

# Uncertain Supply Chain Management

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## Does green supply chain integration contribute towards sustainable performance?

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### CHRONICLE

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### ABSTRACT

Turning the attention towards a net performance of the Indonesian oil and gas industry is important. Inconsistent performance of the oil and gas industry has shown the negative consequence for the nation's economy. However, up to some extent, the issues can be resolved through green supply chain integration. Therefore, the ultimate purpose of this study is to investigate the role of green supply chain integration on the sustainable performance of the oil and gas industry of Indonesia. To collect the data, a survey questionnaire was used, and questionnaires were distributed among the employees of oil and gas companies in Indonesia. From total three hundred (300) distributed questionnaires, two hundred and one (201) were returned and used to analyze the data through Smart PLS 3. Findings reveal that green supply chain activities had a positive contribution in sustainable performance among oil and gas companies. Supplier integration, customer integration and technological integration had a substantial impact on economic sustainable performance and environmentally sustainable performance. Thus, the Indonesian oil and gas companies are recommended to use green supply chain activities to enhance performance.

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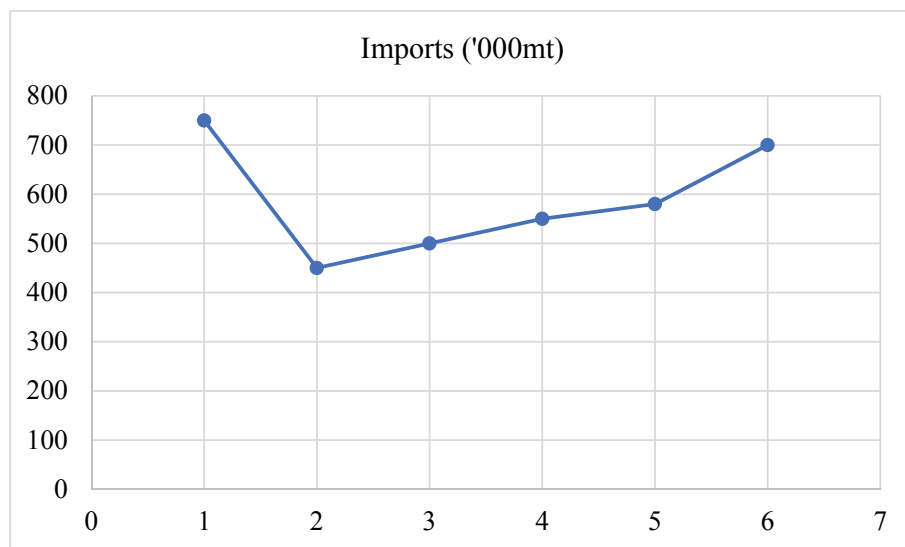
## 1. Introduction

Turning the attention towards a net performance of the Indonesian energy market is a broader area. It is estimated that Indonesia is one of the countries which is going to become a net importer of energy in financial terms. This is happened due to the continual subdued thermal coal prices, increasing investigated oil consumption fueled through different wasteful subsidies, and stagnating oil and gas output. More specifically, if Indonesia follows a path of industrial growth and development, it is estimated that Indonesian energy requirements will continue to increase, increasing from a projected US\$100b in 2012 to US\$190b in five years. Additionally, in case of the production side, oil output seems continues to slide and estimated that 20% shortfall of Indonesia's elusive 1 million barrels per day approximately target with less than ten years' reserves and flat gas production (CLSA estimates 2017). Fig. 1 shows Indonesian imports in oil and gas sector in 2018. It depicts that imports are increasing which is not a good sign for oil and gas industry.

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**Fig. 1.** Indonesian Imports in Oil and Gas Sector  
Source: Statistics Indonesia (2018)

Thus, the condition is threatening for Indonesia oil and gas industry. This downfall has negative consequences on the economy of Indonesia. As the oil and gas have significant contribution in the economic sector of every country (Oboh & Ajibolade, 2017). The energy sector is a significant ingredient to all sectors of the nation's economy including agriculture, telecommunication, transportation, and other industrial activities. This sector has a reasonable economic impact on each country (Kinnaman, 2011; Castorena, et al. 2014; Dim & Ezeabasili, 2015; Jaya & Verawaty 2015; Angbre, 2016; Tanoos, 2017; Chowdhury, et al. 2018).

