

## Relationship between Green Supply Chain Management, Supply Chain Quality Integration, and Environmental Performance

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### ABSTRACT

This study aims to investigate the relationship between green supply chain management and supply chain quality integration on environmental performance. A quantitative approach was adopted for this study; a multi-item measurement scale was adapted from previous studies to collect primary data—the total number of 212 responses from supply chain professionals were collected. Descriptive analysis along with the correlation examination was utilized to test the hypothesis. It was observed that all the hypotheses (H<sup>1</sup>, H<sup>2</sup>, H<sup>3</sup>, and H<sup>4</sup>) were supported. Customer green purchasing, green customer cooperation, supplier quality integration, and customer quality integration were found significantly related to the environmental performance. So the study concluded that implementing green supply chain management practices in the firm is beneficial and it enhances the firm's environmental performance. This detailed research analysis will play an active role for the supply chain executives in taking effective decisions that will ultimately enhance environmental performance. This research study will facilitate the managers and all decision makers by providing directions and guidance for improving the level of performance of the environment.

**Keywords:** Supplier quality integration, Customer quality integration, Green purchasing, Customer green cooperation, Sustainability

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## **Relationship between Green Supply Chain Management, Supply Chain Quality Integration, and Environmental Performance**

### **1. Introduction**

Awareness related to environmental stability is now increasing day by day in the societies of the whole world. To ensure the protection of the environment, the government of various countries has developed different approaches like the development of strict ecological regulations, supporting cleaner production and endorsing ISO 14001 (Tran et al., 2020; Uddin, 2022). Nowadays, in manufacturing industries, it is essential to highlight ecological protection and sustainable production, which act as a priority in manufacturing firms. It was observed that the internal operation of manufacturing firms causes many environmental issues. These issues are also related to upstream and downstream supply chain operations (Saeed et al., 2018; Wu, 2013; Asif, 2022). The ecological programs and proactive initiatives need collaboration in the supply chain. An element of awareness related to the capabilities of the environment and its protection is also essential among supply chain members (Li et al., 2016). To create a sustainable and green image of the environment, the firms need to reduce the pollution from the atmosphere by enthusiastically collaborating with their vendors & customers to effectively implement the concept of green SCM. GSCM mainly supports integrating ecological thinking into SCM (Zaid et al., 2018). It also includes selection and sourcing of material, product design, manufacturing process, delivery of the final product to the end customers and the product end-of-life management after the product's useful life (Singh et al., 2018). Two leading green practices include in green supply chain management; those practices involve green cooperation from customers and green purchasing (Jabbour et al., 2014; Teixeira et al., 2019)

The ecological problems have been considered as the natural addition of quality problems. The low quality of products and firm processes can result in adverse environmental outcomes (Wu, 2013; Alam, 2022). Moreover, there are so many problems and issues that occur in SC operations. Through the combination of supply chain integration and quality management concept, another term is achieved called supply chain quality integration (SCQI). Through this, organizations can improve and enhance the quality level of their product and firm processes (Yu & Huo, 2018; Zhang et al., 2022; Baloch & Rashid, 2022). SCQI can be explained as the extent to which internal functions of firm and external SC members strategically and operationally cooperate to mutually manage quality-related linkages (Huo et al., 2013; Yu & Huo, 2018). The quality integration of suppliers and customers are the two leading practices to develop organizational strategies and practices into a cooperative process that relates to quality to meet the requirements and expectations of customers (Zhang et al., 2019). The quality management system in organizations has been considered a critical tool in reducing the level of pollution in the environment. It can also provide an opportunity for organizations to adopt the concept of GSCM in their firm and positively link it with effective environmental performance (Tran et al., 2020). Though the mechanism through which the impact of SC quality integration on the environment's performance is not defined, few researchers have associated SCQI with environmental performance and Green supply chain management.

