

# Uncertain Supply Chain Management

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## Critical evaluation of policies in supply chain performance: Quality assurance, continuous process improvement and environmental regulation and policies

Andriansyah Andriansyah<sup>a\*</sup>, Taufiqurokhman Taufiqurokhman<sup>a</sup> and Ismail Suardi Wekke<sup>b</sup>

<sup>a</sup>Universitas Prof. Dr. Moestopo (Beragama), Indonesia

<sup>b</sup>Sekolah Tinggi Agama Islam Negeri (STAIN) Sorong, Indonesia

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### ABSTRACT

The primary objective of this study is to find the role of different policies on supply chain performance (SCP). To achieve this objective, quality assurance policies (QAP) and continuous process improvement (CPI) are selected as independent variables. Additionally, the moderating effects of environmental regulations and policy (ERP) are examined between various policies and SCP. ERP is taken as moderating variable because the role of ERP in logistics is crucial. Logistics transport has serious effect on environment due to the emission of CO<sub>2</sub>. Primary data are collected from supply chain companies of Indonesia. Three hundred questionnaires are used in this study and they are analyzed through statistical tests. Conclusion of the study shows that QAP and CPI had major role in SCP. Better implementation of QAP and CPI increase the SCP among Indonesian supply chain companies. Moreover, ERP is a moderating variable between the relationship of QAP and CPI and SCP. Therefore, Indonesian supply chain companies should enhance the policies related to quality assurance, process improvement and environmental policies to enhance SCP.

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## 1. Introduction

Supply Chain is a system between an organization and various suppliers to distribute a product to the ultimate customers (Christopher, 2016; Rushton et al., 2014). It consists of people, activities, resources and information involved in moving a product as well as service from supplier to the specific customer (Hugos, 2018). Logistics is one of the essential and major part of supply chain (Rushton et al., 2014). Logistics consists of heavy transportation to carry goods from one place to another, most importantly, to reach goods to the customers who ordered the goods (Suryanto et al., 2018).

Performance of supply chain companies is important for every country. As the supply chain is one of the major economic instruments. Most of the countries are working hardly to enhance supply chain performance (SCP). Indonesia is one of the emerging countries trying to enhance SCP. However, the Indonesian supply chain industry is facing various issues related to the quality assurance. As the quality assurance is an important element of supply chain (Sroufe & Curkovic, 2008), that is the reason it has significant impact on performance. According to Fearné et al. (2001), it is one of the key segment of

\* Corresponding author

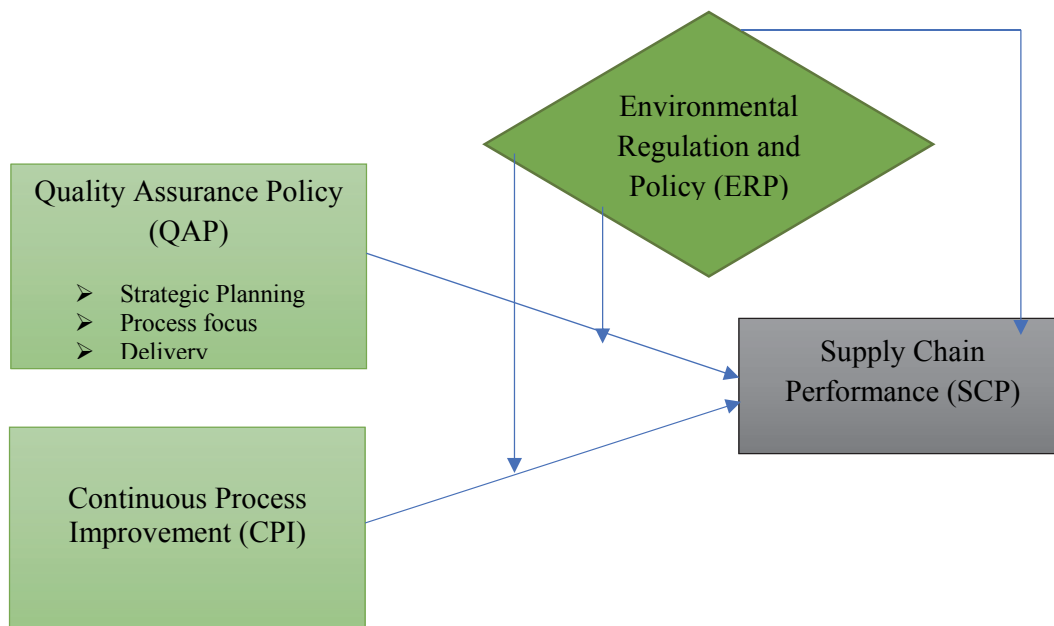
E-mail address: [andriansyah@dsn.moestopo.ac.id](mailto:andriansyah@dsn.moestopo.ac.id) (A. Andriansyah)