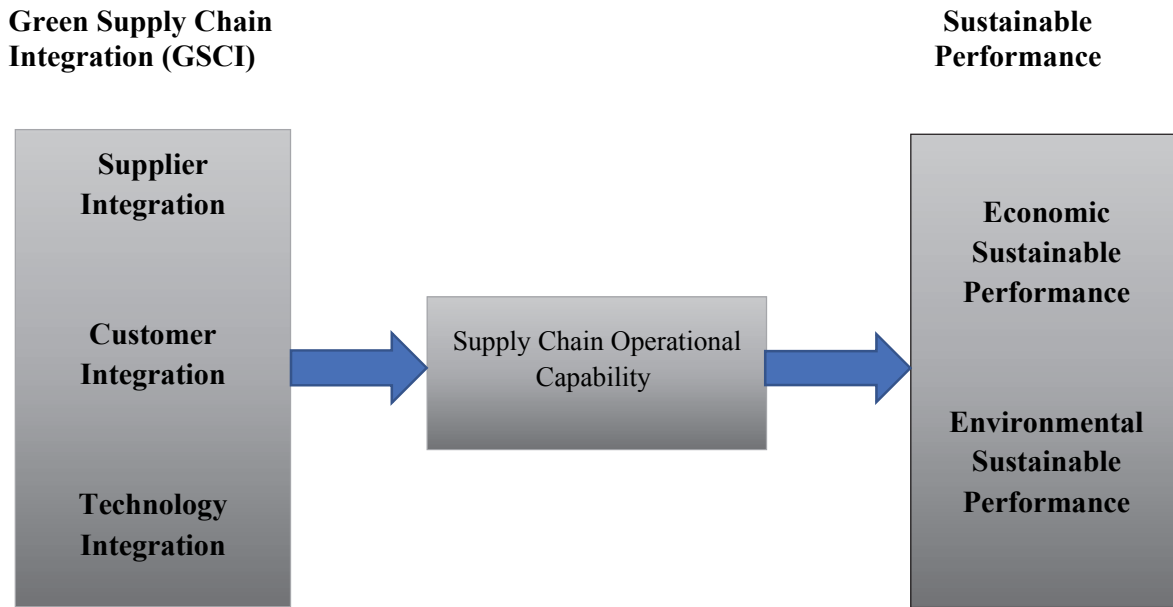
Oil and gas sector has also the contribution in the gross-domestic-product (GDP). As it has a significant impact to provide various opportunities related to employment which has a GDP contribution. It is generally referred to as value-added which also includes income from labor and government revenues contribution. In other cases, it has an indirect effect which is based on the impact on various industries that deliver goods as well as services to the oil and gas industry. Hence, the oil and gas industry has central importance for the economy of the country (Ariweriokuma, 2001; Sagers et al., 1995; Duru & Chibo, 2014; Wang & Lu, 2016; Nazal, 2017; Taqi et al., 2018).

Therefore, Indonesia needs to adopt various strategies to ensure the recovery of the oil and gas sector to boost economic contribution. Energy is one of the essential needs of every country which is increasing day by day; thus, the significant intention must be paid to boost up this sector. This study is one of the attempts to address the issues of Indonesian oil and, gas sector and emphasized on sustainable performance with the help of green supply chain integration. Green supply chain integration has the ability to enhance sustainable performance by increasing economic sustainable performance and environmentally sustainable performance (Purnama, 2014; Solomon, et al. 2014; Suheil, 2015; Nze, et al. 2016; Kimengsi & Gwan, 2017; Gebremeskel, et al. 2018). Therefore, Indonesia can enhance the performance of the oil and gas sector with the help of green supply chain integration.