Due to the highly competitive market and to achieve a competitive advantage, quality has become a vital tool for any company's operations (Hien et al., 2019; Kura et al., 2020). Nevertheless, market competition's attention is no longer limited to inter-organizational supply chain practices. Quality management practices have become a focal point for companies and can efficiently affect the inter-organizational functions and external supply chain partners (Ha et al., 2016). By inducting a green supply chain, the organizations are willing to enhance environmental performance (Çankaya & Sezen, 2019). Thus, quality has become an important and focal point for supply chain management to achieve a competitive advantage. So the problem statement of this study is to integrate supply chain integration and quality management. The present study will incorporate this problem statement and test the relationship between supply chain quality integration and environmental performance by adopting

green supply chain practices mediating between quality integration and environmental performance. Therefore, there are a few following particular research questions as given below:

*RQ1: What is the relationship between green purchasing and environmental performance?*

*RQ2: What is the relationship between customer green cooperation and environmental performance?*

*RQ3: What is the relationship between supplier quality integration and environmental performance?*

*RQ4: What is the relationship between customer quality integration and environmental performance?*

## **2. Literature Review**

### **2.1 Theory of Supply Chain Quality Integration**

Supply chain quality integration (SCQI) comes from connecting the management of quality with the integration of SC, the concept of SCQI can be explained as the extent to which a firm's internal role/functions and external partners of the supply chain (SC) collaborate operationally and tactically (Huo et al., 2013). The definition of integration in SC highlights customer-value orientation and presents the potential to join quality management with supply chain integration (Foster & Ogden, 2008; Khan & Wisner, 2019). Literature based on supply chain integration has found the connection or relationship between quality management (QM) and integration of SC but the results or outcomes have been mixed. A researcher found that the intensity of integration in SC significantly influenced the delivery quality and reliability of products (Rosenzweig et al., 2003). However, in another study, it is recognized that supplier, customer, and internal integration significantly affect the quality performance of the firm (Wong et al., 2011). Another researcher believed that supplier integration significantly influences quality performance but on the other hand customer integration did not show any effect (Devaraj et al., 2007).

The concept of SCQI includes three dimensions; customer quality integration, supplier and internal quality integration used in the context of the internal supply chain and external (Sila et al., 2006; Yu & Huo, 2018). Research believed that collaboration or development of a relationship with supply chain partners for managing the firm's quality standards ultimately improves results related to the firm's performance (Huo et al., 2013; Lin et al., 2005; Sila et al., al., 2006; Yeung, 2008). Moreover, many studies reveal that integration with suppliers and customers may contribute to affecting outcomes about the performance of the organization's SC in different ways (Zhao et al., 2013). Many academics related to the management of quality fail to recognize the unique influence of internal, customer, and supplier quality integration on the competitive performance of organizations (Flynn et al., 2010). Moreover, minimal studies explain how to develop an integrated system infirm to advance the quality performance of the SC firm (Zhang et al., 2019).

### **2.2 Conceptual Framework**

The given below Figure 1 illustrate the proposed conceptual framework for this research study. It contains two independent variables, which include supplier quality integration (SQI), customer quality integration (CQI), green purchasing (GP) and customer green Cooperation (CGC). On the other hand, it has one dependent variable: environmental performance (EP).

#### **2.2.1 Supply Chain Quality Integration (SCQI)**

The term SC quality integration is explained as the extent to which internal functions of a firm and external SC members collaborate in both contexts, strategically and operationally. This concept allows organizations to effectively all kinds of associations, procedures & communications related to

the quality between two firms or within the organization to achieve desired goals related to quality in a low-cost frame (Huo et al., 2014). SCQI is also categorized into two sections external quality integration and internal quality integration (Huo et al., 2014; Huo et al., 2016; Yu et al., 2017; Yu & Huo, 2018; Zhang et al., 2019). Internal quality integration mainly focuses on joining the quality-related processes of a firm's internal supply chain functions. Internal quality integration also supports forming its practices, functions and strategies into cooperative and coordinated processes to meet the customers' requirements in the context of quality. On the other hand, external quality integration is elaborated as the extent to which a firm incorporates with their supply chain members the development of inter-organizational strategies, procedures and practices into the cooperative process to fulfil the quality-related demands of the customers (Huo et al., 2014). External integration is also considered as the extension and expansion of internal quality integration to the downstream customers and upstream suppliers with the involvement of customer and suppliers quality integration that also essential and is considered as the main quality-related capabilities for synchronizing complex SC members (suppliers & customers) (Huo et al., 2014; Yu & Huo, 2019; Shaheen, 2022).

