

# The Mediating Impact of Green Supply Chain Management on the Relationship of Supply Chain Integration and Corporate Sustainable Performance

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## The Mediating Impact of Green Supply Chain Management on the Relationship of Supply Chain Integration and Corporate Sustainable Performance

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### Abstract

The aim of the current study is to investigate the mediating impact of green supply chain management (GSCM) in the relationship of supply chain integration (SCI) and corporate sustainable performance (CSP) of the manufacturing industry of Indonesia. The data was collected from 308 top and middle managers by using a random sampling technique. The direct effect key findings have shown supply quality integration (SQI) has positive and significant association with both of the GSCM indicators namely, green production (GP) and customer green cooperation (CGC). Similarly, customer quality integration (SQI) also has a positive and significant association with the GP while did not have significant association with the CGC. The indirect effect key findings have shown that GSCM indicators namely, GP and CGC are significantly mediates among the relationship of SCI like, SQI and SP. The GP also has a significant mediating impact on the relationship of GP and SP while CGC did not have significant mediating impact on the relationship of CQI and SP. These findings indicate that manufacturing industry of Indonesia has a greater attention on the importance of GSCM and SCI to increase their SP. Therefore, these findings added a body of literature which could become a new area of research in future.

**Key words:** green supply chain management, supply chain integration, sustainable performance, Indonesia, manufacturing industry.

### Introduction

In place of the global manufacturing region and more developing country, Indonesia has been facing critical pollution problems and big environmental burden (Muma, Nyaoga, Matwere, & Nyambega, 2014). Inside the overall society rising environmental awareness, government of Indonesia remained developing several practices for the purpose of environment protection, for instance of encouraging cleaner production, establishing regulation on stricter environmental and promoting certification of ISO 140001 (De Giovanni & Vinzi, 2012; Hong, Zhang, & Ding, 2018). The Indonesian manufacturing industries remain required to pay more attention on environmental protection and green purchasing has become one of the strategic tasks and priorities in the "Made in China 2025" program and the 13 Five-Year Plan (Marshall, McCarthy, Heavey, & McGrath, 2015).

There are various sustainable problems which are not made happen in an internal processes of the manufacturer. On the other hand, these are associated to its downstream and upstream supply chain (SC) (Wong, Wong, & Boon-Itt, 2015; Yang, Hong, & Modi, 2011). Therefore, in this way to establish an environmental image and decrease environmental pollution, it is necessary for a manufacturer to actively collaborate with their customers and suppliers for appliances of green supply chain management (GSCM). In the supply chain management (SCM), GSCM could be described as an integrating environmental thoughtful, product design, selection and material sourcing, final product delivery towards customers and end of the life management of product later its valuable life, and manufacturing processes (Azevedo, Carvalho, Duarte, & Cruz-Machado, 2012). The customer green and green purchasing cooptation are waived as the two very important practices of GSCM practices (de Sousa Jabbour, Jabbour, Latan, Teixeira, & de Oliveira, 2014; Hong et al., 2018; Kannan, de Sousa Jabbour, & Jabbour, 2014; S. A. R. Khan & Qianli, 2017; Lin, 2013; Longoni, Luzzini, & Guerci, 2018). At this stage there are maximum manufacturer of Indonesia were applying the green purchasing as well as customer's green collaboration to increase sustainable performance (Santoso, et al., 2020).

The environmental issues considered as the natural enhancement of the quality problems for the reason is that poor product as well as process of quality inevitably indicated towards environmental issues (Longoni et al., 2018). Furthermore, various quality problems are made happen by SC processes and operation of the consumers and suppliers. Applying quality management by SC integration, for example SC quality integration (SCQI) have come in to be an important means in which enhance quality of processes and products (Hong et al., 2018; van Donk & van Doorne, 2016). Therefore, SCQI could be describe as a degree in which a firms internal operations as well as external SC partners are operationally and strategically cooperate with other to mutually manage intra- or inter-firms quality –associated relationships, processes and communication etc, through the objective of attaining low level of costs and high levels of quality which is related to performance (Yu & Huo, 2019a). The customers and suppliers quality integration remain two very important practices for structure of internal organizational strategies, synchronized and cooperative quality associated processes to meet the quality requirements of its customers, procedures and practices (Lo, Zhang, Wang, & Zhao, 2018; ).