Green supply chain integration majorly includes supplier integration, customer integration and technology integration. Supplier generally refers to a body that delivers materials, services, parts and various goods straight to a concerned manufacturer (Russell & Taylor-III, 2008; Slack et al., 2010). The customer is a body that accepts or consumes products, services as well as goods and has the capability to select between various products and suppliers (Nurhaida et al., 2017; Slack et al., 2010). In the case of a supply chain, consumer comprises of merchandiser, online retailer and wholesaler (Russell & Taylor-III, 2008). Finally, the third element of green supply chain integration is technological integration. Technology integration is an environmental exercise of the utilisation of technology instruments taking place between a supplying and buying firms concerning actions such as

product development procedure, a various process of re-engineering as well as technical training (Wu, 2013).

Therefore, the ultimate purpose of this study is to investigate the role of green supply chain integration on the sustainable performance of the oil and gas section of Indonesia. In this study, three major elements of green supply chain integration (supplier integration, customer integration, technology integration) were taken as independent variables. Moreover, the oil and gas sector sustainable performance were measured based on economic sustainable performance and environmentally sustainable performance.



**Fig. 2.** The theoretical framework of the study showing that how green supply chain integration promotes sustainable performance

This study explores the role of green supply chain integration by considering the oil and gas sector of Indonesia. To the best knowledge of the author, this is one of the rare studies which investigated the effect of green supply chain integration on the sustainable performance of the oil and gas industry, particularly in Indonesia. Therefore, this study is beneficial for oil and gas companies to focus on green supply chain integration to enhance the overall performance.

## 2. Literature Review

### 2.1 Green Supply Chain Management (GSCM)

GSCM can be defined as “carrying products as well as services from suppliers, different manufacturers to customers with the help of information flow, material flow, and transactions of cash flow in the setting of environment” (Zhu & Cote, 2004; Zhu, Geng, & Lai, 2010; Zhu & Sarkis, 2007; Zhu, Sarkis, Cordeiro, & Lai, 2008). Moreover, Srivastava (2007) explained, GSCM is thinking about environmental into different supply-chain activities which consist of product design, various material sourcing, selection of sources, manufacturing procedures and ending product delivery to the users. Based on the different regulatory necessities and intense customers pressures, the scope of GSCM started from monitoring of the overall environmental administration to more proactive activities applied through different reverse logistic activities including recycle, refurbish, remanufacture, re-use, and rework. The GSCM is shown in Fig. 3. The green supply chain is based on environment-friendly customers, suppliers, purchases, warehouses, packaging, manufacturing, transportation and whole green design in which all stakeholders support the environment.



**Fig. 3.** Green Supply Chain Management

The GSCM has increased intention for practitioners and academic researchers about efficiently managing supply chain activities. The developing significance of GSCM is driven fundamentally because it is environment-friendly, for example, expanding levels of contamination, flooding waste destinations, and reducing crude material assets. In any case, it is not limited to the environment; it is about great marketing prudence and higher profits. Indeed, it is a business esteem driver and not a cost focus (Wilkerson, 2005). Since manufacturing organizations have regularly been charged for the liabilities of environmental of their suppliers (Rao, 2008). There has been a significant interest to incorporate environmental activities, inside the boundaries of the organization, as well as over the whole supply chain including all supply chain partners to safeguard the company's sustainable performance (Cote et al., 2008).

The green supply chain has many benefits including financial benefits, environmental benefits and social benefits. Financial benefits include; increase in revenue, reduction in overall cost, increase in asset utilization and enhanced customer services. However, the financial benefits can be disturbed through political influence on stock returns (Maqbool et al., 2018). The environmental benefits include; reduction of waste material, increase in the efficiency of energy, reduce in air emission, reduce in water emission and reduction in fuel consumption which automatically enhance the sustainable performance. Moreover, social benefits include, reduce community impact, noise reduction, traffic congestion avoidance, health safety and improvement in securities. All the benefits of the green supply chain have a considerable effect on overall economic sustainable performance and environmentally sustainable performance among Indonesian oil and gas companies by increasing the operational capabilities which have significant contribution in sustainable performance. An increase on the quality of economic and environmental performance through the help of supply chain operational capabilities will also increase the sustainable performance of companies (Schaltegger & Wagner, 2017). Moreover, open-innovation capabilities through external knowledge (Hameed et al., 2018) and better investment decision making (Hameed et al., 2018) in the supply chain can be influential to boost green supply chain. However, the element of enterprise risk management cannot be neglected (Hameed et al., 2017).