supply chain which has influence on performance. Good SCP requires a reasonable level of quality assurance policy (QAP) (Aung & Chang, 2014; Kiggiboon, 2013; Henry, 2014; Bank & Bank, 2014; Adebambo et al., 2014; Zomorodi & Zhou, 2017).

Therefore, Indonesian supply chain industry must incorporate good quality assurance practices in supply chain. Secondly, Indonesia supply chain companies are facing issues in continuous process improvement (CPI). CPI is important to maintain the quality among supply chain firms. CPI is not only important in supply chain but also it is important for all companies. A study conducted by Diekola (2016) in Malaysian food and beverages industry found that both the QAP and CPI had significant positive impacts on performance. Thus, Indonesian supply chain industry must adopt QAP and CPI to boost performance and to resolve various issues. Additionally, as mentioned above, logistics is the big part of supply chain process which consists of transportation. Heavy transportation has negative effect on environment through CO<sub>2</sub> emission (Gideon, 2014; Zheng et al., 2017; Luong et al. 2017; Zhang, 2017; Al-Fatlawi, 2018; Baran & Yilmaz, 2018). This negative impact can be resolved with the help of environmental regulations and policy (ERP). ERP has significant influence to enhance the performance of supply chain.

Hence, the objective of this study is to examine the effect of critical evaluation of policies in SCP among Indonesian supply chain companies. Moreover, the other objectives of the study are as follows:

1. To investigate the effect of QAP on SCP.
2. To investigate the effect of CPI on SCP.
3. To investigate the moderating effect of ERP.



**Fig. 1.** Framework showing that how QAP, CPI and ERP effect on SCP  
Source: Developed by the author

## 2. Literature Review

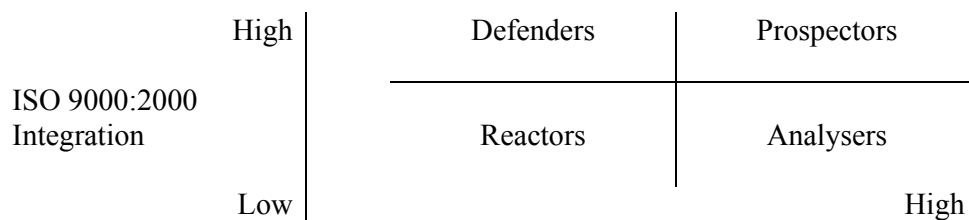
### 2.1 Quality Assurance Policy (QAP)

Quality assurance is the element of Total Quality Management (TQM). Policies against quality assurance is most important to sustain performance among supply chain companies. Quality assurance includes the idea of orderly administration and evaluation systems used to guarantee accomplishment of quality yields or progressed quality. Quality assurance, in light of extensive survey has three phases,

including; design of planning, process focus and delivery (Abdous, 2009). Quality assurance policies has the tendency to enhance performance of supply chain by satisfying the customers and enhance profitability.

Alkafaji (2007) analysed quality assurance survey projects of auditing firms from international point of view. The reason for the examination is to thoroughly analyse quality assurance survey programs in various parts of the world with the end goal to recognize likenesses and qualifications in these projects. An overview for data was sent to the accounting administrative bodies who are individuals from the international federations of accountants (IFAC). The outcome demonstrated that nations with noteworthy stock markets have a tendency to require quality assurance projects of their firms while nations of less massive stock markets tend not to require such projects. These quality assurance practices have significant role on supply of goods. As there is a strong relationship between quality assurance and supply chain quality performance (Fynes et al., 2004; Fynes et al., 2005; Ekpung, 2014; Chidoko, 2014; Zomorodi & Zhou, 2016; Danbaba et al., 2016; Marshal, 2017; Marshal, 2017; Mušić, 2017; Chen et al., 2018; Al-Fatlawi, 2018).

