

Internal vs External Green Supply Chain Management at Petrochemical Industry Economic Performance in Indonesia

Yuary Farradia and Abdul Talib Bin Bon

Faculty of Technology and Management
Universiti Tun Hussein Onn
Batupahat, Johor , Malaysia
juaryfarradia@yahoo.com, talibon@gmail.com

Hari Muharam

Faculty of Economics
Pakuan University
Bogor, Indonesia
hrmuharam@yahoo.com

Abstract

Indonesia's petrochemical sector contributes to 3% of Indonesia GDP and its demand should soon grow by 5% per year due to Indonesia's economic expansion. This is correlated with the economic expansion of Indonesia, since petrochemical derivative products are utilized in the production process of plastic products, pharmaceuticals, and textile. The Indonesia government put high effort on the integrated petrochemical industry development toward green industry in order to achieve better economic performance. The overall objective of this study is to draw the relationship between internal green supply chain management (GSCM) and external GSCM practices on economic performance of petrochemical industry in Indonesia. Internal GSCM consist of eco design and internal environment management. Whilst external GSCM consist of green purchasing and reverse logistic. This study was conducted among petrochemical olefin manufactures based in Banten Province Indonesia. The result showed that Internal GSCM has no direct effect on economic performance, but external GSCM has a positive effect on economic performance. The external GSCM practice implementation not only reduce any cost from waste treatment, environment accidents, and energy consumption toward profit achievement as well as profit growth over the years, but also generate sales and earnings.

Keywords

Internal Green Supply Chain Management, External Green Supply Chain Management, Petrochemical, Economic Performance,

1. Introduction

The petrochemical industry in Indonesia is one of the most important primary industries toward economic growth. It is the foundation of a wide variety of industrial production processes such as plastic and container, textile, rubber, agriculture, cosmetic, pesticide, cleaning agent, pharmaceutical, artificial skin, explosive material up to and fertilizer industries. These industries then create value added to Indonesia GDP as well as for exporting value. Indeed, the petrochemical industry is the sector experiencing the highest growth in Indonesia. This is correlated with the economic expansion of Indonesia, since petrochemical derivative products are utilized in the production process of plastic products, pharmaceuticals, and textiles, amongst others.

Rambu Energy (2014), stated that Indonesia imported raw material used by petrochemical industry around US\$8 billion since 2013. Hence, due to this imported raw material then upstream petrochemical industry offers thin margin and requires huge investment and advanced technology. One of the strategies for being sustainable in the business particularly in the business margin is to have a domestic plant of raw material supply instead of import. There are a number of petrochemical plants have decided to expand their plant capacity or building a new petrochemical plant.

Despite the effort for expanding domestic petrochemical plants, however, petrochemicals are also among the factors which has a relatively high share of biomass and the rapid growth in energy-intensive industrial activities. Thus this share contributes to the high level of Indonesia emissions. The government's National Medium Term Development Plan (RPJMN) for 2015–2019 reaffirms Indonesia's commitments to reduce its greenhouse gas emissions and strengthening its national energy security.

Jakfar et al., (2015) point out from their study about the application of Green Supply Chain, that Indonesia still needs a deeper understanding of both GSCM application and implementation on environmental problems caused by business operations. From the above statements related to the urgency of GSCM, it can be concluded that GSCM plays the main role for the manufacturing industry to reduce the environmental impacts to the business which could reduce the business cost incurred to the business. Moreover, through implementation of GSCM, it would generate additional profit to the firm.

The study is aimed to understand in what extent of the internal and external GSCM practice within the petrochemical industry in Indonesia. In addition, the study is also aimed to investigate the internal and external green supply chain management practices within the petrochemical industry in Indonesia.

Shibao et al. (2014) understand how to process the relationship between business strategies of GSCM (internal practices, external, green investments, eco-design and reverse logistics), the green profile (proactive and reactive corporate) and performance measures (environmental, economic and operational) in Brazilian chemical industries. Their results showed that proper management of the green supply chain, implemented by environmental practices, results in superior performance, whether environmental, economic or operational. This alignment of strategy and supply chain is becoming an important trend as supply chain management becomes more and more integrated into company strategies.