## *2.2 Green Supply Chain Management (GSCM) and Sustainable Performance*

Business sustainable performance is developed when an organization generates constant value for its stakeholders by strictly following the environmental requirement (Brent & Labuschagne, 2004). Firm's sustainable value has a few important features which are; environmental protection and society, and more significantly by making the customer as well as shareholders happy. According to Dunphy (2011),

“sustainability contains activities that spread socially appropriate lives of companies, enhance the ability to maintain and restart the survival of the biosphere and also to befriend all living species, increasing the ability of the community to uphold itself. In addition, sustainability can track its main problems and to maintain the welfare, participation and autonomy of the present and future generations of humanity”. However, this study is concerned with economic and environmental sustainable performance.

According to Green Jr et al. (2012), economic sustainable performance is based on the assessment of firm cost reduction, market shares contribution, increase in return on assets, increase in income, and increase in profits margins concerning the economic objectives of performance (Green Jr et al., 2012). GSCM always have a significant positive effect on economic performance (Liu et al., 2012) through supply chain operational capabilities.

On the other hand, environmental concerns are driving business organizations to consider various operational impacts. According to Junquera et al. (2012), environmental sustainable performance can be defined as the assessment of firm reduction for emissions of harmful elements, reduction of utilization for dangerous or destructive materials, and well-organized energy use. Achievement of environmentally sustainable growth can be attained through a reduction in different resources utilization such as reduction in waste generated material and any other harmful resources (Brent & Labuschagne, 2004).

The business firms have an immense obligation socially where they have to deal with their employees and social orders. Teraji (2009) characterized social sustainable performance as an assessment of association on the solid workplace, social responsibility and investment, education, and human resources advancement. He concluded that as mindfulness among consumers on corporate social performance expands, management progressively perceives their duties regarding actualizing ethical projects to upgrade social welfare. There are several domains, namely; human resources, corporate governance, human rights, and environment that ought to be legitimately surveyed (Bessire & Onnée, 2010; Komalasari & Suryanto, 2017; Suryanto & Grima, 2018). Environmental performance is also based on social sustainable performance.

Past investigations (Vachon & Klassen, 2006; Zhu et al., 2010) have demonstrated that supplier integration is emphatically identified with firm sustainable performance. Vachon and Klassen (2006) have discovered that collaboration with suppliers could enhance sustainable performance of one association economically and second environmentally. Creating collaborative association with suppliers is additionally positive for a successful selection, advancement, and usage of the GSCM toward social commitments (Vachon, 2007).

The customer is an individual that utilizes or consumes products (goods or services) and can pick between various products and suppliers (Slack et al., 2010). In the supply chain, a customer consists of wholesaler incorporates merchandiser, consumers and retailer (Russell & Taylor-III, 2008). Coordinating customer from the GSCM point of view can be characterized as “environmental communication between a principal company and its different customers that plan to satisfy environmental prerequisites related to the customer” (Vachon & Klassen, 2008). It centers about the downstream side of the various supply chain activities. Customer integration handles the level of integration in receiving green supply chain practices for environmental handling, arranging purposes, and to discover arrangements of environmental issues (Wu, 2013).

Huber et al. (2007) demonstrated that the utilization of technology in the supply chain adds to successful correspondence with operations. A plenty of innovations having customer driven highlights and data concentrated give massive advantages like cost reduction process, increased flexibility, and increase in coordination (Andiç et al., 2012). The technology integration in green supply chain management ought to have the capacity to help the advancement of green activities prepared in an organization, which naturally expands the likelihood to accomplish environmental objectives. In any case, the technology

integration still requires contribution from supplier and customers in terms product configuration, preparing, and help to enhance firm's economy, social performance and environmental performance (Vachon, 2005).