Orientation of the quality management by customers and suppliers could be decrease waste as well as defects, and later failing towards supply SCQI can hinder application of maintainable production within a company (Bracci & Tallaki, 2015; Lin, 2013; Muma et al., 2014; Ruiz-Benitez, López, & Real, 2017; Vachon & Klassen, 2007). Moreover, quality management considered as an important aspect in pollution prevention. This will also facilitate the manufacturer towards implement GSCM as well as in future with the sustainable performance it can be positively associate (De Giovanni & Vinzi, 2012; Machado, Telles, Sampaio, Queiroz, & Fernandes, 2019). On the other hand, a tools by which the quality management associated with sustainable performance are not clear, and some researchers have described linked among SCQI, sustainable performance and GSCM. The main objective of the study empirically examines the association among GSCM, SCQI and sustainable performance of Indonesia manufacture industry.

## **Literature Review and Hypothesis Development**

### **The relationship between supplier quality integration and GSCM**

The supplier quality integration (SQI) get used to a basic quality derived of competencies from cooperative association among suppliers and involving suppliers inside internal operations of an organizations. For instance, supplier development, product development as well as quality enhancement projects (Machado et al., 2019) and (Lii & Kuo, 2016) suppliers and producers should keep stability into the decision-making as well as objective of performance, like green manufacturing and environmental strategies, mostly when facing enhancing environmental knowledge from various

shareholders (Sarkis, Zhu, & Lai, 2011). Therefore, synchronized planning can be increase suppliers and the manufacturer to manage jointly the processes of purchasing, including use of material, workflow and technological design (Huo, 2012; Huo et al., 2013; Kristiansen & Santoso, 2006; Pati, Sundram, Chandran, & Bhatti, 2016).

In this way frequently exchange of communication and information also facilitate manufacturer towards providing specifications about product as well as process with comprehensive suppliers environmental requirements, and could urge the suppliers to enhance environmental image, for instance of applying for the certification of ISO 140001 (Wiengarten, Humphreys, Onofrei, & Fynes, 2017). Provide solutions of problems on mutual basis creates suppliers and the manufacturer come to be more familiar that very helpful for manufacturer towards processes of purchasing (Hong et al., 2018; H. Khan & Wisner, 2019; Yu, Zhang, & Huo, 2019). Therefore, SQI can promote the manufacturer to cooperate for purpose of developing green purchasing with supplier help (Lin, 2013; Vachon & Klassen, 2007).

SIQ can be effectively make sure that the suppliers delivered environmental and friendly products in high and stable quality, that could be substantially enhance the customers satisfaction, and also permits them for the purpose of achieving all environmental objectives to be work with manufacturer more actively (Kim, 2006; Lii & Kuo, 2016; Longoni et al., 2018). Furthermore, manufacturer also have extra willing to enhance investment inside pollution within downwards SC, thus with the help of customer developing the green cooperation (De Giovanni & Vinzi, 2012). Accordingly, SQI can encourages the manufacturers to improve written as well as detailed policy and SC management planning such as recycle content of solvent emission and packaging, and also facilitate the green cooperation customers (Lo et al., 2018; Schaltegger, Burritt, Beske, & Seuring, 2014). Therefore, SQI can provides the basis of attaining cooperation solutions towards decreasing the environmental influences with customers and material flows (Youn, Yang, Hong, & Park, 2013). Consequently, on the behalf of above discussion following hypothesis are developed:

**H<sub>1</sub>:** Supplier quality integration has significant association with green purchasing of the manufacturing industry of Indonesia.