2. Conceptual Model

Institutional Theory. The institutional theory provides explanations about the causes of the adoption certain organizational practices by firms (Hirsch, 1975). Specifically, to examine how external pressures coming from the environment in which the firm operates. The Indonesia Development Regulation no 14, 2015, The government's development plan for the year 2015–2019 and the Presidential Decree No. 5/2006 on national committee economics emphasizes environment sustainability concerns as well as direction to achieve green industry objective for the long run national development. Thus this regulation in line with the coercive pressure mechanisms within institutional theory. Normative pressures cause firms to conform to expectations in order to be perceived as having legitimate organizational activities (Sarkis et al. 2011). Normative pressures include industry standards, best practices and conventional wisdom (Milstein et al. 2002). Mimetic pressures derive from uncertainty. The Environment Management in Indonesia was managed by the Ministry of Environment and Forestry (MOEF) which is principally regulated by Law No. 32 on Environmental Management and Protection and PROPER is one of a government program to review and give a rating on the corporation subject to environmental management system standardization. Thus this practice is part of normative pressures by the government in Indonesia to the Petrochemical Industry as well.

Resource Based View Theory. The RBV is one of the most-adopted theoretical lenses in analyzing supply chain management (Carter et al. 2014). According to the RBV, supply chain collaboration does not only help to build these valuable resources but it also allows firms to focus on their core activities, which increase firm-specific skills and realize economies of scale and learning effects. In this study, the RBV theory is used to explain the relationship between collaborative practices and performance. The dimension of internal green supply chain management practices in this study (eco-design and internal environment management) and external green supply chain management practice (green purchasing and reverse logistics) are the implementations of RBV theory in the industry. This study then needs to know in what extent the industry implements both internal and external green supply chain management practices.

Stakeholder Theory. From the Stakeholder theory perspective, Externalities often cause stakeholders to increase pressures on companies to reduce the negative impacts and increase the positive ones. Specific stakeholder would have an influence on green purchasing, reverse logistics. The petrochemical industry provides the raw material for other downstream industry, thus it will contribute the country gross domestic product toward country economic growth. Lo (2014) claims that drivers to go green can be either external such as legislation, customers and competitors, or internal which include: senior management support, firm reputation and cost reduction.

2.1. Internal green supply chain management practice

Internal GSCM is defined as the environmental management practices conducted within a company (Rao & Holt, 2005; Vachon & Klassen, 2006). Yu et al., (2013) based on their study also confirmed that Internal GSCM affects operational performance in terms of flexibility, delivery, quality, and cost. The internal GSCM practices are internal environmental management, eco-design, and investment recovery (Jabbour & Sousa, 2015); According to Green et al. (2012), companies tend to adopt internal GSCM first, followed by external GSCM. Similarly, Zhu et al. (2012) affirm that external GSCM can improve firms' performance after the adoption of internal GSCM.

Eco-Design refers to the environmental design of a product and /or a process. It focuses on reducing (preventing) the environmental effects of a product before it is produced, distributed and used. According to Zhang (2017), the most obvious features of green design and traditional chemical product design are embodied in realize efficient utilization of resources means from the point of view of sustainability, renewable resources should be used as far as possible to maximize the utilization of resources. Zhou et al, (2016) on their study about integrated factor analysis model for product eco-design based on full life cycle assessment concluded that there was logical relationships among resource efficiency, economic efficiency, and environmental efficiency, builds a fully comprehensive evaluation analysis model to trace, evaluate and analyze the status of the material and value flow of the product lifecycle process. Thus enterprises achieve an ideal condition of all three dimensions, namely resource efficiency, economic efficiency, and environmental benefits. Further, Zhang (2017) concluded that in the era of increasing chemical pollution, green chemistry and chemical industry came into being, and in the development of chemistry and chemical engineering, using the idea of "green", adopt green manufacturing methods, and paying attention to the training of talents in the field of expertise will be the main direction and goal of country's future efforts in the field of chemistry and chemical engineering. On the other hand, Singhal (2013) defined the scope of eco-design is Materials, Manufacturing, Packaging, Transport and Distribution, Use and finally End-of-life

International environmental management is defined as the process and procedures that espouse intra-organizational environmental goals in which the significant strategic resource comes from the management support (Green et al., 2012). Internal Environmental Management includes top management commitment, cross-functional cooperation for environmental improvements, total quality environmental management, environmental compliance, environmental management system and ISO14001 certification (Bag et al, 2017. p .162; Guerrero-Baena et al., 2015).

2.2 External green supply chain management practice

The external GSCM has direct contact with the external factor of a firm such as with supplier and customer. The External GSCM practices used in this study are referred to Green Purchasing (GP and Reverse Logistics (RL).