### 2.3 Hypotheses Development

- H<sub>1</sub>:** Supplier integration has significant positive effect on supply chain operational capability.
- H<sub>2</sub>:** Customer integration has significant positive effect on supply chain operational capability.
- H<sub>3</sub>:** Technology integration has significant positive effect on supply chain operational capability.
- H<sub>4</sub>:** Supply chain operational capability has significant positive effect on economic sustainable performance.
- H<sub>5</sub>:** Supply chain operational capability has significant positive effect on environmental sustainable performance.

### 3. Research Method

This study was carried out by using a survey method. Questionnaires were developed based on previous studies and distributed among the employees of oil and gas companies in Indonesia. The employees having direct involvement in green supply chain activities were selected as the respondents of the current study. All the questionnaires were distributed by self-visit to the respondents.

A 5-point Likert was preferred and the reason to use 5-point Likert scale from strongly disagree to strongly agree is that this scale has suitable to increase the reliability and originality of the data. Because it decreases the respondent's frustration and increases the overall quality. This scale was developed by using the already conducted studies from the previous literature.

Moreover, by following the instructions of Comrey and Lee (1992), three hundred (300) sample size was selected. Total number of 300 questionnaires were used among the staff of oil and gas companies in Indonesia. From these three hundred (300) questionnaires two hundred and one (201) were returned.

Furthermore, area cluster sampling techniques were utilized to collect the data from oil and gas companies. Area cluster sampling was selected based on the reason that it is suitable to collect the data when population is spread on wide area (Ul-Hameed, Mohammad, & Shahar, 2018). As the population is spread in whole Indonesia, therefore, area cluster sampling is most suitable technique in this study.

### 4. Findings

The current study preferred to utilize PLS-SEM to analyze the data. This is one of the suitable techniques. PLS-SEM has two major steps, and the first step is based on the fulfilment of various assumptions such as reliability and validity. As the Table 1 shows the reliability and validity of the current study. Cronbach alpha is more than 0.7, and composite reliability is also more than 0.7 which is above satisfactory level. Moreover, factor loading is shown in Fig. 4 which is above 0.7 (Hair Jr et al., 2014). Furthermore, the convergent validity is also achieved as the average variance extracted (AVE) is above 0.5.

**Table 1**  
Reliability and Convergent Validity

	Cronbach's Alpha	rho A	Composite Reliability	(AVE)
CI	0.941	0.943	0.955	0.810
ENSP	0.936	0.937	0.955	0.840
ESP	0.895	0.896	0.927	0.760
SCOC	0.886	0.891	0.922	0.748
SI	0.943	0.944	0.956	0.814
TI	0.930	0.933	0.947	0.781