### ***2.2.2 Customer quality integration (CQI)***

CQI is the concept that also plays a vital role in creating sustainable competitive benefits for the firm. Developing and maintaining intense contact with the customers not only allow firms to get effective feedback about the quality of the products but also act as an encouraging factor for sharing quality information about demand and mutually solving issues related to the quality of product among two parties, in that manner the helping firms provide products with high quality and also provide reliable, trusted and fast delivery services by maintaining flexible production at a minimum level of cost. The information collected from customers in the form of product feedback provides much help to the firms for further improvement in the quality standards of their products. Customers' contribution also helps firms form a new product by providing the correct information about the requirements of the product. It also helps firms to involve in customer-driven product development, in that way firms effectively enhance the rate of product success and minimize the risk of innovation. According to an empirical study, customer focus positively influences the operational performance of an organization (Xu et al., 2020). Another researcher indicated that SCQM plays an immense role in the enhancement of the quality level of the final product (Soares et al., 2017). From past research, it was also observed that customer quality integration significantly improves the product delivery unction and minimizes the cost of product in the context of quality (Huo et al., 2014; Anwar, 2022).

### ***2.2.3 Supplier quality integration (SQI)***

The concept of SQI is identical concept of CQI. SQI is a robust dynamic competency that helps firms to create sustainable competitive benefits (Yu & Huo, 2019). For organizations, the sharing of quality information, and coordination of processes with suppliers act as a beneficial activity that can enhance the effectiveness of quality management. In that way, organizations promote their process of production and performance related to quality (Huo et al., 2016). The contribution of manufacturers in the enhancement of quality standards provides excellent support to the suppliers to meet requirements related to the quality, which ultimately enables suppliers or vendors to provide suitable material and mechanisms. In this manner, helping and coordinating manufacturers or firms increase the quality of services and their products (Yu & Huo, 2017). On the other hand, in developing a new product, the involvement of suppliers enables the organizations to generate products quickly by minimizing the product manufacturing cost (Yu et al., 2017). Vendors' authorization helps the supplier strengthen and understand the quality requirements and provisions to ensure that the raw material and other elements fulfil the requirements. Authorization also stops suppliers' opportunistic attitude in dealings to successfully minimize the supply risks. In that way, manufacturers ensure the excellent quality standards of products and lessen the chances of a product recall. In various past research studies, the association between supplier quality integration and a firm's operational performance has been observed in various contexts. For instance, it was observed by the authors' definitions that a vast network of firm supply chains could increase their capacity to meet the expectations of their end customers. Past studies found that supplier quality control highly supports the supplier in forming new products in that manner. They

contribute to improving product quality (Ali, 2022). Another study clarifies by their study that suppliers' quality management positively and significantly affects the operational performance of a firm (Soares et al., 2017; Victory et al., 2022). Mardani et al. (2020) specified in their research work that practices of quality management, like the selection of suppliers and their participation, particularly in designing products, improvement seminars and programs, directly enhance the firm's operational performance.

#### ***2.2.4 Green supply chain management (GSCM)***

The concept of green SCM is considered an encouraging concept that mainly focuses on the firm's environment while managing other supply chain functions. To a large extent, green SCM highly put efforts to gain effective results related to the atmosphere by adopting the method of the life cycle from selection of material, design of product, production and end sales of product and its recovery. Mainly the term green SCM is explained as the integration of environmental concepts into the field of SCM by including product design, sourcing of raw material, manufacturing process, delivery of the final product to the end customers and end of product life cycle after its useful life (Tseng et al., 2019). In addition, green SCM practices are considered as the bundle of activities that are joined with ecological problems into SCM to ensure atmospheric compliance s and enhance the capabilities and effectiveness of the supply chain environment (Lee, 2015). The results of the implementation of green SCM must be displayed in various contexts, including ecological, economic and social perspectives, to ensure sustainable development and performance (Alayón et al., 2017; Amjad, 2022)