Green purchasing (GP) is defined as an environmentally conscious purchasing initiative that tries to ensure that purchased products or materials meet environmental objectives set by the purchasing firm, such as reducing the sources of wastage, promoting recycling, reuse, resource reduction, and substitution of materials (Carter et al., 1998; Min & Galle, 2001; Zsidisin & Siferd, 2001). GP refers to the procurement of products and services that have a reduced effect on human health and the environment when compared with competing products or services that serve the same purpose (Vishal & Avinash, 2016).

As GSCM not only focuses on environmental issues but also economic aspects too, thus an appropriate reverse logistics system should be designed to achieve efficiency and thereby, achieve economic benefit for the company (Govindan, et al., 2015). Reverse logistics is receiving much attention recently due to growing environmental or legislative concern and economic opportunities for cost savings or revenues from returned products (Roghianian & Pazhoheshfa, 2014), means that implementation of reverse logistics especially in product returns would allow not only for savings in inventory carrying cost, transportation cost, and waste disposal cost due to returned products but also for the improvement of customer loyalty and futures sales. It refers to all the things that take place ones the product has been sold (Christopher, 2016). The primary objective of reverse logistics is to maximize the activities taking place after selling the product such as customer service, warehousing and inspecting the quality which can act as another source of income, increase the satisfaction of the client as well as conserve the environment (Christopher, 2016). Reverse logistics is based on the 4Rs i.e. refund, restock, refurbish and recycle (Murray, 2012).

3. Hypotheses Development

Schmidt et al., (2017), confirmed that there is positive relationship between GSCM practice (focus on eco-design and green purchasing) with firm performance (mainly on financial and market share aspect). Rahim et al.,(2016) found

the green supply chain management practices and its elements can improve organizational performance and help sustain the business. In addition, the available empirical evidence suggests that GSCM practices are associated with sustainable firm performance (environment, economic and social performance), Tritos et al., (2013).

Hence, this study postulates that GSCM practices influence firm economic performance. The research hypotheses framework is illustrated at figure 1 below with hypotheses are developed as follow:

H₁: Internal GSCM directly has a positive effect on economic Performance

H₂: External GSCM directly has a positive effect on economic Performance

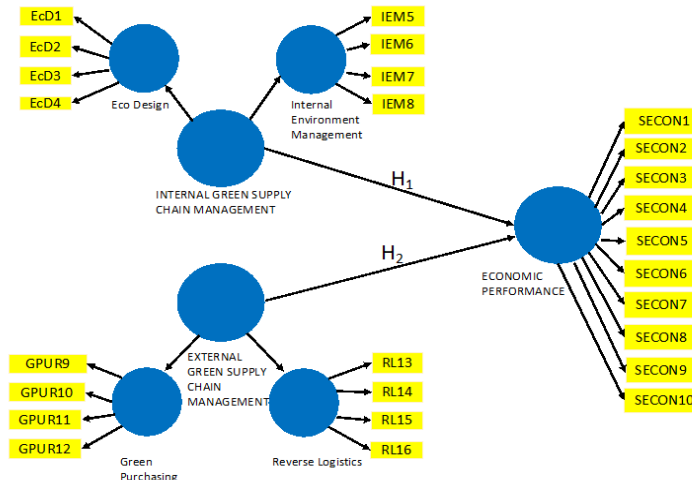


Figure 1. Research Model

4. Sample, Data Collection and Measurements

This study focuses only for the Olefin petrochemical group located in Banten province Indonesia. As this survey is a multistage purposive random sampling, thus the position of respondents is various, starting from a senior supervisor, superintendent, assistant manager, manager up to general manager. The total number of employees from superintendent level upward is 704 people and using the Slovin formula to choose the respondent then the total respondents in this study are 296 which in line with the recommended sample size for the requirement SEM(Breckler, (1990) and Shah & Goldstein, (2006) which is above 200. Having data screening form outliers by SPSS then the data ready for measurement analysis is 255.

In this study the concepts related to GSCM practices (internal and external) will be measured by quantitative approach as this approach is considered to be more accurate since it can be conducted on a large scale and gives a lot of information as far as value statistic to describe, explain and predict phenomena (Khalid et al., 2012). Two types of software are employed for data analysis namely SPSS and Smart PLS. SPSS will be used for data screening, and descriptive statistics, whilst smart PLS 3 will be used to test the hypotheses by means of Structural Equation Model (SEM) from Partial Least Square (PLS).