Töremen et al. (2009) demonstrated that in quality, the duty regarding quality is positioned in both the people and group through some formative procedures which speaks to a way to deal with quality assurance to be more understanding with the structures and basic morals of instructive associations than more robotic and progressive procedures. Systems for quality assurance on enterprises have developed interminably as per the innovative changes that have denoted the fast development of society (Cătălin et al., 2014). Tran et al. (2011) clarified that ISO was produced from Quality Assurance; Quality Assurance empowered the event of quality administration amid the new-item advancement process and concentrated on nonstop enhancement as a key quality administration. The framework of Miles et al. (1978) in Fig. 2 can be utilized to distinguish between companies that are involved in ISO registration only because customers need it and to support certain characteristics of quality assurance.



**Fig. 2.** ISO integration and supply chain quality assurance

Source: Miles et al. (1978)

Cheong Cheng (2003) described quality assurance in respect to interface, internal and future education. The investigation opined that quality assurance is isolated into three extraordinary ideal models in training. First, inside quality assurance that enhances the inside condition and process to such an extent that the feasibility of learning and educating can be guaranteed to accomplish the arranged objectives. Second, interface quality assurance guarantees that training administrations fulfil the requirements of partners and are assessable to general society openness. Third, future quality assurance which highlights on guaranteeing the importance of aim, practices and results of training to the education to the future of new generations worldwide, data innovation and the information driven economy. In understanding quality assurance, Choon Boey Lim (2008) led a cross-country contextual investigation by looking into on understanding quality assurance. The motivation behind the investigation is to work on the elements of quality assurance approach usage inside and crosswise over foundations. Interviews were directed, and information were received in Malaysia. The investigation uncovered that quality assurance might not be healthy in cases if the organization is suffering with internal problems. herefore, it requires plaining, produces and delivery to enhance quality assurance in supply chain companies.

**H<sub>1</sub>:** QAP has positive effect on SCP.

## *2.2 Continuous Process Improvement (CPI)*

One of the regularly debated TQM components in literatures is continuous improvement or continuous process improvement (Intra & Zahn, 2014; Jørgensen et al., 2003). Continuous improvement has turned out to be an intense device in companies (Krittanathip et al., 2013). Furthermore, from the components of TQM, all issues are exceptionally organized because of continuous improvement, with the end goal to upgrade the better performance of company (Suárez-Barraza et al., 2009).

As indicated by Adina-Petruța and Roxana (2014), intensity, advancement and performance are the objectives of the present business conditions under the given ideas, for example, quality and continuous improvement are vital stimuli in accomplishing this objective. Their investigation centres around coordinating six-sigma with quality administration for the advancement and continuous improvement of higher training foundations. The discovering demonstrates that continuous improvement is accomplished by estimating the quality of processes and results of research and useful items. Moreover, it is contended that continuous improvement to be effectively established through cooperation (Atkinson, 1994). According to various studies, continuous improvement has important influence on supply chain (Hyland et al., 2003). However, the political influence of stock return and economic factors can make the difference (Basheer et al., 2019; Maqbool et al., 2018). Christofi et al. (2008) expressed that, continuous process improvement is viewed as one of the TQM standards. Ellis and Castle (2010) conceptualized a parallel connection between continuous process improvement and instructor research by laying out the basic attributes and processes. Jung and Wang (2006) examined the association between TQM and continuous improvement. Data was obtained by a cross sectional method from 100 middle levels to senior level managerial employees to examine the hypotheses. The research study recommends that the mutual association between soft TQM fundamentals and continuous improvement is much significant as compared with the relationship among hard TQM fundamentals. A study conducted by Chapman and Corso (2005) found that continuous improvement and collaborative innovation had significant positive connection with each other which had influence in supply chain. Collaboration increases the innovation, as mentioned by Hameed et al. (2018), which increases the performance of supply chain. Therefore, continuous process improvement increases the supply chain performance.