**H<sub>2</sub>:** Supplier quality integration has significant association with the customer green cooperation of the manufacturing industry of Indonesia.

### **The Relationship between customer quality integration and GSCM**

Customer quality integration (CQI) enhance the quality abilities through the customer collaborating on design of product and learning from the customers, and quality improvement (Guiffrida, Datta, El Saadany, Jaber, & Bonney, 2011; Kim, 2006; Siyu Li, Cui, Huo, & Zhao, 2019). The CQI very helpful for a manufacturer to utilized minimum hazardous materials as well as optimize the processes of production, and also facilitating the green purchasing implementation (Diabat & Govindan, 2011; Narasimhan & Schoenherr, 2012). In this way the customer integration very beneficial and essential for collaborative implementation to a cleaner production, product recycling and green packaging in upstream SC (Diab, Al-Bourini, & Abu-Rumman, 2015; Schaltegger et al., 2014). Such as, maintaining a close contact towards customers provides helps to the manufacturer to significantly understand and also satisfy requirements of customers on the green management as well as in future manufacturer could design better processes of green purchasing (Chan, He, & Wang, 2012; Diab et al., 2015; Fornasiero, Brondi, & Collatina, 2017).

Stability of the synchronized planning by customers in processes of delivery and production, green purchasing remains more likely for implementation the reason is that it should take in a complete account of the customer requirements and demands . Furthermore, for the purpose of better satisfy the requirements of customers, the manufacturer could be actively seek helps of the suppliers, as a result promoting collaboration between suppliers and the manufacturer to establish the environmental

objectives on constant basis (S. A. R. Khan & Qianli, 2017). In this way a manufacturer can provide specification in design which include the environmental requirements of purchased items towards suppliers (Intravaia & Viana, 2016). Thus, the suppliers can be able to selected using of environmental criteria, for instance certification of ISO140001, and a manufacturer will come to be more actively towards conduct of environmental auditing of the internal operation of suppliers and assess environmental management performances of second-tier suppliers (Pettersen & Johannessen, 2019). As a result, CQI will enhance the green purchasing.

At this stage when customers and the manufacturer attaining a unified quality integration, in this way green innovation competencies of dual sides could be increase (Rajabian Tabesh, Batt, & Butler, 2016; Santoso, Khakifirooz, Fathi, & Wu, 2019; Wolf, 2014). Consequently, manufacturer remain more willing towards customers sharing of private knowledge as well as co-develop the strategies of green management (Agyabeng-Mensah, Ahenkorah, & Korsah, 2019; Diabat & Govindan, 2011). Including customers inside the quality enhancement projects also encourage the mutual problem solving, like product recycling as well as minimize the consumption of energy during process of distribution and transportation, that facilitate the cooperation of green customers (Hong et al., 2018; Kumar, Holt, Ghobadian, & Garza-Reyes, 2015). In addition, CQI encourages the manufacturers to enhance investments within technologies of pollution control and improving cooperation of green customers as well as adopt ex post control an environmental management platform (Longoni et al., 2018; Narasimhan & Schoenherr, 2012). As a result, according to above discussion following hypothesis are suggested:

**H3** : Customer quality integration has significant association with green purchasing of the manufacturing industry of Indonesia.

**H4** : Customer quality integration has a significant association with customer green cooperation of the manufacturing industry of Indonesia.

#### **The relationship between SQI, CQI, GSCM, and CSP.**

There are through integrating of sustainable objectives inside procurement activities, into the success of manufacturers environmental approaches the green purchasing has plays a positive and significant role (Grief, Altmann, & Bogaschewsky, 2017; Lin, 2013). In addition, by increasing the environmental awareness, must enhancing the demands of products which is environment-friendly (Chowdhury, Upadhyay, Briggs, & Belal, 2016; Vachon & Klassen, 2007). Thus, green purchasing cannot just increase the products value, on the other hand it also enables the manufacturer to cooperate with suppliers for design upstream SC processes and provide solution of environmental problems, as a result increasing the environmental practices (Zhu, Sarkis, Cordeiro, & Lai, 2008).