The research model (figure 1) of this study consists a higher order construct. According to Hair et al (2017) instead of modeling the attributes on a single construct layer, higher-order modeling involves summarizing the lower-order components into a single multidimensional higher-order construct. This modeling approach leads to more parsimony and reduces model complexity, whilst in situations characterized by collinearity among constructs, establishing a higher-order structure can reduce collinearity issues and may solve discriminant validity problems.

The measurement validity test is conducted to all the first order construct subject to their reflective model. These reflective variables within the first order construct are:

- i. Representing Internal: Eco Design, Internal Environment Management
Items measured covers environmentally friendly of product design process; design of process for minimization of waste; design of products for reuse, recycle, recovery of material and component parts; design of products for reduce consumption of material/energy; policy statements urging environmental awareness within the company operational; efforts to let employee understand the importance of environmental

- preservation; value level of environment preservation; employee care on the manufacturing environment.
- ii Representing External GSCM: Green Purchasing, Reverse Logistic
Items measured covers environmental criteria of supplier selection; cooperation with the suppliers; environmental audit for supplier's internal management; environmental design specification to the suppliers; remanufacturing; cost savings in return process; revenue contribution by reverse logistics; decreasing inventory holding cost.

On the other side, the items measurement for the endogen variable economic performance covers decreasing fee for waste treatment and discharge; profit growth; market share growth; market need fulfillment; decrease fee for environmental accidents; profit consistently with the past three years; decrease of energy consumption cost; growth on sales and earnings; customer satisfaction; increase customer loyalty.

According to Ramayah, et al., (2018), in the assessment of reflective measurement model, three main assessment criteria are needed at the outset such as the internal consistency reliability, convergent validity (indicator reliability / outer loading and average variance extracted) and discriminant validity. In this study, all the items' loadings for reflective construct have fulfilled all the criteria of the minimum cut-off value such as at 0.70 for the consistency reliability (Hair, et al., 2013) as well as pass the threshold of minimum 0.70, 0.70 and 0.50 (Fornell & Larker, 1981) for the convergent validity Cronbach's alpha, composite reliability (CR) and average variance extracted (AVE) respectively.

Having measured the eco design, internal environment Management, green purchasing and reverse logistic, then the higher order construct measurement of internal and external green supply chain management will use the two stage approach as the tool for higher order construct measurement. Hence, the Eco-Design and Internal Environment Management are modeled to the second order namely Internal GSCM, whilst the Green Purchasing and Reverse Logistic are modeled to the second order namely External GSCM. In term of two stage approach, Becker, et.al., (2012) stated that the two-stage approach proves more useful than the repeated indicator approach because it can be applied to estimate the higher- level, i.e., the path coefficient to and from the higher-order constructs. The two-stage approach is also can be applied to models with interaction effect among all constructs that are measured by reflective indicators.

Once we have confirmed that the construct measures are reliable and valid, the next step addresses the assessment of the structural model (figure 2) results.

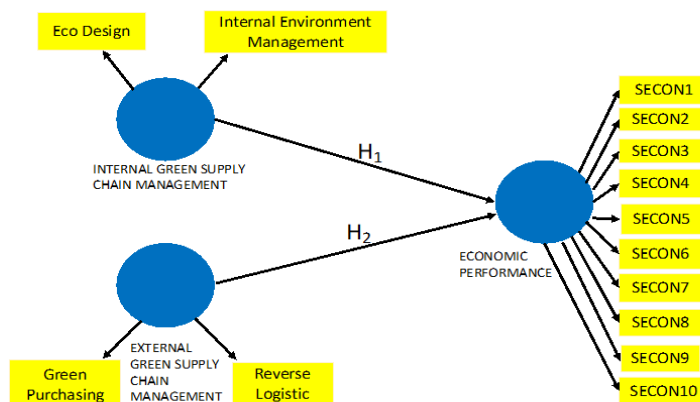


Figure 2. Structural Model

Hair (2018), suggested five indicators for the inner model measurement namely coefficient of determination (R^2), Effect size (f^2), predictive relevance (Q^2), the goodness of fit (GoF) and path coefficient. The measurement results are presented at table 1 – 6 below.

