

# POLICY ANALYSIS ON SMEs VEHICLE COMPONENTS IN ORDER TO IMPROVE ITS SUPPLY CHAIN ABILITY WITH SYSTEM DYNAMICS APPROACH

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## ABSTRACT

*One key to the success of the industry is the presence of a reliable supply chain network. However the SMEs vehicle components have problems in meeting the market demand in a sustainable manner. This study uses the system dynamics approach to study the variety of variables that make up the SMEs of vehicle component. The system dynamics try to explain this pattern of behavior of SMEs in the period of the simulation and develop some policy scenarios. Simulation results show that the improvement of labor skills and the lower level of bank lending rates, are able to provide a significant impact on the level of production that is able to improve the performance of the supply of vehicle components on an ongoing basis. This scenario was selected as the policy that is able to guarantee the sustainability of the supply chain of SMEs vehicle components in West Java.*

**Keywords :** Supply Chain, SMEs of Vehicle Components, System Dynamics

## 1. INTRODUCTION

Small and Medium Enterprise (SMEs) is a labor-intensive industry. Development of SMEs should receive careful attention at each stage of the chain. This would be a solid economic foundation and SMEs will be able to develop independently and able to support large industrial cooperation within the framework of equal and mutual benefit. The main problems faced by SMEs is the difficulty of getting access to capital, limited skills of human resources, lack of management ability and business, and the limited ability to access information to capitalize on market opportunities.

Many research concluded that the SMEs has contributed to economic development. At the time of economic crisis, SMEs had shown its superiority to stay afloat when many a great industries was falling. SMEs of vehicle component will continue to grow despite still facing many obstacles. Strengthening the SMEs of vehicle component is affected by the high growth of the number of motor vehicle ownership. According to the Office of the Indonesian National Police in the report of Central Bureau of Statistics ([www.bps.go.id](http://www.bps.go.id)), the number of motor vehicles in the year 2000 there were 18,975,344 units and continue to grow up to 65,273,451 units in 2008.

The size of the potential market vehicle components are also indicated by the entry of China, Korea and Taiwan in addition to Japan as a state exporter of aftermarket vehicle components into Indonesia (Department of Industry and Trade, West Java, 2006). This is indicated by the use of local components in the national automotive industry only 30% which means that the use of very large import content of 70%.

There is the size of the potential market that still can not be utilized by SMEs of vehicle component in West Java. This is indicated by the number of vehicle components compliance by SMEs in West Java alone only reaches 21.15%. These conditions describe a real major problems faced by SMEs vehicle component which is an inability for its production to meet the market demand. But why the SMEs are generally not able to increase its production in order to meet the market demand ?. Such difficulties are caused by several inter-related reasons, among which the most important are lack of culture and skills in planning, (Joyce P., et al., 1997). A lower managerial level of human resources skills is often a major obstacle in introducing innovation which may be more expensive or less productive in small firms than in the larger ones.

The main purpose of this study is whether the results of a number of studies that has been conducted by several authors, mainly due to the low competency of human resources and the inability to access financial resources due to higher interest rates, have a strong correlation with the production volume. Thus the company can meet market demand and maintain the continuity of supply of vehicle components. The relationship between these variables will be illustrated through a system dynamics approach in order that the system behavior can be studied by applying a number of scenarios. Thus through the behavior of the system will know what policies are needed to improve the performance of supply for the SMEs in meeting the market demand of vehicle components.

## **2. SUPPLY CHAIN MANAGEMENT**

### **2.1 Supply Chain Concept**

Operations and industrial modelling and management have a long history dating back to the first industrial revolution. With the growth of supply chains, the complexity of operations and logistics problems has increased rendering traditional operational management issues far more complex and of increased strategic importance (Kogan and Tapiero, 2007). Simultaneously, the growth and realignment of corporate entities into strategic supply chains, global and market sensitive, have altered our conception of operations, their modeling and performance measurements. Rendering them far more strategic and sensitive to external events and to the externalities that beset the operations of supply chains.

The supply chain concept was born in the 90's when management techniques in the business world were evolving from independent to collaborative logistics. It is well known that the supply chain is a complex macro system. This complexity is firstly due to the variety of the involved organizations and the diversity of relationships between them, and secondly it results from the decision-making mechanisms between these companies. Thus, the success and subsistence of a company in the economic market rely not only on its ability to integrate managerial processes but also on coordinating all the related actors (Drucker

1998; Lambert and Cooper 2000). The SMEs evolve in an unstable and complex network. In order to guarantee its role in a supply chain, SMEs must be able to support the inherent requirements of the supply chain for example low lead times and high level consumer satisfaction. Consequently, SMEs have to collaborate together in order to achieve their goals without losing their autonomy and identity (Villarreal et al. 2005). Meanwhile, Thakkar, et al., 2007, explained that supply chain in SMEs is a set of business activities including purchase from open/spot market, manufacturing or processing of sub-components/subassembly within the plant and delivery to large enterprises using hired transportation to enhance value of end product and in-turn to ensure long-term regular purchase orders.

