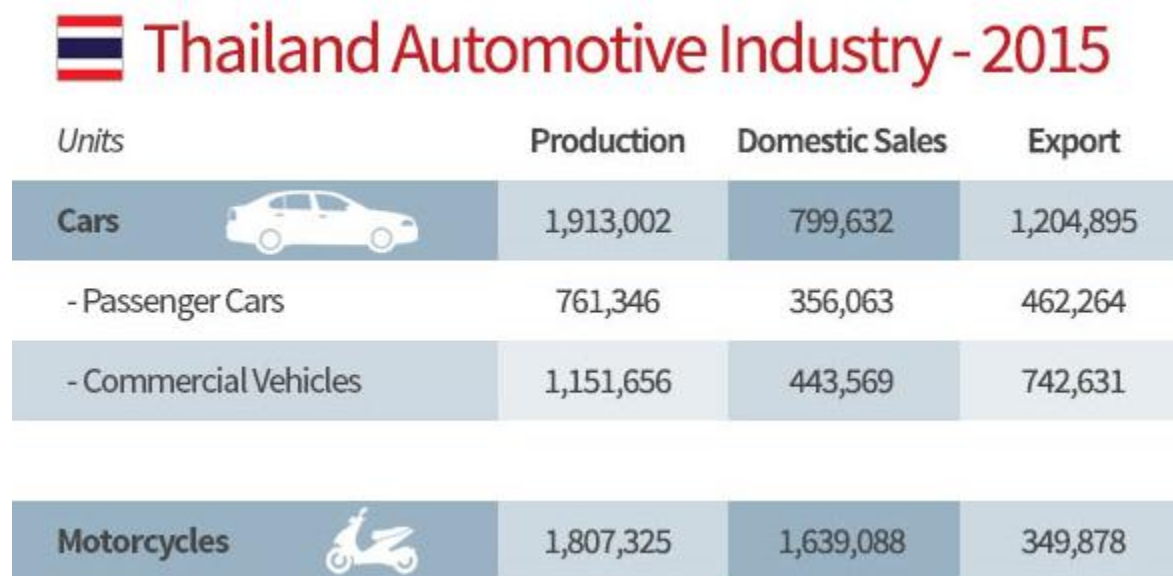


Figure 1

Source: Asean up [6]

Green supply chain management improves the organizations' performance in all aspects such as financially, socially and environmentally. Empirical evidence is available which states that following the green practices in supply chain results in better environmental performance of a firm [7, 8], financial performance [9] and organizational performance [10]. Which asserts that it is also necessary to identify the factors or antecedents which contribute towards the green supply chain management practices [7]. This study identifies the three main antecedents namely; Just-in-time (JIT), total quality management (TQM) and quality management system (QMS) which contributes towards the green supply chain management practices. Generally speaking JIT and TQM can provide valuable contribution towards the supply chain management practices. In this regard it was argued that one factor focuses on reduction of

wastes and the later one focuses to provide the customer with excellency in products and services [7].

There is lot of criticism regarding the interrelationship of total quality management and quality management system/practices. According to some authors [11] quality management system is subset of the total quality management whereas according to some other authors it is not and they argue that total quality management is subset of the quality management [12, 13]. According to Asif, et al. [14], QM in broad context denotes and umbrella term which includes number of quality management and improvement programs (Haseeb, Iqbal-Hussain, Ślusarczyk, & Jermsttiparsert, 2019). Whereas TQM covers the fineness models such as EFQM, MBNQA and six sigma. Fernandes, et al. [15], argued that QM system and supply chain management systems must

be studied regarding their integration. The knowledge is still limited regarding the similarities and differences between their relationship and integrations which asserts for the study of association between quality management and supply chain management. So following this rationale current study seeks to explain the impact of different components of quality management system and overall quality management system on the green supply chain management practices. Previously there are studies available which has examined the JIT and TQM or lean productions but only few ones have studied these constructs in combination. This study has integrated the three quality related constructs which can influence the green supply chain management practices. To best of our knowledge this is one of the few studies especially in Thailand which has combined the three quality related factors as an antecedents for the green supply chain management. Primary objective of this study is to assess the impact of JIT, TQM and QMS on the green supply chain management practices. The findings of present study will be helpful for the production managers in the organizations to effectively and efficiently manage the quality systems at production that contribute towards the green supply chain management practices. A brief literature review is mentioned in section two, methodology is mentioned in section three. Data analysis and results are presented in section four of the study. The final part of the study provides the discussion and future directions.