There are the customers green cooperation permits the manufacturer to appliances of environmental development projects to decrease pollution into the downstream SC (Vachon & Klassen, 2006).

Moreover, the customer green cooperation will also enables the manufacturer to act in accordance with several environmental regulations of the different markets, increasing competitiveness and operational performance (Shaorui Li, Jayaraman, Paulraj, & Shang, 2016). With the line in this through collaborating with the customers to bring in the line environmental objectives, the manufacturer can be integrate green philosophy into the design process of transportation and distribution, minimize carbon emission, solid wastes, water waste and hazardous materials consumption in the downstream SC (Bag, 2014; S. A. R. Khan et al., 2018; Setyadi, 2019). In this way cooperating with the customers on cleaner production, green packaging and eco-design enables a manufacturer towards optimization of production as well as operations which rising environmental performance and reducing the consumption of energy and pollution (Das, 2018; Dubey, Gunasekaran, Childe, Papadopoulos, & Wamba, 2017; Pagell & Shevchenko, 2014; Shub & Stonebraker, 2009). Hence, we suggest:



**H5:** Green purchasing is significantly mediating in the relationship of supplier quality integration and corporate sustainable performance of manufacturing industry of Indonesia.

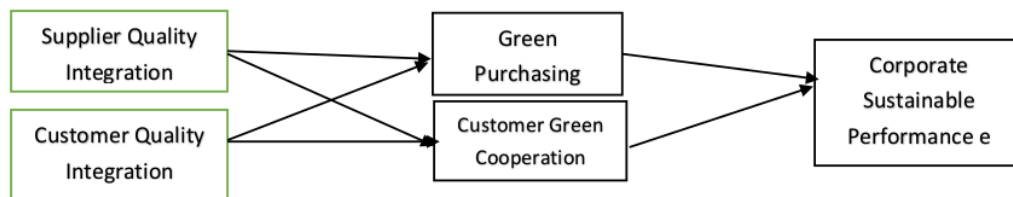
**H6:** Customer green cooperation is significantly mediating in the relationship of supplier quality integration and corporate sustainable performance of manufacturing industry of Indonesia.

**H7:** Green purchasing is significantly mediating in the relationship of customer quality integration and corporate sustainable performance of manufacturing industry of Indonesia.

**H8:** Customer green cooperation is significantly mediating in the relationship of customer quality integration and corporate sustainable performance of manufacturing industry of Indonesia.

### Research Framework

Based on the previous discussions, the current research framework of the study is formulated. In the current framework, the green supply chain management (GSCM) is mediator, supply chain integration (SCI), and corporate sustainable performance is dependent variable. All of these variables are depicted in Figure 1 below.



**Figure 1:** Research Framework of the study

### Research Methodology

The current was consisting of quantitative research approach and used the cross sectional research design. The data was collected by using a self-administered questionnaire from the top and middle managers through the email survey. The manufacturing companies were selected by using a random sampling technique. With the bureau of commerce, there were 450 questionnaires were distributed among the selected responded. Among of them, there were 308 questionnaires were come back from the respondents which yield a 67.4 percent response rate. The questionnaire was adopted from the previous relevant literature. A multiple item, seven-point Likert-type scale (1 = strongly disagree ;7 = strongly agree) was employed for all constructs. The supply quality integration was measured by nine items” (de Sousa Jabbour et al., 2014; Punniyamoorthy, Thamaraiselvan, & Manikandan, 2013). In addition, the customer quality integration was measured by ten items” (Vanpoucke, Vereecke, & Muylle, 2017; Yu & Huo, 2019b). Furthermore, the green purchasing was measured by seven items” (Diabat & Govindan, 2011; S. A. R. Khan & Qianli, 2017). On the other hand, the customer green cooperation was measured by seven items” (S. A. R. Khan & Qianli, 2017; Zhu et al., 2008).