**H<sub>2</sub>:** CPI has positive effect on SCP.

## *2.5 Environmental Regulation and Policy (ERP)*

Environmental quality is measured through the degree in which ERP is being appropriately followed. It is a feature of the supervisory socio-natural connection, the functional significance of which depends on the capability to reflect the maximum procedures of environmental safety techniques (Chervinski, 2014). ERP has strong connection with supply chain, as increases in logistics increases the Carbon emission. The demand for convincing environmental regulation on item end-of-life and generation processes is upgraded by customer concerns in respect to the environmental factors (Santos-Reyes & Lawlor-Wright, 2001). Esty et al. (2005) communicated about the environmental issues dependent on environmental sustainability index of environmental related concerns. The investigation demonstrated that no environmental protection and laws issues had been discussed widely as far as the environmental contamination issues are concerned. The study demonstrated that the environmental data, straight forwardness and responsibility, sufficient limit with regards to trustworthy requirement and different strategies would advance the better environmental performance. As the supply chain is majorly related to the transport and transport is related to the environmental issues (Hensher & Button, 2003; Hesse & Rodrigue, 2004), therefore, environmental issues may influence on supply chain. Leshinsky (2012) expressed that the utilization planning to help maintainability and environmental protection through a logical structure that would draw cooperative planning theory and practice for arranging and understandings together can be utilized as an instrument to protect environmental qualities and

standards. The findings uncovered that environmental policies may have set up great system and practice to save the earth. The understandings of the policies as an environmental instrument can reduce the negative impact on environment. Reduces in negative effect on environment has positive role in supply chain performance. Madu et al. (1995) explained that numerous companies have not considered the capability of normal environmental quality planning which causes to effect on organization's item quality, growth and competitive advantage. Apart from other companies, it is more important for supply chain companies. As the emission of CO<sub>2</sub> from logistics transport decreases the environmental safety (Kim et al., 2009).

**H<sub>3</sub>:** ERP has positive effect on SCP.

**H<sub>4</sub>:** ERP moderates the relationship between QAP and SCP.

**H<sub>5</sub>:** ERP moderates the relationship between CPI and SCP.

### 3. Research Methodology

#### 3.1 Data Collection Procedure

Data is the set of information needed to test the hypotheses. In this study, the employees of supply chain companies were preferred to take the data. Firstly, the email addresses of employees were gathered from the head offices of companies. After that emails were sent to them by attaching the survey questionnaire. Objective of the study and instructions to fill the questionnaire were also described in the email. Data were collected from Indonesia. Supply chain companies were selected to collect the data. Supply chain company's employees were selected as respondents. Therefore, questionnaires were distributed among the employees of Indonesian supply chain companies by using simple random sampling. Data collection was carried out during the period May, 2018-June, 2018. In the month of May, the questionnaires were distributed with the help of email. After 15 days on 15 May, first remainder was sent to those respondents who did not respond. Second remainder were sent on 01 June. Finally, the third remainder was sent on 15 June. The response rate is give in below Table 1.

**Table 1**

Response from respondents

Response	Frequency/Rate
Total questionnaires distributed	300
Total questionnaires returned	210
Total Useable questionnaires	203
Total questionnaires excluded	07
Total response rate	70%
Total useable response rate	67.6%

#### 3.2 Sample Size

Different studies provide various methods to determine the sample size. Most of the studies suggested that sample size should be based on the total population. In this case, total population of Indonesian supply chain companies is required. It was found that the total population is not known. Therefore, in that case the instructions of various studies to take 300 sample size was preferred. Thus, the study used 300 sample size to collect the data.

#### 3.3 Sampling Technique

Due to the limitation of cost and time, the current study followed simple random sampling technique to collect the data from the employee of supply chain companies in Indonesia. First of all, the lists of employees were obtained from different companies, after that the respondents were selected from this list randomly.

### 3.4 Questionnaire Development

A survey instrument including the profile of respondents and scale items were developed with the help of previous studies. Specificity, a 5-point Likert scale was developed. Questionnaire is suitable in this study because a questionnaire is a method of gathering information from participants about the behaviour, knowledge, values and feelings (Polit Denise & Hungler Bernadette, 1999). It comprises the research items related to main variables including; QAP, CPI, ERP and SCP. Questionnaire was divided in to two main sections. First section was based on the respondent's profile such as gender, age, education and marital status shown in Table 2. Second section was based on the main research items.