2. Literature review

2.1. Green supply chain management practices

Sustainability issues has gained greater attention in the recent decade and as a key aspect of the sustainability initiatives, green supply chain management has appeared to be an important strategic direction which can result in competitive advantages for the company with at bottom line [16]. Green supply chain design ask for the adoption of best practices completely and across all the levels of a business which ranges from conceptualization to product delivery or even the recycling stage of a product. Many companies have admitted that greening the supply chain has provided them with number of benefits such as reduced cost of operation, improved their business' sustainability (Ahmed, Isa, Majid, Zin & Amin, 2017). Green supply chain management is inclusive of different functions such as plan, execute, monitor and control the practices, approaches and tools that helps a firm in their

greening initiative. It helps a firm to be more socially responsible and by protecting the environment enhances its sustainability [17].

2.3. TQM

Soares, et al. [18], argued that total quality management is a set of practices which emphasizes on the continuous improvement, continuous measurement of outcomes, satisfying the needs of customers, collectively solving the problems, reduction in working schedule, long term planning and a good relationship with the suppliers. Total quality management comprises three words which can be elaborated as follows: Total means that each individual in the firm is dedicated to a broad context of the quality, it may also include the customers and suppliers as well. *Quality* denotes that the needs of the customers are completely satisfied. *Management* means that the managers at every level of the organization specifically the top management is supporting and enthusiastically implementing a quality oriented organizational culture [19].

JIT

Just-in-time is also a philosophy which falls under the continuous improvement terminology. It emphasize that products should only be produced when they are needed. It ask for the effective quality management system. JIT requires that the quality must be designed into products and processes and raw material should be of refined quality. Further it also for the empowerment of employees so they can use the tools and equipment required to do a job [20]. Just-in-time is employed to reduce/minimize the cost and for the improved performance in production as it reserves the minimum possible work in process which is the ultimate purpose of the JIT. This argument has been supported by previous study which argued that Just-in-time is one of the modern techniques employed for the better performance of firm, diminish production wastes. Undoubtedly, it is playing a considerable roles in nowadays working environment and for the accomplishment of organizational objectives (Haseeb, Abidin, Hye & Hartani, 2018). It is well known system in the world and beneficial for the companies especially the advantages which have been derived by the manufacturing companies helped the JIT to gain such popularity [21].

2.2. QMS effectiveness

Organizations get benefits by establishing the quality management systems. Quality management system improves the organizational performance by focusing on the two major requirements such as customer's requirement and organization's requirement. Earlier one denotes the sureness in the capability of a firm to provide with the preferred product/service to the customers to satisfy their needs. Later one denotes that the organization internally and externally working at an optimal level with lowest cost as possible. Responsible utilization of the resources by considering the impact on the environment and sustainability concerns of the society. It also enables an organization to accomplish its goals and objectives. It has been proposed as combination of fully integrated actions/activities which are focused to give direction or control an organization for the continuous improvement. Further to persistently present the better performance [22].

Quality management system is broader term which includes number of tools and techniques for the quality management and improvement [14]. Quality management is a concept which encourages an organization to be distinctive (Ali & Haseeb, 2019). Customers are always look for the organizations which can encounter their prerequisites in terms of product or service delivery. They seek for the organizations which can go beyond their expectations [15]. In this way the quality management system impacts the organizational performance and satisfaction of customers and stakeholders as well.