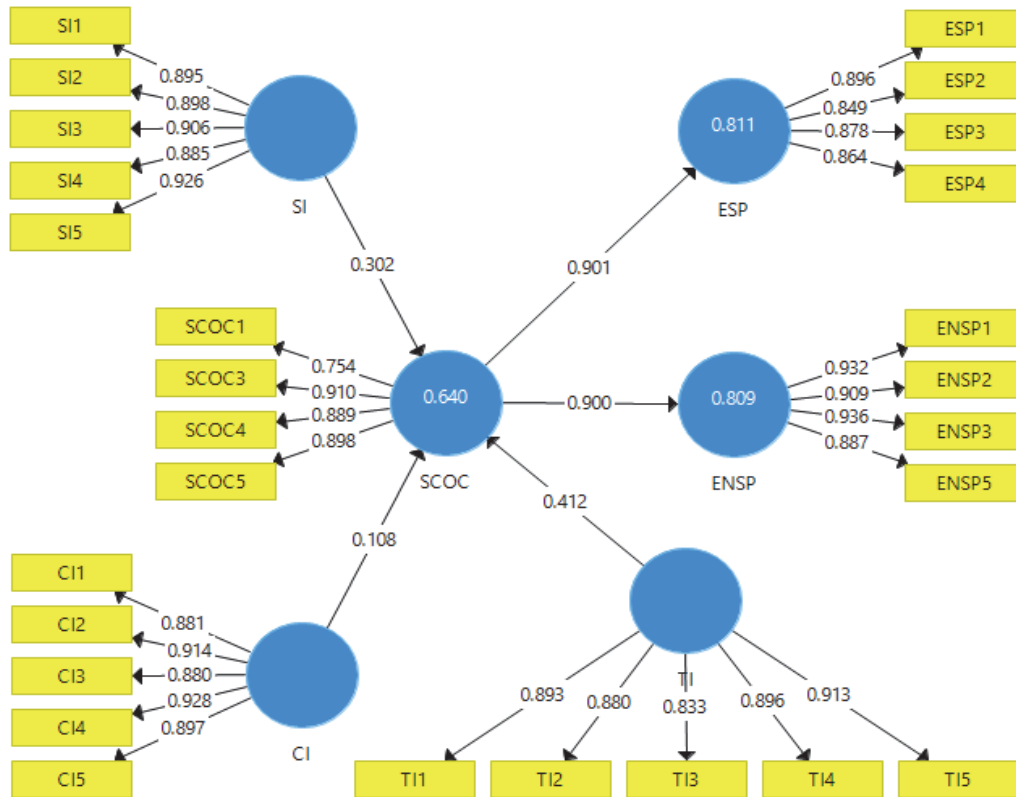


Fig. 4. Factor Loadings

Additionally, discriminant validity is shown in Table 2. It is confirmed through average variance extracted (AVE). The AVE square root was considered to check the discriminant validity.

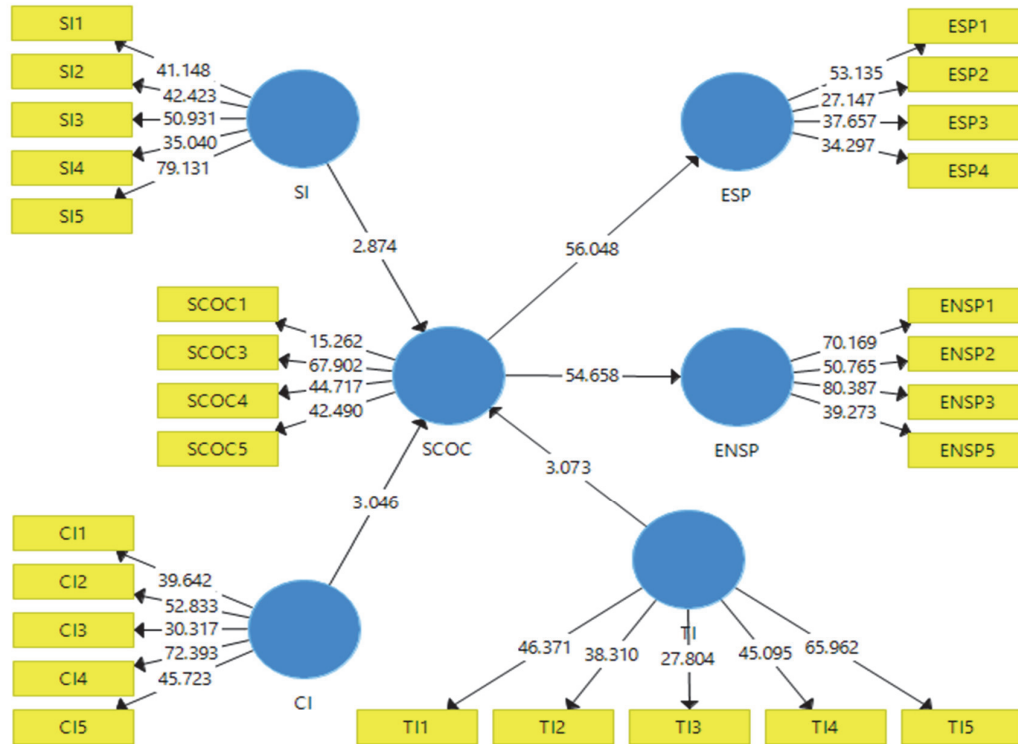
Table 2  
Discriminant Validity

	CI	ENSP	ESP	SCOC	SI	TI
CI	<b>0.900</b>					
ENSP	0.714	<b>0.917</b>				
ESP	0.667	0.911	<b>0.872</b>			
SCOC	0.762	0.900	0.801	<b>0.865</b>		
SI	0.810	0.700	0.683	0.774	<b>0.902</b>	
TI	0.821	0.762	0.723	0.785	0.806	<b>0.883</b>