#### ***2.2.5 Green purchasing (GP)***

The term green purchasing is explained as it is the eco-friendly purchasing practice that minimizes the cause of wastage and enhances the process of recycling material and recovery of purchased material without badly affecting the material performance requirements. The practice of GSCM integrates the concept and thinking of atmosphere with the supply chain system, including purchasing of material, product design, selection of suitable material, product manufacturing process, delivery of the final product to the end consumers and end of the product life management after useful product life (Çankaya & Sezen, 2019; Tseng et al., 2019). The material purchasing process is one of the essential processes that comes at the very first stage of manufacturing activities by the firms where purchasing of materials highlights impactful ecological management that is required for implementing green purchasing behaviour in firms (Foo et al., 2019; Rasheed, 2022). Like many other researchers, Hsu et al. (2014) explain that the concept of green purchasing is considered the most responsible way of the material purchasing process that occurs through following both social and ecological concerns. On the other hand, it participates in activities that minimize and recycle the material that precise the ecological preferences through the supply chain system.

#### ***2.2.6 Environmental performance (EP)***

The level of awareness about environmental performance is increasing daily, and measures and different policies have been formed to improve the environmental condition at various stages. Many government and non-government organizations & international NGOs and also the United Nations putting efforts to make eco-friendly policies. The implementation of ecological strategies is increasing daily to lessen the ecological disruptions and enhance the factors of a healthy environment. The strategies implemented in firms to maintain the better condition of the environment include minimization of CO<sup>2</sup> gas, the release of a chemical, minimizing the level of energy consumption, recycling of products and keeping control on pollution, reducing the wastage and purification of water. The association between ecological performance and an organization's firm performance has been studied (Fujii et al., 2013; Hunaid et al., 2022). Figure 1 illustrates the research model.

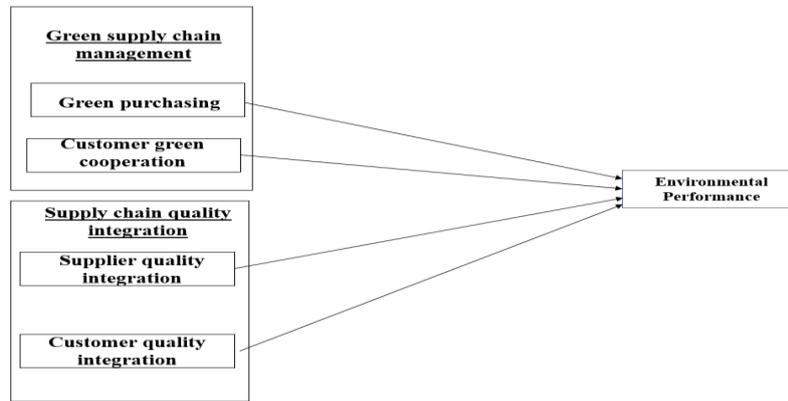


Figure 1: Conceptual framework

## 2.3 Hypothesis Development

### 2.3.1 Green purchasing and environmental performance

The purchasing process is considered one of the primary strategic business processes many manufacturers and organizations use to perform a bundle of activities (Jabbour et al., 2017). The purchasing process plays an immense role in selecting the right product in the form of raw material, core components and other supplies that are used to form a complete desired product (Jabbour et al., 2017). In that way, suitable suppliers are also an essential part of the business that mainly help provide the suitable material to the industrialists. Quality suppliers also improve the purchasing process of the firm by reducing the risk and enhancing the overall value to the buyer firm (Zhang et al., 2018).