### Data Analysis and Discussions

There are following analysis has been discussed as under below.

#### Construct Reliability and Validity

Before assessing the model, the construct reliability and validity must be established (Hair, Sarstedt, Hopkins, & Kuppelwieser, 2014). Consequently, first, convergent validity assessed and discriminant validity of the measurement model. In addition, the Table 1 has shown the study measurement model. All the factor loadings that are less than 0.5 are deleted from the model in order to establish the indicators reliability. All the constructs have cronbach’s alpha > 0.70, average variance extracted (AVE) > 0.5 and composite reliability (CR) > 0.60 that established the convergent validity of the model (Hair, Hult, Ringle, & Sarstedt, 2014). For

discriminant validity, in the Fornell and Larcker criterion, the diagonal values represent the square of AVE that must be greater than the constructs' correlation with other variables and in the HTMT analysis all the values should be less than 0.85 (Hair, Hult, Ringle, & Sarstedt, 2017). Correspondingly, the Fornell and Larcker criterion and HTMT analysis have been recognized the construct discriminant validity in the following Table of 2 and 3.

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**Table 1: Measurement Model**

Construct	Item	Loadings	Cronbach's Alpha	AVE	CR
Supplier quality integration	SQ1	0.877	<b>0.745</b>	<b>0.66</b>	<b>0.854</b>
	SQ2	0.823			
	SQ3	0.735			
	SQ4	0.890			
	SQ5	0.823			
	SQ6	0.673			
	SQ7	0.783			
	SQ8	0.781			
Customer quality integrations	SQ9	0.903	<b>0.796</b>	<b>0.54</b>	<b>0.851</b>
	CQ1	0.629			
	CQ2	0.611			
	CQ3	0.696			
	CQ4	0.656			
	CQ5	0.726			
	CQ6	0.725			
	CQ7	0.645			
	CQ8	0.711			
Green purchasing	CQ9	0.823	<b>0.749</b>	<b>0.50</b>	<b>0.833</b>
	GP1	0.764			
	GP2	0.754			
	GP3	0.685			
	GP4	0.748			
	GP5	0.577			
	GP6	0.896			
Customer green cooperation	GP7	0.840	<b>0.706</b>	<b>0.53</b>	<b>0.821</b>
	CGC1	0.617			
	CGC2	0.784			
	CGC3	0.757			
	CGC4	0.758			
	CGC5	0.670			
Economic Performance	CGC7	0.912	<b>0.761</b>	<b>0.799</b>	<b>0.504</b>
	EP1	0.721			
	EP2	0.825			
	EP3	0.72			

Environmental Performance	EP4	0.544	<b>0.787</b>	<b>0.811</b>	<b>0.521</b>
	ENP2	0.597			
	ENP4	0.813			
	ENP5	0.719			
Social Performance	ENP8	0.739	<b>0.787</b>	<b>0.855</b>	<b>0.545</b>
	SP1	0.825			
	SP2	0.687			
	SP4	0.794			
	SP5	0.77			

**Note:** SQI- Supplier quality integration, CQI-customer quality integration, GP-green purchasing, CGC-customer green cooperation, SP-social performance, ENP-environmental performance, EP-environmental performance.

**Table 2:** Fornell and Larcker Criterion for Discriminant Validity

	SQI	CQI	GP	CGC	EP	ENP	SP
<b>SQI</b>	<b>0.717</b>						
<b>CQI</b>	-0.336	<b>0.671</b>					
<b>GP</b>	-0.28	0.611	<b>0.709</b>				
<b>CGC</b>	-0.405	0.579	0.445	<b>0.732</b>			
<b>EP</b>	-0.238	0.447	0.446	0.384	<b>0.890</b>		
<b>ENP</b>	0.577	0.76	0.608	0.577	0.76	<b>0.908</b>	
<b>SP</b>	0.379	0.569	0.593	0.541	0.379	0.569	<b>0.893</b>

**Note:** SQI- Supplier quality integration, CQI-customer quality integration, GP-green purchasing, CGC-customer green cooperation, SP-social performance, ENP-environmental performance, EP-environmental performance.