2.5. TQM and green supply chain management

Tan, et al. [23], conducted a study which examined the relationship between total quality management practices and supply chain management by collecting 218 responses from the logistics companies managers in Malaysia. They reported a positive direction for the impact of total quality management practices on the supply chain management practices, while the results was significant. They also contended that companies should focus on the TQM practices in order to form a systematic and competitive supply chain management. Zimon [19], argued that the total quality management improves the supply chain management. It was also reported a positive direction for the impact of the soft and hard TQM practices on the supply chain performance in the areas namely: flexibility, cost, relationship with stakeholders and

responsiveness. All the total quality management practices adds value in SCM [24]. Moreover Alharbi, et al. [25], by collecting responses from 204 respondents in Saudi hotel industry has reported that the total quality management improves the organizational sustainability. As previously mentioned literature highlights that the total quality management do improve the supply chain management practices and following the findings of previous study [7], it is hypothesized that:

H1: Total quality management is significantly related with the green supply chain management practices.

2.4. JIT and green supply chain management

Just-in-time focuses on the elimination of the processes which are not adding any value to goods/services and waste. Which leads towards the sustainable supply chain management [26]. It is worthy to mention the list of main green supply chain practices by Carvalho, et al. [27] which are as "reduction of redundant and unnecessary materials, introduction of reusable and remanufactured parts in the material inventory, reduction of replenishment frequency, integration of the reverse material and information flow in the supply chain, environmental risk-sharing, waste minimization, reduction of transportation lead time and the efficiency of resource consumption". According to the previous studies Just-in-time is focused on the reduction of waste [7] from different processes such as production and delivery of products and services [28]. Similarly, a study [29] which focused on the Australian organizations reported that the Just-in-time had a positive impact on their environmental sustainability. The findings of the study asserts that Just-in-time can be a predictor of the green supply chain management practices. Previous studies clearly mention that the green supply chain management practices are focused to reduce the resource waste and Just-in-time is also focused on the reduction of waste so it can argued that the implementation of the Just-in-time practices in the organizations will improve their green supply chain management practices. Based on the literature it is hypothesized that:

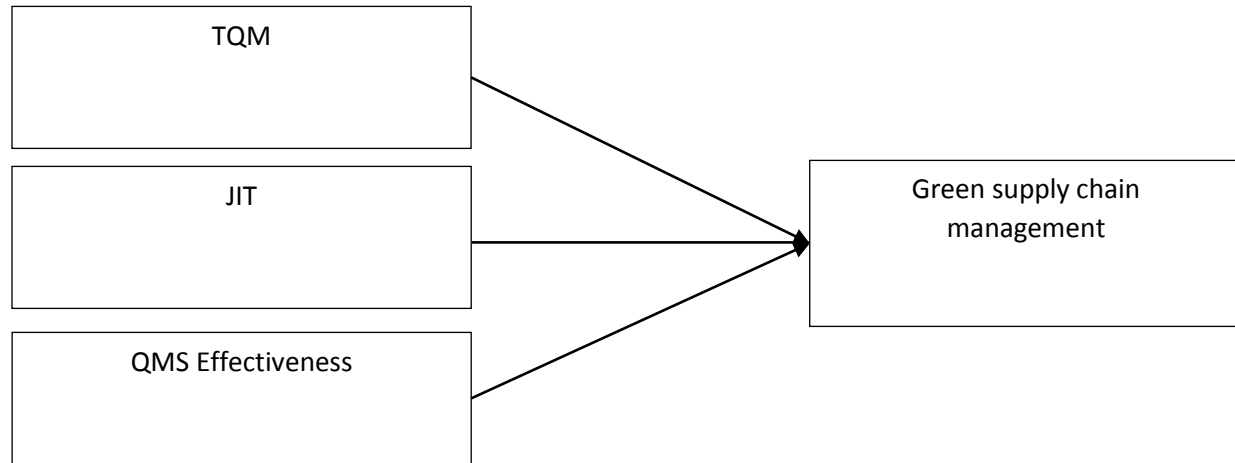
H2: Just-in-time is significantly related with the green supply chain management practices.

2.6. QMS effectiveness and green supply chain management

Recent two decades have seen an increasing trend of empirical and hypothetical research on quality management. Some previous studies have reported a strong positive and significant relationship between quality management, financial and non-financial performance of organizations [15, 30, 31].