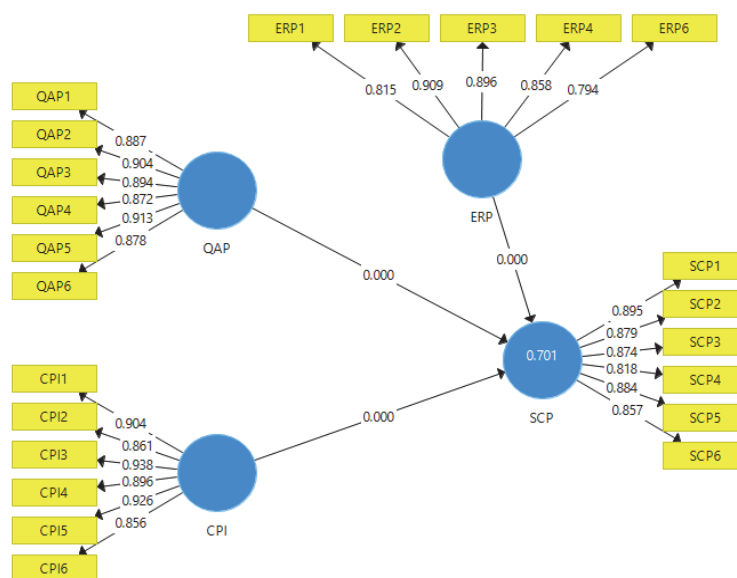
**Table 2**  
Respondents Profile

Variables	Category	Percentage	Variables	Category	Percentage
Gender	Male	67	Marital status	Single	40
	Female	33		Married	60
Age	Below 20 years	03	Education	Matriculation	07
	21-30 years	15		Intermediate	15
	31-40 years	41		Bachelor	42
	41-50 years	25		Master	29
	Above 50 years	16		Ph.D.	07

## 4. Research Analysis and Results

Structural equation modeling is the most acceptable technique to test the hypothesis. It is recommended by different studies Henseler, Ringle, and Sinkovics (2009) and F. Hair Jr, Sarstedt, Hopkins, and G. Kuppelwieser (2014). In PLS-SEM, part one is based on an outer model assessment in which reliability as well as validity were scrutinized. The second major part is based on an inner model assessment in which hypotheses were tested. In the first part, convergent validity and discriminant validity was examined. Average variance extracted (AVE) was used to examine convergent validity. Value of factor loading for each item should be above 0.4, composite reliability above 0.7 and AVE not less than 0.5.

According to Fig. 3, factor loading is more than 0.5, AVE is more than 0.5 and composite reliability is also more than 0.7. Additionally, discriminant validity is shown in Table 5 and Table 6 through AVE square root and HTMT criterion, respectively. All the values satisfying the minimum requirements.



**Fig. 3.** Measurement Model

**Table 3**  
Factor Loadings

	CPI	ERP	QAP	SCP
CPI1	0.904			
CPI2	0.861			
CPI3	0.938			
CPI4	0.896			
CPI5	0.926			
CPI6	0.856			
ERP1		0.815		
ERP2		0.909		
ERP3		0.896		
ERP4		0.858		
ERP6		0.794		
QAP1			0.887	
QAP2			0.904	
QAP3			0.894	
QAP4			0.872	
QAP5			0.913	
QAP6			0.878	
SCP1				0.895
SCP2				0.879
SCP3				0.874
SCP4				0.818
SCP5				0.884
SCP6				0.857

**Table 4**  
Measurement Model

	Cronbach's Alpha	rho A	Composite Reliability	Average Variance Extracted (AVE)
CPI	0.952	0.955	0.961	0.806
ERP	0.909	0.918	0.932	0.732
QAP	0.948	0.950	0.959	0.795
SCP	0.935	0.936	0.948	0.754

**Table 5**  
Fornell and Larcker criterion

	CPI	ERP	QAP	SCP
CPI	<b>0.898</b>			
ERP	0.805	<b>0.856</b>		
QAP	0.897	0.802	<b>0.891</b>	
SCP	0.700	0.727	0.705	<b>0.868</b>

**Table 6**  
HTMT criterion

	CPI	ERP	QAP	SCP
CPI				
ERP	0.781			
QAP	0.745	0.775		
SCP	0.638	0.679	0.747	

The SEM has been used to analyse the hypotheses developed in literature review. Both moderatinion and direct hypotheses were tsted with the help of PLS bootstraping. In this process, the p-value was considered. While analysing the data, 1.96 minimum level of t-value was considered to test the hypotheses. According to the direct results, it is shown that all hypotheses had t-value above 1.96.