**Table 3:** HTMT Analysis for Discriminant Validity

	SQI	CQI	GP	CGC	EP	ENP	SP
<b>SQI</b>							
<b>CQI</b>	-0.436						
<b>GP</b>	-0.308	0.511					
<b>CGC</b>	-0.505	0.679	0.545				
<b>EP</b>	-0.338	0.547	0.346	0.4			
<b>ENP</b>	0.677	0.176	0.508	0.677	0.75		
<b>SP</b>	0.379	0.469	0.493	0.541	0.379	0.569	

**Note:** SQI- Supplier quality integration, CQI-customer quality integration, GP-green purchasing, CGC-customer green cooperation, SP-social performance, ENP-environmental performance, EP-environmental performance.

### Hypotheses Testing

After testing the measurement model of the study, to test the hypothesis testing, PLS-SEM was employed by the Smart PLS 3. The model was consisting of four exogenous variables namely, supplier quality integration (SQI), customer quality integration (CQI), green purchasing (GP) (mediator), and customer green purchasing (CGP) (mediator). One endogenous variable that corporate sustainable performance (CSP) (dependent variable). Table 4 presents the results of PLS bootstrap algorithms that confirms the significant direct relationship of SQI ( $\beta = 0.507$ , t value = 8.693, p value = 0.000) on GP.



In addition, SQI also has positive and significant association ( $\beta = 0.575$ , t value = 9.416, p value = 0.000) CGP. On the other hand, the CQI also has a significant and positive ( $\beta = 0.20$ , t value = 2.62, p value = 0.01) association with GP. In contrast, the CQI integration did not has significant ( $\beta = 0.0811$ , t value = 1.259, p value = 0.209) association with the CGC. These results are consistent with other studies (Lo et al., 2018) and (DeGroot & Marx, 2013). Thus, considering direct relationship, hypotheses 1,2 and 3 are supported whereas hypothesis 4 is not supported by the results. In addition, the GP and CGC have a partially mediating impact ( $\beta = 0.09$ , t value = 2.57, p value = 0.01), ( $\beta = 0.08$ , t value = 2.34, p value = 0.02) on the relationship of SQI and SP. On the other hand, the GP has a partially mediation in the relationship of CQI and SP. However, CGC did not has a mediating impact ( $\beta = 0.081$ , t value = 0.523, p value = 0.209) in the relationship of CQI and CSP. One possible reason for this relationship is that CQI did not have a direct effect on CGC, therefore it might be a reason that CGC did not have a mediating impact on their relationship. In this regard, CQI does not seems to be indirectly related with SP through CGC.