H3: *Quality management system effectiveness is significantly related with the green supply chain management practices.*

Following is the theoretical model for the present research study:



3. Methodology

Thai auto parts manufacturing industry was selected to get the responses for the study. According to Asean up [6], there more than 500000 employees working in automotive sector and this sector contributed almost 12% of Thai GDP. 350 sample size was carefully chosen using the Krejcie and Morgan [32] sampling table and by adopting the convenient sampling data were collected. Initially, permission for data collection was obtained from the HR managers of the firms and then the questionnaires were distributed to the procurement managers working in auto parts manufacturing firms. Data collection took 2 months. A structured questionnaire was designed for data collection from the respondents which consisted of two sections.

The first section addressed the questions regarding the respondent's personal profile and second section addressed the questions related to the variables under study. Measures for the total quality management, just-in-time, quality management system effectiveness and green supply chain management practices have been adopted from the previous studies the details of which are as follows: Green supply chain management practices were measured

with a measure of 23 items [33]. Total quality management and just-in-time was measured by 13 items each [34] and 14 items measure was adopted for the measurement of quality management system effectiveness [13]. Data collection from the respondents resulted in 200 valid responses which were used for further data analysis. Some of the items from the questionnaires with low factor loadings were deleted.

4. Results

First of all the convergent validity is calculated in this study. The purpose to assess the convergent validity is to make sure that items in a measuring instrument are measuring the latent variable to which they are supposed to and they are not measuring the other latent variable. There are three criteria are proposed which asserts that the scale has convergent validity. These criteria are known as "factor loadings, composite reliability and average variance extracted" (Hair et al., 2010). First of all, it is checked that either all the factor loadings are up to certain criteria or not. If there is any problem with the factor loadings the particular item will be deleted. As it is obvious from the table that some of the items were deleted as their value was below 0.50. A scale will be regarded as

having convergent validity if the value is greater than 0.50 [35]. All the values in the below mentioned table are in acceptable range. The table is also showing the alpha values for the variables which are also within the acceptable range. Table 1 is also showing the

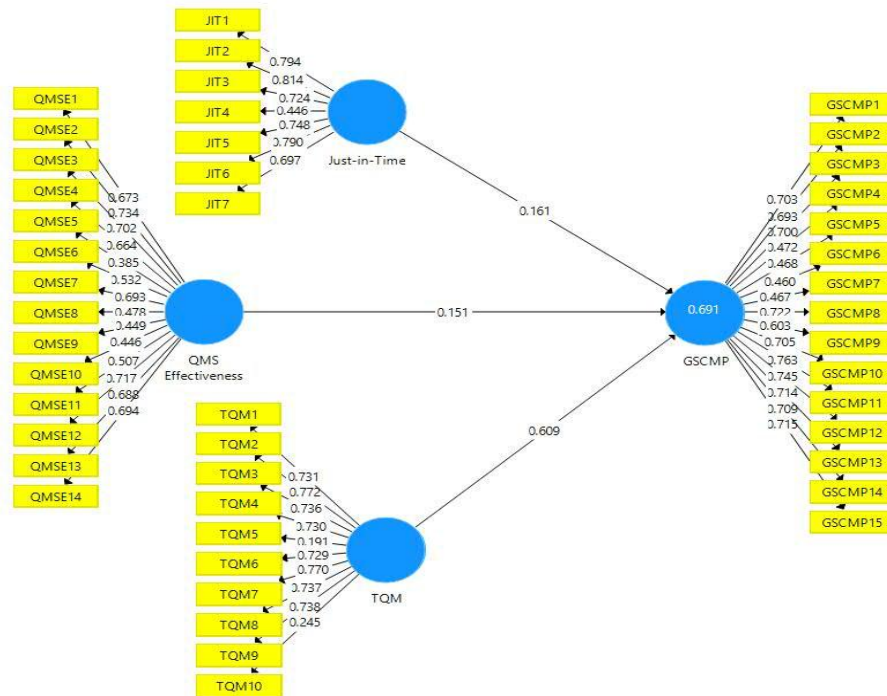
values for the AVE and CR. As per the criteria the values for AVE and CR should be greater than the 0.5 and 0.8 respectively [36]. All the values are more than the acceptable range which asserts the convergent validity for the scale.