Therefore, we accept H<sub>1</sub>, H<sub>2</sub> and H<sub>3</sub>. All the results of direct effect are shown in Table 7. Moreover, the PLS bootstrapping process is given Fig. 4 where the t-value is shown for each relationship.

Furthermore, the moderating effect of ERP is shown in Table 8 in which it is clear that the t-value is above than minimum threshold level for both moderation effect which supports the results of moderation. Therefore, it supported H<sub>4</sub> and H<sub>5</sub>. Additionally, R-Square is shown in Table 9 which is 0.701. (See Fig. 3).

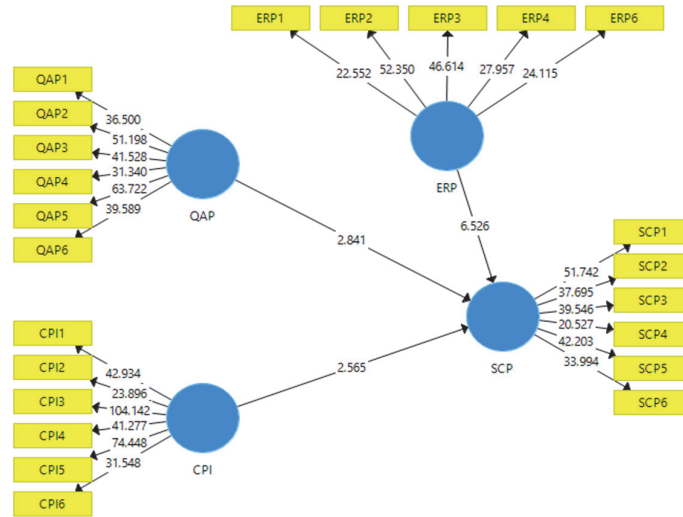


Fig. 4. Structural Model

Table 7  
Hypotheses results without Moderating effect

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics ( O/STDEV )	P Values	Decision
CPI → SCP	0.218	0.205	0.085	2.565	0.023	Accepted
ERP → SCP	1.14	1.127	0.175	6.526	0.000	Accepted
QAP → SCP	0.128	0.122	0.045	2.841	0.015	Accepted

Table 8  
Hypotheses results (Moderating effect)

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics ( O/STDEV )	P Values	Decision
CPI×ERP → SCP	0.111	0.108	0.053	2.051	0.041	Moderation
QAP×ERP → SCP	0.180	0.174	0.041	4.382	0.000	Moderation

Table 9  
R-square value

Endogenous Latest Variable	Variance explained
Supply Chain Performance (SCP)	0.701

### 5. Findings

The objective of this study is to find the role of different policies on SCP. To achieve this objective, three key policies were selected, namely; quality assurance, process improvement, environmental regulation and polices. In this study, ERP is taken as moderating variable. To attain the objective, five hypotheses were formulated concerning the relationship of independent variables (QAP, CPI), moderating variable (ERP) and dependent variable (DV). Summary of hypotheses is given below;



- H<sub>1</sub>: QAP has positive effect on SCP.  
 H<sub>2</sub>: CPI has positive effect on SCP.  
 H<sub>3</sub>: ERP has positive effect on SCP.  
 H<sub>4</sub>: ERP moderates the relationship between QAP and SCP.  
 H<sub>5</sub>: ERP moderates the relationship between CPI and SCP.

The results of the study show that QAP had positive effect on SCP with t-value 2.841 and beta value 0.128. It shows a significant positive effect of QAP on SCP. These results supported hypothesis one. The results also accepted hypothesis two, as the effect of CPI found positive on SCP with beta value 0.218. It also found significant with t-value 2.565. Therefore, an increase in QAP and CPI also increases the SCP. Indonesian supply chain companies must insure good QAP and CPI to boost performance. Moreover, it is found the ERP had positive effect on SCP with t-value 6.526 and positive beta value. Thus, an increase in ERP also increases the SCP supporting the hypothesis three. The hypothesis four and hypothesis five were accepted as the moderation effect was found significant. ERP moderates the relationship between QAP and SCP, CPI and SCP. The moderation effect is shown in Fig. 5 and Fig. 6 which shows that moderation effect of ERP strengthens the effect of QAP and CPI on SCP.