**Table 4: Direct Effect**

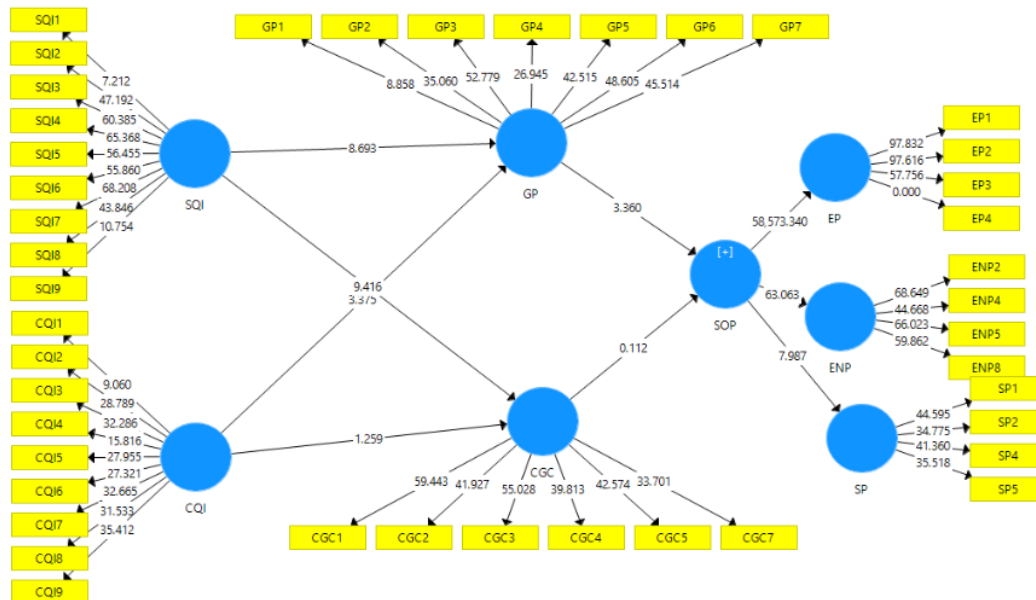
Hypothesis	Beta	S.E	T Value	P Value	Effect Size (f2)	CI <sup>BCa</sup> Low	CI <sup>BCa</sup> High	Decision
SQI-> SP	0.507	0.058	8.693	0.000	0.304	0.089	0.374	Supported
SQI-> CGC	0.575	0.061	9.416	0.000	0.221	0.007	0.259	Supported
CQI -> SP	0.221	0.066	3.375	0.001	0.002	-0.226	0.029	Not Supported
CQI -> CGC	0.081	0.064	1.259	0.209	0.204	0.051	0.349	Supported

**Note:** SQI- Supplier quality integration, CQI-customer quality integration, GP-green purchasing, CGC-customer green cooperation, CSP- Corporate social performance, Significance level = 0.05

**Table 5: Indirect Effect**

Hypothesis	Beta	S.E	T Values	P Values	CI <sup>BCa</sup> Low	CI <sup>BCa</sup> High	Decision
SQI -> GP -> SP	0.088	0.034	2.567	0.011	0.024	0.162	Supported
SQI-> CGC -> SP	0.076	0.032	2.354	0.019	0.022	0.148	Supported
CQI-> GP -> SP	0.067	0.029	2.123	0.021	0.019	0.138	Supported
SQI-> CGC -> SP	-0.006	0.012	0.523	0.601	-0.034	0.014	Not Supported

**Note:** SQI- Supplier quality integration, CQI-customer quality integration, GP-green purchasing, CGC-customer green cooperation, CSP- Corporate social performance, Significance level = 0.05



**Figure.2** Regression effect model

**Conclusion**

The aim of the current study is to investigate the mediating impact of green supply chain management (GSCM) in the relationship of supply chain integration (SCI) and sustainable performance (SP) of the manufacturing industry in Indonesia. Based on this objective, the key findings of the study supplier quality integration (SQI) have a direct effect on green purchasing (GP) and customer green cooperation (CGC). In the same vein, the customer quality integration also has a direct effect on the relationship of green purchasing (GP) while did not have an effect on customer green cooperation (CGC). On the other hand, the GP partially mediates in the relationship of SQI and sustainable performance, while CGC did not have any mediating impact in the relationship of SQI and SP. Based on these findings, it could be explained that GP and CGC are considered to be important mediator among their relationship. The study could have added a body of literature which could become a new area of research in future. Finally, this research will help the regulators to develop the policy guidelines to define the ethical business process for enhancing overall sustainable performance in the country

**2 Limitations and Directions for the Future Research**

It is necessary to elaborate the limitations of study so that reliability and validity of research could be increased. As, the study was cross sectional in nature and data was collected one time. Based on this limitation, a future longitudinal research could be supported out to quantity and change the across time, and also the direction of the connection among their interactions. Moreover, the study was limited on the Indonesia, so the study is may be limited, so to enhance the scope, there is need of study also include other industries in the research. Finally, the study was limited on mediating effect, so a future research could be established along with the moderating variable.

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