Purchasing process highly contributes to a significant ecological threat in the form of rejected packaging material. However, with time, awareness about ecological issues has been increasing worldwide; therefore, many organizations are focusing on greening their purchasing system. Purchasing initiatives that are according to the environmental concerns include procurement of particular products and services that strongly meet objectives related to the atmosphere (Semana et al., 2019). The concept of green purchasing help organizations reduce the adverse effects on the environment in the firm's manufacturing process and prevent transportation by using durable and reusable material. The organizations that are applying environmental strategies in their purchasing process get benefits in the form of saving costs, a good image of their service in public and minimizing the level of liability (Abdel-Baset et al., 2019). Those organizations that can leverage their green supply chain system with low cost, improved quality, and ecological concern features to impact their structure of total cost and quality of their services and products have a competitive benefit in their business market (Al-Ghwayeen & Abdallah, 2018).

*H1: Green Purchasing has a significant relationship with environmental performance.*

### 2.3.2 Customer green cooperation and environmental performance

The practice of customer green cooperation is critical in the business field as it allows organizations and manufacturers to organize projects based on ecological improvements to minimize pollution in the downstream supply chain (Zailani et al., 2012). Customer green cooperation makes a manufacturer capable of fulfilling all the environmental regulations and policies in various markets to enhance their operational performance and competitive benefits in the business market (Yang et al., 2013). By maintaining contact with the clients to support ecological purposes, an industrialist can implement the concept of green in of product, transportation process, wastage of water, solid wastages, minimization of carbon emission and utilization of dangerous material that is used in downstream supply chains (Green et al., 2012). Firms' collaboration with their customers on designing eco-friendly products, cleaner production and green eco-friendly packaging allows the manufacturers capable them

to enhance the level of production to minimize the level of pollution and utilization of energy and enhance ecological performance (Jabbour et al., 2014; Yang et al., 2013). Therefore, we propose that

*H2: Customer green cooperation has a significant relationship with environmental performance.*

### **2.3.3 Supplier quality integration and environmental performance**

The concept of supplier quality integration links with the suppliers, internal processes, and projects that help firms improve their quality standards. An extensive structural model of supply chain quality management and firm performance (Quang et al., 2016; Yu & Huo, 2018). Manufacturers and vendors can maintain their quality in the decision-making process and in setting objectives related to performance through building long-lasting, strategic and stable relationships. Through long-term association, organizations form eco-friendly strategies, most notably when firms face awareness about atmospheric conditions from different business investors. Decision-making and planning or other processes done with coordinated behaviour will speed up the suppliers and manufacturers to mutually manage the processes of material purchasing, including technological design and workflow of manufacturing firms (Flynn et al., 2010). A quick exchange of information and knowledge allows the manufacturers to provide the specifications of products and various other processes to the suppliers by following the ecological requirements. Effective communication among manufacturers and suppliers enhances the atmospheric image (Wiengarten & Pagell, 2012; Yu et al., 2019). Mutual efforts to solve the problems play an immense role in making manufacturers and suppliers more familiar, ultimately helping producers and suppliers synchronize for the material purchasing process (Zhang & Yang, 2016). Therefore, it is clear that the concept of supplier quality integration can encourage the producers to work with the suppliers to enhance green purchasing (Yen & Yen, 2012).

Supplier quality integration highly certifies that vendors provide eco-friendly products with high-quality standards that can substantially enhance the satisfaction level of customers, which ultimately allows the suppliers to actively cooperate with the manufacturers in accomplishing ecological objectives (Huo et al., 2013; Yu & Huo, 2019). The industrialists are also more enthusiastic about spending more money to avoid the level of pollution in the downstream SC of a firm. In that way, they enhance the green corporation with customers, resulting in SQI (Blome et al., 2014). Therefore, quality integration with suppliers provides a foundation for accomplishing solutions to minimize the ecological effect of the material flows with customers (Zhang & Yang, 2016).

*H3: Supplier quality integration has a significant relationship with environmental performance.*

### **2.3.4 Customer quality integration and environmental performance**

The practice of customer quality integration enhances the firm's quality capabilities by collaborating and cooperating with customers on the designing of products and enhancing the quality and learning from customers about the product of their requirement (Huo et al., 2014; Lo et al., 2018). The quality integration of customers helps the industrialists use less harmful materials and improve the production process of firms that implement green purchasing. In the upstream supply chain, customer integration is valuable in cleaner production, product recycling, and green packaging (Jermisittiparsert et al., 2019). Through cooperating planning with customers in the delivery of products process and production, the concept of green purchasing is much more likely to be executed because it is essential to make products according to the customers' requirements. Moreover, to satisfy the requirement of the customers, manufacturers actively seek suppliers' support, ultimately promoting the cooperation and linkage between the manufacturers and suppliers to arrange better environmental objectives (Yu et al., 2019). The industrialists will provide product design, including the ecological requirements for purchased material, to the vendors and apply eco-labelling (Zhang & Yang, 2016).