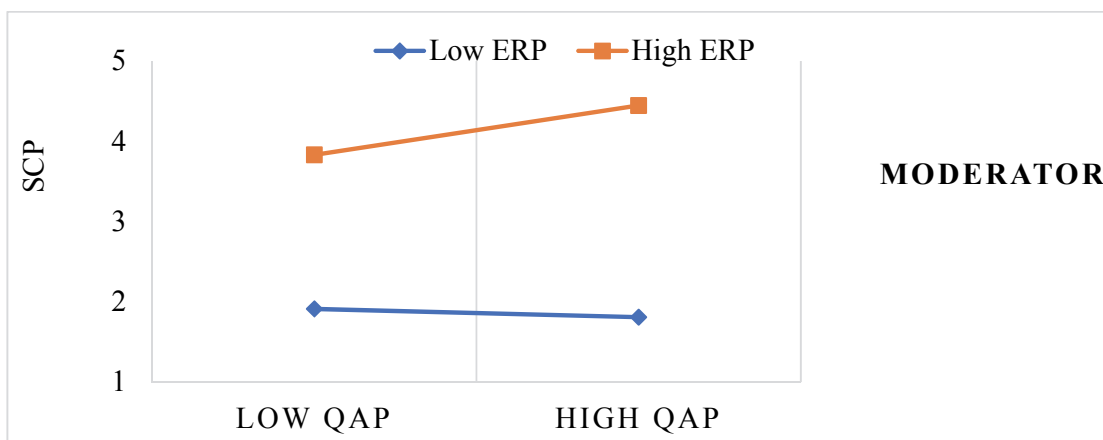


Fig. 5. Moderation effect of ERP between QAP and SCP

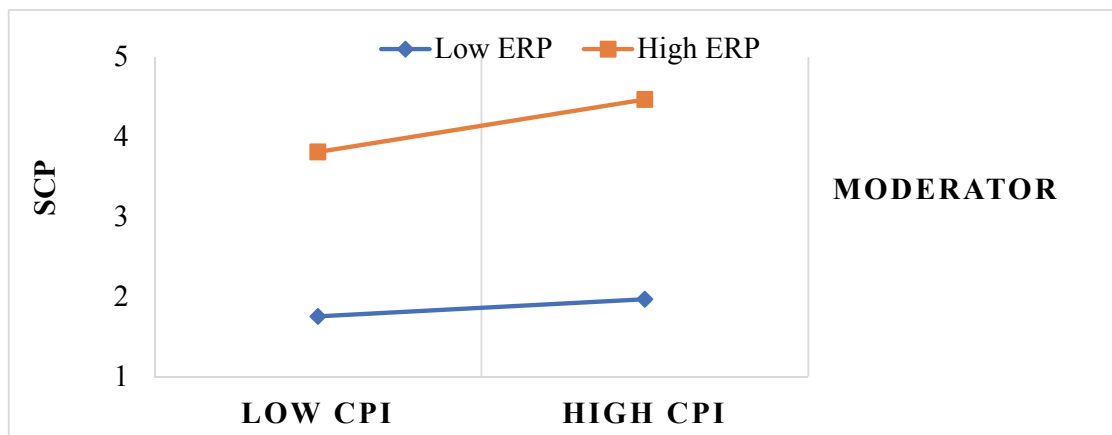


Fig. 6. Moderation effect of ERP between CPI and SCP

## 5. Conclusion

This study has investigated how critical evaluation of policies in supply chain affect the performance of supply chain companies in Indonesia. Employees of these companies were selected as the respondents. It has revealed that policies related to quality assurance had major important for

performance among supply chain companies. QAP such as strategic planning, focus on process and delivery had significant role on performance of supply chain. Better QAP policies increase the performance. Moreover, continuous improvement in process had also the tendency to influence SCP. CPI policies increase the operations and delivery of goods and services which increase the SCP. Moreover, different regulations related to environment had the effect on the relationship of QAP and SCP. It also has influenced on the relationship of CPI and SCP. ERP increased the positive effect of QAP and CPI on SCP. Therefore, Indonesian supply chain companies should enhance the policies related to quality assurance, process improvement and environmental policies to enhance SCP.

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