Table 1. Inner VIF value

	ECONOMIC PERFORMANCE
EXTERNAL GSCM	2.127
INTERNAL GSCM	2.695

Table 2. Path values

RELATIONSHIP	PATH COEFFICIENT	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
	Original Sample (O)				
EXTERNAL GSCM -> ECONOMIC PERFORMANCE	0.259	0.255	0.067	3.855	0
INTERNAL GSCM -> ECONOMIC PERFORMANCE	-0.159	-0.15	0.091	1.753	0.04

Table 3. Confidence interval bias results

	Original Sample (O)	Sample Mean (M)	Bias	5.00 %	95.00 %
EXTERNAL GSCM -> ECONOMIC PERFORMANCE	0.259	0.255	-0.004	0.147	0.366
INTERNAL GSCM -> ECONOMIC PERFORMANCE	-0.159	-0.15	0.009	-0.309	-0.012

Table 4. R Square result

Construct	R Square	R Square Adjusted	Remarks for R Square
ECONOMIC PERFORMANCE	0.494	0.486	Substantial (Cohen, 1989); Moderate (Chin, 1998) ; closed to moderate (Hair et al., 2017)

Table 5. Effect size result

	ECONOMIC PERFORMANCE
EXTERNAL GSCM	0.062
INTERNAL GSCM	0.019

Table 6. Construct cross-validated redundancy

CONSTRUCT	SSO	SSE	Q ² (=1-SSE/SSO)	REMARKS
ECONOMIC PERFORMANCE	2,550.00	1,794.39	0.296	Have Predictive Relevance for Endogenous Construct

Table 7. Hypothesis

Hypothesis	Relationship	Std Beta	Std Error	t - value	p - value	Decision
H ₁	INTERNAL GSCM → ECONOMIC PERFORMANCE	-0.159	0.091	1.753	0.04	Not Supported (t value < 1.96
H ₂	EXTERNAL GSCM → ECONOMIC PERFORMANCE	0.259	0.067	3.855	0	Supported

Based on all criterion of structural model result thus the hypothesis of this study can be concluded. Internal GSCM does not have positive relationship with economic performance. On the other side external GSCM have positive relationship with economic performance.

5. Discussion and Conclusion

5.1 The extent of green supply chain management practice within petrochemical industry in Indonesia

Green industry standardization has started to be implemented by some of the petrochemical producers in Indonesia. The green industry concept is in line with the effort of driving the organizations to focus on driving excellence through all areas of the organization from supply chain to operations, to channel management, to sales and marketing, research and development and finance, toward better economic performance. GSCM started to run at the petrochemical industry in Indonesia due to various efforts, though other countries have higher extent of GSCM implementation at their petrochemical industry (Younis, 2016). Azari et al., (2018) concluded from their study on GSCM risk identification at local petrochemical company in Indonesia, majoring in fertilizer (PT Petrokimia Gresik) that GSCM implementation at PT Petrokimia Gresik able to identify 70 risks and 78 risk agent based on SCORE model.

5.2 Internal green supply chain management

The finding results indicate that internal GSCM has no effect on economic performance, although statistically, the first order construct measurement analysis result indicates the industry do the effort of eco design which an internal enforcement on internal environment management. Whilst on the other side green purchasing has implemented in relation to their procurement activities as well as reverse logistic policy for both cost saving and waste minimization. This finding is related with the fact that though the overall national policy is toward green industry, however the implementation of GSCM still just in beginning stage due to still only a few producers have started to run it. One example is PT Chandra Asri Petrochemical which has ecolabel certification issued by the Ministry of Environment for Developing Degradable plastic green (Chandra Asri Petrochemical Company Profile). This ecolabel certification effort relates to internal GSCM implementation and this effort also runs at the petrochemical organization in India (Khastagir & Roy, 2014).

Eco-design still has some challenges subject to the active ingredient of olefin products. Therefore, manufacturing firms must actively engage in green innovation, including environmentally oriented product designs and manufacturing process in order to meet the requirements of sustainable development (Tseng et., al, 2013). Economic sustainability in this study is measured by market need fulfillment in order to achieve customer satisfaction as well as customer loyalty which finally lead to industry growth on sales and earnings. Thus the internal GSCM improvement effort such as eco design development and the various of industry green certifications need to be more promoted to the customer.

5.3. External green supply chain management

The finding results indicate that external GSCM has a positive effect on economic performance. The dimension of external GSCM in this study is green purchasing and reverse logistic. Green purchasing is less capital intensive as it is an externally oriented green supply chain initiative. In line with the various green certification (i.e. ISO 14001, Eco label, Indonesia PROPER certificates) thus majority of the petrochemical manufacturers have set their product specification to be based on the green basis. Thus it implemented on their purchasing or procurement product specification. This finding was also found to be the case in Malaysia, for example, where Eltayeb et al. (2011) found that better economic performance is the main driver for Malaysian firms to adopt green purchasing practice.