Table 1
Confirmatory factor analysis

Constructs	Items	Loadings	Alpha	AVE	CR
Green supply chain management practices	GSCMP1	0.703	0.903	0.521	0.915
	GSCMP2	0.693			
	GSCMP3	0.700			
	GSCMP4	0.472			
	GSCMP5	0.468			
	GSCMP6	0.460			
	GSCMP7	0.467			
	GSCMP8	0.722			
	GSCMP9	0.603			
	GSCMP10	0.705			
	GSCMP11	0.763			
	GSCMP12	0.745			
	GSCMP13	0.714			
	GSCMP14	0.709			
	GSCMP15	0.715			
Just-in-time	JIT1	0.794	0.845	0.526	0.883
	JIT2	0.814			
	JIT3	0.724			
	JIT4	0.446			
	JIT5	0.748			
	JIT6	0.790			
	JIT7	0.697			
Quality management system effectiveness	QMSE1	0.673	0.875	0.555	0.888
	QMSE2	0.734			
	QMSE3	0.702			
	QMSE4	0.664			
	QMSE5	0.385			
	QMSE6	0.532			
	QMSE7	0.693			
	QMSE8	0.478			
	QMSE9	0.449			
	QMSE10	0.446			
	QMSE11	0.507			
	QMSE12	0.717			

	QMSE13	0.688			
	QMSE14	0.694			
Total quality management	TQM1	0.731	0.841	0.551	0.881
	TQM2	0.245			
	TQM3	0.772			
	TQM4	0.736			
	TQM5	0.730			
	TQM6	0.191			
	TQM7	0.729			
	TQM8	0.770			
	TQM9	0.737			
	TQM10	0.738			

Figure 3 Factor loadings



4.1. Discriminant validity

The other criteria for the validity of measure is known as discriminant validity it measure the degree to which the questions in a measure do not reflect the all other variables under study. Previously used the

Fornell-Larcker criterion for the discriminant validity. However the latest studies are using the new technique named as ‘Heterotrait-Monotrait ratio’. For discriminant validity under HTMT technique the HTMT ration should be less than 0.85 [37]. As shown in table 2 all the values for the HTMT ration

are not more than 0.85 which asserts the discriminant validity of measurement.

Table 2
Discriminant validity

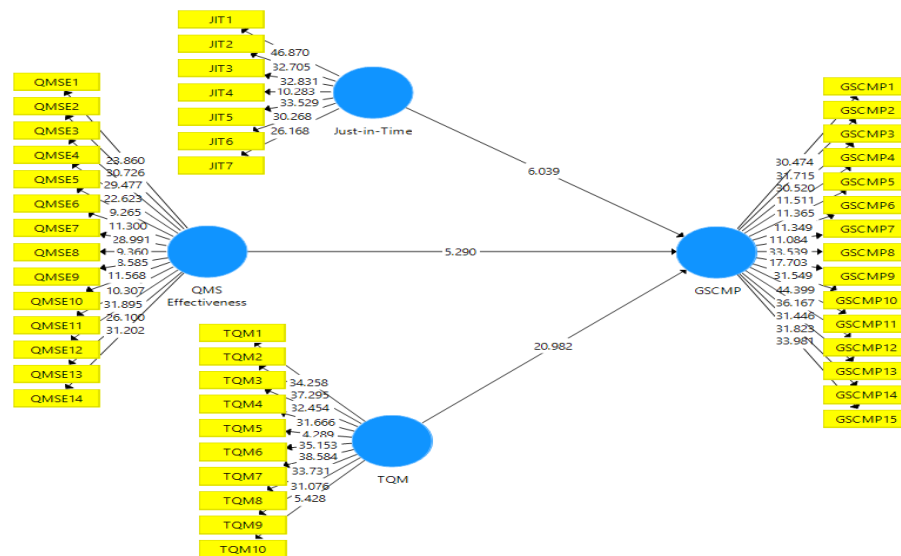
	GSCMP	Just-in-Time	QMS Effectiveness	TQM
GSCMP				
Just-in-Time	0.659			
QMS Effectiveness	0.613	0.508		
TQM	0.845	0.723	0.713	