When the industrialists and vendors achieve quality integration in their processes, green capabilities and innovation competencies increase at both sides' suppliers & manufacturers (Seman et al., 2019). Industrialists can share quality information and knowledge and develop green strategies with their customers (Flynn et al., 2010). The contribution of customers to a firm's projects that they initiate for quality improvement also acts as a key to solving the problems jointly like recycling of products, less consumption of energy during delivering products to the end customers that ultimately facilitate the concept of green customer cooperation (Burki et al., 2019). In addition, customer quality integration encourages manufacturers and industrialists to increase investment in buying and implementing technology that helps firms control pollution. It also supports firms to implement an ex-post control which is an ecological management program that is an environmental management program that actively participates in the enhancement & increase of customer green cooperation (Santos et al., 2019)

*H4: Customer quality integration has a significant relationship with environmental performance.*

### **3. Research Methods and Materials**

The research approach is based on the objective of the research (Creswell & Creswell, 2017; Alrazehi et al., 2021; Das et al., 2021). According to Creswell & Creswell (2017), there are two primary research approaches one is the qualitative approach and the second is the quantitative approach. The quantitative research study is based on existing theories and concepts, while the qualitative study is based on exploring new concepts and theories. As the current study is based on the existing theories and the objective of this study was to test the relationship among these variables so quantitative approach was used for this study (Rashid et al., 2019; Agha et al., 2021; Haque et al., 2021).

#### **3.1 Data Collection Source**

The data collection sources include the primary source and secondary source of data (Saunders et al., 2009; Rashid, 2016). Primary data is newly collected data initially collected for the research. On the other hand, the secondary source of data collection stated that the gathered data is already collected for other purposes. The data is arranged from newspapers, annual reports, journals, books and other internet sources. Besides this, the primary data sources include surveys, questionnaires, experiments, observations and interviews (Rashid & Amirah, 2017). In the current study, the data will be collected using a questionnaire survey technique, so the primary source of data collection will be used in this study.

#### **3.2 Population and Target population, Sampling Technique, and Sample Size**

The pool of all individuals that can be part of the research is termed the population of the study, i.e. in the current study, all employees related to pharmaceutical companies were the population of the study (Saunders et al., 2009). In contrast, the researcher specifies this population that is more related to the research objective that is termed the target population. In the current study, the target population will be employees related to the supply chain department in manufacturing firms.

It is impossible to collect data from the whole population because of its feasibility and limitation of time for research. So Saunders et al. (2009) stated that to resolve this issue; the researcher should take samples from the target population representing the whole population. Moreover, the author also develops a sampling procedure divided into two types of sampling techniques. One is probability sampling and the other is non-probability sampling. In probability sampling, the researcher knows the chances of selecting participants for a survey, whereas, in non-probability sampling, all participants can be part of the sample. In the current study, non-probability sampling will be used. Further, this non-probability sampling is divided into more types: convenience, purposive, quota, and snowball. In the current study, convenience sampling will be used because the data will be collected from the available participants.

Hair et al. (2018), later cited by Rashid and Amirah (2017), stated that the subset of the target population is the sample. For the sake of accuracy in results, the sample size should be reliable and calculated using a reliable source. Thus, in the current study, the sample size was calculated by using G\*power software. This software was specifically designed to calculate sample size and samples based on a statistical model number of variables. The calculated sample size is 129 respondents (minimum). However, the study collected data from 212 respondents, which adequately generalizes the research findings (Hashmi et al., 2021).