The relationship between green purchasing and economic performance covers about cost for energy consumption, customer satisfaction and fulfillment of market need. Whilst reverse logistic implementation covers the profit, cost and fee for waste treatment and discharge.

Reverse logistics is the least adopted practice by the petrochemical industry in Indonesia, in particular of inventory cost. Abdulrahman, et al., (2014) described that one of a possible reason that causes reverse logistics to have less attention is due to low commitment to reverse logistics practices and lack of reverse logistics expert at management

level in the manufacturing firms. Most of the petrochemical manufacturers objective of reverse logistics in line with the prior study by Christopher (2016). According to Christopher (2016), the objective of reverse logistics practice was to maximize the activities taking place after selling the product such as customer service, warehousing and inspecting the quality which can act as another source of income, increase the satisfaction of the client as well as conserve the environment. Thus an appropriate reverse logistics system should be designed to achieve efficiency and thereby, achieve economic benefit for the company (Govindan, et al., 2015).

Comparing all measurement of extent level external GSCM, the green purchasing still be the challenge to be fulfilled by the industry. Green purchasing is about taking social and environmental factors into consideration alongside financial factors in making procurement decisions. Making decisions in this way requires setting procurement into the broader strategic context including value of money, performance management, corporate and community priorities (UN, Procurement Handbook, 2012).

5.4. Conclusion

In summary, petrochemical industry in Indonesia is has a tendency toward fulfillment the green supply chain management application. Although, the petrochemical industry in Indonesia indicates that only the external GSCM practices affect the economic performance. An earlier study of economic performance revealed that out of the four GSCM practices, only green purchasing was found to have a significant impact on economic performance (Younis, 2016). On the other side, eco-design, which failed to impact any of corporate performance dimensions.

Hence, economic performance considerations should be taken into account in the petrochemical industry, considering the scarcity of natural resources and importance of this industry in development in one hand and environmental damage caused by this industry on the other hand.

Some indicators for economic performance might be used for the benchmark based on this study can be started on the successful of any new product launches as the impact of GSCM practices implementation subject to the green product or green production process. The external GSCM practice implementation could generate sales and earning toward profit achievement as well as profit growth over the years. Because, it might impact customer satisfaction toward their loyalty to the firms. In addition, the process production might reduce any cost / fee from waste treatment, environment accidents, and energy consumption due to the effect of external GSCM practices implementation.

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Biographies

Abdul Talib Bon is a professor of Production and Operations Management in the Faculty of Technology Management and Business at the Universiti Tun Hussein Onn Malaysia since 1999. He has a PhD in Computer Science, which he obtained from the Universite de La Rochelle, France in the year 2008. His doctoral thesis was on topic Process Quality Improvement on Beltline Moulding Manufacturing. He studied Business Administration in the Universiti Kebangsaan Malaysia for which he was awarded the MBA in the year 1998. He’s bachelor degree and diploma in Mechanical Engineering which he obtained from the Universiti Teknologi Malaysia. He received his postgraduate certificate in Mechatronics and Robotics from Carlisle, United Kingdom in 1997. He had published more 150 International Proceedings and International Journals and 8 books. He is a member of MSORSM, IIF, IEOM, IIE, INFORMS, TAM and MIM.

Yuany Farradia is currently PhD candidate in technology management in the Faculty of Technology Management and Business at the Universiti Tun Hussein Onn Malaysia since October 2018. Her master degree in natural resources economics has been obtained from Universiti Putra Malaysia (UPM) in the year 1993-1995. Her bachelor degree in Agriculture in field of fisheries has been obtained from Universitas Padjadjaran, Bandung Indonesia in 1991. Currently she is a lecture at various universities in both Jakarta and Bogor, Indonesia where she teaches production and management operation, strategic management operation, global marketing, entrepreneurship, service management, organization behavior, human resource development plan at both undergraduate and postgraduate level.

Hari Muharam is currently a senior lecturer at Universitas Pakuan, Bogor Indonesia in the faculty of both economics and post graduate program. His PhD in marketing and magister management have been obtained from YAI, Jakarta Indonesia. His bachelor degree in management has been obtained from Universitas Pakuan, Bogor Indonesia. Currently he is a lecture where he teaches in filled of production and management, marketing, human resource, and research methodology at both undergraduate and postgraduate level.