4.2. Structural Equation Modeling

Table 3
Path coefficients

	beta	SD	t Value	Decision	R2	f2	VIF
Just-in-Time -> GSCMP	0.161	0.027	6.039	Supported	0.691	0.049	1.725
QMS Effectiveness -> GSCMP	0.151	0.029	5.29	Supported		0.042	1.775
TQM -> GSCMP	0.609	0.029	20.982	Supported		0.514	2.337

Figure 4 SEM path modeling Structural equation modeling has been used to test the hypothesis under study. Table 3



is showing the path coefficients for the hypothesis tested in the study. According to the results the relationship between just-in-time practices and green supply chain management practices is significant and valued at 0.161. The direction of the relationship is positive which means that improvement in one

variable will improve the later one. General interpretation of results means that 1% change in just-in-time practices will bring about 16% change in the green supply chain management practices. Similarly the other relationship between quality management system effectiveness and green supply

chain management practices has proved to be significant and its value is 0.151. The direction of the relationship is positive. Lastly, the relationship between total quality management and green supply chain practices has proved to be significant and is valued at 0.609. The direction of the relationship is positive. Thus the results of the study supported the hypothesized relationships and all the hypotheses (H1, H2 and H3) are accepted. It is obvious from the results that the total quality management has the strongest impact on the green supply chain management practices as compared to other variables. Figure 4 is showing the structural paths for the variables.

5. Discussion

The globalization, rapid economic growth, changing world order, and most importantly the environmental issues have created a serious situation for the businesses in which it has become necessary for them to review/redesign their processes. These situations have put the supply chain sustainability as a topic of concern for the practitioners and researchers. Having in mind the growing importance of the green supply chain management practices, the present study has attempted to examine the impact of total quality management, just-in-time and quality management system on the green supply chain management practices. As these all are focused on the continuous improvement, waste reduction etc. which can improve the overall sustainability of the supply chain of a business. In this regard the present study hypothesized a significant link between total quality management and green supply chain management practices. The results of the study reported a significant association between total quality management and green supply chain management which is valued at 0.609. The direction of the relationship was positive. The findings of the present study are in line with the previous study [19, 24]. Which also has concluded that the total quality management contributes towards the green supply chain management practices. In this regard Green, et al. [7] also commented that total quality management directly influences the green supply chain management practices which further lead towards the better environmental performance. The study also hypothesized a significant association between Just-in-time and the green supply chain management practices. The results also reported a significant link between Just-in-time and green supply chain management practices which is valued 0.161. The

direction of the relationship was positive. The results of the present study are in consistency with the previous studies [26, 29]. Finally, the study hypothesized that quality management system effectiveness is significantly related with the green supply chain management practices. Accordingly the mentioned relationship is valued at 1.51 as per the results of the study [38-41]. This signifies that all the hypotheses of the study have been accepted which asserts that the total quality management and just-in-time practices not only improve the supply chain management practices of the firm but also lead them towards the sustainability. As per the results of the study total quality management has emerged to be the strongest predictor/contributor for the supply chain management practices. Which asserts that the organizations need to focus on their quality, efficiency and effectiveness. Further it also interprets that the organizations need to strictly focus on the six sigma technique for the quality management. Overall it must be improved in the organizations to get better results.

The present study offers some valuable implications for the managers regarding how they should integrate the quality related techniques to improve their green supply chain management practices. This study has reported that total quality management, just-in-time and effectiveness of quality management system improves the green supply chain management practices in an organization which further asserts that the practitioners must focus on these aspects to improve their organizational impact on the environment. All the objectives and hypotheses have been supported by the results of the study, still there are some limitations which can serve as a potential area for the future research to be carried out by the researchers. Firstly, the longitudinal research should be designed in order to get better insights for the causal relationships between the under study variables. Further a comparative study can be designed for better understanding of the results. In future the research study may collect the data from the stakeholders or customers. Hence further research studies are suggested.

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