### 3.3 Instrumentation

A structured close-ended questionnaire was developed by adapting constructs from existing studies. It has five constructs which include four items for supplier quality integration, four for customer quality integration, five for green purchasing, four for green customer cooperation, and five for environmental performance (Yu et al., 2019).

## 4. Data Analysis

This study aims to determine the relationship between the dependent and independent variables. Therefore, IBM SPSS version 22.0 was used to test the study hypotheses. A total of 300 questionnaires were distributed to targeted respondents. The selected companies were FMCG and packaging companies. These companies were also interlinked because the packaging firms supply packaging materials to FMCG firms. A total of 220 responses were responded to, eight were dropped due to missing values, and 212 responses (i.e. 70.6%) were kept for data analysis.

### 4.1 Demographic Profile of Participants

Data analysis was performed using IBM Statistical Package for Social Science (SPSS) version 22. The demographic analysis was carried out to test the demographic attributes of the respondents. For analysis of the demographic variables, a summarized result is presented in table 1, which includes Gender (Male/Female), Age, and experience. The total number of respondents was 212, of which 182 (85.8%) were male and 30 (14.2%) female. 64 (30.2%) respondents were less than the age of 25 years, 119 (56.1%) respondents were between the age of 25-31 years, and 29 (13.7%) respondents were between the age of 36 to 40 years. There were fewer supply-chain experienced professionals with 7-10 years of experience (24,11.3%) and more with 3-6 years (117, 55.2%). Whereas 42.5% are young supply-chain professionals who are gaining experience from others' experience had been in the industry for around 6-10 years, and 30% are the entrants to this profession due to its growing demand are between 01-05 years of experience.

Table 1: Demographic profile

Demographic variable	Category	Frequency	Percentage
Gender	Male	182	85.8
	Female	30	14.2
Age	Less than 25 years	64	30.2
	25- 30 years	119	56.1
	36-40 years	29	13.7
Experience	less than three years	117	55.2
	3 to 6 years	71	33.5
	7 to 10 years	24	11.3

Source: SPSS output

### 4.2 Descriptive Statistics

The descriptive statistics were ascertained to check the univariate normality of the data. These values include skewness and kurtosis and the value of skewness should be -3 to +3 (Hair et al., 2018). Table 2 shows the summarized results for descriptive statistics. This indicate that the maximum value of skewness (sk=0.88) is for construct green purchasing (GP) (Mean =3.49, St. Dev. =0.72) while the

least skewness value (sk=0.52) is for construct Supplier quality integration (SQI) (Mean =3.38, St. Dev. =0.68). On the other hand, the maximum kurtosis value (k=1.19) is for construct environmental performance (EP) (Mean =3.46, St. Dev. =0.78). In contrast, the least kurtosis value (k=0.09) is for construct Supplier quality integration (SQI) (Mean =3.38, St. Dev. =0.68). Since these outcomes indicate that all the results are fulfilling the acceptable range, all adapted constructs have no issue with univariate normality.

Table 2: Descriptive statistics

Construct	Mean	Std. Dev.	Skewness	Kurtosis
Supplier quality integration	3.38	0.68	-0.52	-0.09
Customer quality integration	3.54	0.62	-0.64	0.30
Green purchasing	3.49	0.72	-0.88	0.80
Customer green cooperation	3.46	0.74	-0.64	0.53
Environmental performance	3.46	0.78	-0.79	1.19

Source: SPSS output

### 4.3 Reliability Analysis

For the internal consistency of data, the reliability analysis was applied. The acceptable reliability value for each construct should not be less than 0.70 (Hair et al., 2018; Khan et al., 2021; Khan et al., 2022; Hashmi et al., 2020b). Given below Table 3 illustrates consolidated outcomes for reliability analysis. The summary shows that the minimum reliability value is (0.860) for construct green purchasing (GP). Thus, these results indicate that all the reliability values are not less than 0.70, so all adapted constructs have no internal consistency issue and no error related to data collection (Rashid et al., 2021; Khan et al., 2022; Khan et al., 2022).