After the fulfilment of basic assumptions of PLS-SEM, the bootstrapping was performed. It was carried out to check the hypotheses. The results of PLS bootstrapping are shown in Table 3. In this result, it is shown that all the hypotheses were accepted as the t-value was above 1.96 and p-value was below 0.05.

Table 3  
Hypotheses Testing

		Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics ( O/STDEV )	P Values	Decision
H <sub>2</sub>	CI → SCOC	0.108	0.107	0.035	3.0460	0.003	Supported
H <sub>5</sub>	SCOC → ENSP	0.900	0.900	0.016	54.658	0.000	Supported
H <sub>4</sub>	SCOC → ESP	0.901	0.901	0.016	56.048	0.000	Supported
H <sub>1</sub>	SI → SCOC	0.302	0.305	0.105	2.8740	0.004	Supported
H <sub>3</sub>	TI → SCOC	0.412	0.408	0.134	3.0730	0.002	Supported



**Fig. 5.** Hypotheses Testing

Nevertheless, r-square value is shown in Fig. 4. The r-square value for environmental sustainable performance is 0.809 and 0.811 for economic sustainable performance. It indicates that all the independent variables are expected to bring 80.9 variance in environmental sustainable performance and 81.1% in economic sustainable performance. Additionally, all the variables have small effect Size ( $f^2$ ); however, supply chain operational capability has strong effect Size ( $f^2$ ).

**Table 4**  
Effect Size ( $f^2$ )

Construct	Value	Effect size ( $f^2$ )
Supplier Integration	0.036	Small
Customer Integration	0.024	Small
Technology Integration	0.059	Small
Supply Chain Operational Capability	0.921	Strong

## 5. Discussion and Conclusion

The current study was based on the green supply chain integration and sustainable performance. The role of green supply chain activities was examined on sustainable performance of oil and gas companies from Indonesia. The sustainable performance was measured through economic sustainable performance and environmentally sustainable performance. Three major elements of green supply chain were selected; namely customer integration, supplier integration and technological integration.

Findings of the study have shown that green supply chain activities had significant positive relationship with sustainable performance of oil and gas companies of Indonesia with the help of supply chain operational capabilities. As it was found that supplier integration had significant positive effect on supply chain operational capabilities with t-value 2.874, beta value 0.302 and p-value. 0.004. In line with these findings, customer integration and technological integration also had significant positive



effect on supply chain capabilities with beta value 0.108 and 0.412, t-value 3.046 and 3.073, p-value 0.003 and 0.002, respectively.

Thus, an increase in supplier integration, customer integration and technological integration increase the supply chain operational capabilities among oil and gas companies. Effective integration with these partners will enhance the operations of supply chain. Consistent with current study, according to Lau et al. (2010), supplier and customer integration had significant effect on performance of innovation, operations and service. Supplier integration is helpful in product or service development (Petersen et al., 2003). Moreover, in line with this study, Salvendy (2001) found a significant relationship between technology and operations management.

Nevertheless, it was found that supply chain operational capabilities have maintained significant positive relationship with economic sustainable performance having t-value 56.048, beta value 0.901 and p-value 0.000. Similarly, the relationships between supply chain operation capability and environmental sustainable performance also were found significant positive relationships. Thus, an increase in supply chain operational capabilities will also increase the economic and environmental sustainable performance. These results are consistent with Hooley et al. (1999) and Hong and Hwang (2011). Finally, in conclusion, green supply chain integration increases the supply chain operational capabilities and supply chain operational capabilities increases the sustainable performance among oil and gas companies of Indonesia.

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