Table 3: Reliability analysis

Construct	Cronbach's Alpha s
Supplier quality integration	.884
Customer quality integration	.862
Green purchasing	.860
Customer green cooperation	.843
Environmental performance	.854

Source: SPSS output

### 4.4 Correlation Analysis

The bivariate correlation was applied to test the relationship among each pair of constructs. These relationship strengths determine the uniqueness of constructs, which means that each construct measured a different concept. According to Hair et al. (2018), the value for correlation should be not greater than  $\pm 0.90$  and less than  $\pm 0.30$ . The summarized results are presented in table 4. According to the results in table 4, the relationship among each pair of constructs is statistically significant. Moreover, the strangest association (0.770) is between environmental performance (EP) and customer quality integration (CQI). At the same time, the weakest relationship (0.482) is between environmental performance (EP) and Supplier quality integration (SQI). Since these results illustrate that all correlation values are fulfilling the acceptable range with a significant  $p$  value less than 0.01 (2-tailed).

Table 4: Bivariate correlation

Construct	T_SQI	T_CQI	T_GP	T_CGC	T_EP
Supplier quality integration	1.00				
Customer quality integration	0.617	1.00			
Green purchasing	0.498	0.614	1.00		
Customer green cooperation	0.558	0.634	0.665	1.00	
Environmental performance	0.482	0.591	0.670	0.770	1.00

\*\* Correlation is significant at the 0.01 level (2-tailed).

Source: SPSS output

## **5. Discussions**

All the proposed hypotheses were consistent with existing studies, and the findings for the hypothesis that "green purchasing has a significant relationship with environmental performance" was retained and answered research question one: What is the relationship between green purchasing and environmental performance? It was matched with existing literature. For instance, the organizations that are applying environmental strategies in their purchasing process get benefits in the form of saving costs, a good image of their service in public and minimizing the level of liability (Abdel-Baset et al., 2019). The hypothesis that "customer green cooperation has a significant relationship with environmental performance" was retained and answered to research question two: What is the relationship between customer green cooperation and environmental performance? It was consistent with existing literature. For instance, customer green cooperation makes a manufacturer capable of fulfilling all the environmental regulations and policies in various markets to enhance their operational performance and competitive benefits in the business market (Yang et al., 2013). By maintaining contact with the customers to support ecological objectives, an industrialist can implement the concept of green in products, transportation processes, wastage of water, solid wastages, minimization of carbon emission and the utilization of dangerous material that is used in downstream supply chains in downstream SC (Green et al., 2012). The hypothesis that "customer quality integration has a significant relationship with environmental performance" and "supplier quality integration has a significant relationship with environmental performance" were retained. The findings are consistent with existing literature.

### **5.1 Conclusion**

This study was conducted to investigate the association of SC quality integration & green SC management with environmental performance. This particular research was done in the context of manufacturing firms (FMCG & Packaging) that are located in Karachi, Pakistan. The theory of supply chain quality integration is the base of this research study. For the environmental performance, certain variables were adopted from previous research studies, including supplier quality integration, customer quality integration, green purchasing and green customer cooperation. The research population was all pharmaceutical firms located in Karachi, Pakistan, while the targeted population was all of the employees that belong to the supply chain departments. A sample size of 129 respondents from the targeted population was measured through G\*power software. For data collection, the questionnaire survey technique was applied to collect primary data from respondents. A structured questionnaire was circulated among 300 respondents, from which only 212 responses were considered for analysis. Data were analyzed to obtain the results, and all the hypotheses were retained.

### **5.2 Limitations and Recommendations**

Each research has a few limitations and recommendations for future research. First, the data that was collected for this research was gathered from only manufacturing firms in Karachi, Pakistan. In that way, future researchers could reproduce this research in other regions and countries with different businesses by applying this topic to culture and institutional environments to achieve a broad view of research outcomes. Secondly, this particular research study investigated the relationship of GSCM & SCQI with ecological performance. Future empirical studies could also examine the association of GSCM with SCQI in the presence of environmental performance. Third, research was mainly concentrated on the primary influence of GSCM & SCQI practices on ecological performance. For future research studies, scholars could study the moderating impact of internal and external factors like strategic orientation and influential environment.

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