### **2.2 The Problems of SMEs**

Bianchi et al., 2012, mentioned that the SMEs may need a tailored approach enabling their key-actors to frame their own specific dynamic complexity, so to understand how to pursue sustainable development, design strategies, manage trade-offs in time and space, and assess the results emerging from strategy implementation. Subroto, 2012, was applied system dynamics approach to understand the behavior of a production coordination system through information sharing and financing mechanism for Small Enterprises. Some relevant variables included in the simulation model are potential demand, aggregate demand, and quantity of SMEs and Large Enterprises.

Bhavani T.A. (2010) have already mentioned that the issue of quality employment generation by the SMEs and negates the short term attitude of increasing the volume of employment generation compromising with quality. The author argues that employment generation by the SMEs may be high in quantitative term but very low in quality. Technological upgradation would enable the small firms to create quality employment improving remuneration, duration and skill. This structural shift may reduce the rate of employment generation in the short run but would ensure high-income employment generation in the long run.

Another problem associated with inability of the SMEs as studied by Lahiri, 2012, is their less capacity of collective bargaining in

the credit market. Thus they became fully dependent on banks and have to take loans at a higher rate than the prime lending rate. The larger businesses can bargain with the banks and often can get loans at a lower rate. One possible solution may be to regulate the banks more effectively and establish a uniform rate of lending. Faced with the problems, this research emphasizes that the need to improve SMEs performance based on sustainable competitive strategies has strongly emerged.

### 3. SYSTEM DYNAMICS OF SMEs

#### 3.1 Basic Model of SMEs Vehicle Components

The basic model that describes the relationship variables of SMEs of vehicle component are as follows :

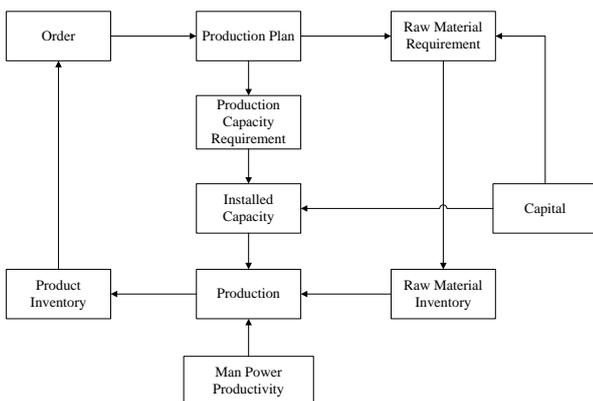


Figure 1 Basic Model of SMEs Vehicle Components

This basic model begins with the entry of the demand component of the market to SMEs. This request is then followed up with a production plan that is tailored to the capabilities. The amount of raw materials ordering is done depends on the amount of capital owned by SMEs. Then the production process carried out by SMEs vehicle components with the existing process raw materials with the use of equipment and manpower available. The output of this process is dependent on the productivity of labor owned. The final product of this process

will increase the supply of vehicle components in the warehouse. Inventory of vehicle components are then distributed to the market to meet the market demand. This process will be repeated and form a regular cycle and rotates continuously.

#### 3.2 CLDs Basic Models of SMEs Vehicle Components

One of the steps that need to be done in the process of system dynamics is a stage in the formulation of dynamic hypotheses. The hypothesis starts with making causal loop diagrams (CLDs). CLDs are an important tool to describe the feedback structure of the system and can quickly describe hypotheses about the causes of the dynamics of the system. The main problems found in SMEs is the inability to meet market demand. This is indicated by many incoming orders can not be fulfilled. Or at least a delay in meeting the demand of the product to the market is very long. As known, the companies included in the group of SMEs in particular providers of vehicle components is small processors with a workforce of 5 to 19 people. Also, the use of capital is still small because one of the constraints faced by the industries is the lack of venture capital ownership. Inability to collect sufficient capital to meet all the demands of the market, the performance of SMEs become increasingly weak among the major industries. Not all incoming orders were able to be realized because of the limitations of capital. In addition, SMEs vehicle components are also highly dependent on availability of workforce that is known to have low competence and expertise. Inadequate productivity is likely to impact the low production. The data showed that the level of labor productivity only reached a maximum of 76%. As a result of the low level of productivity, the rate of delivery of finished products to meet the demand for increasingly long anyway. Currently, orders delivery time is one month, since the request is received until the final product is accepted by consumers.

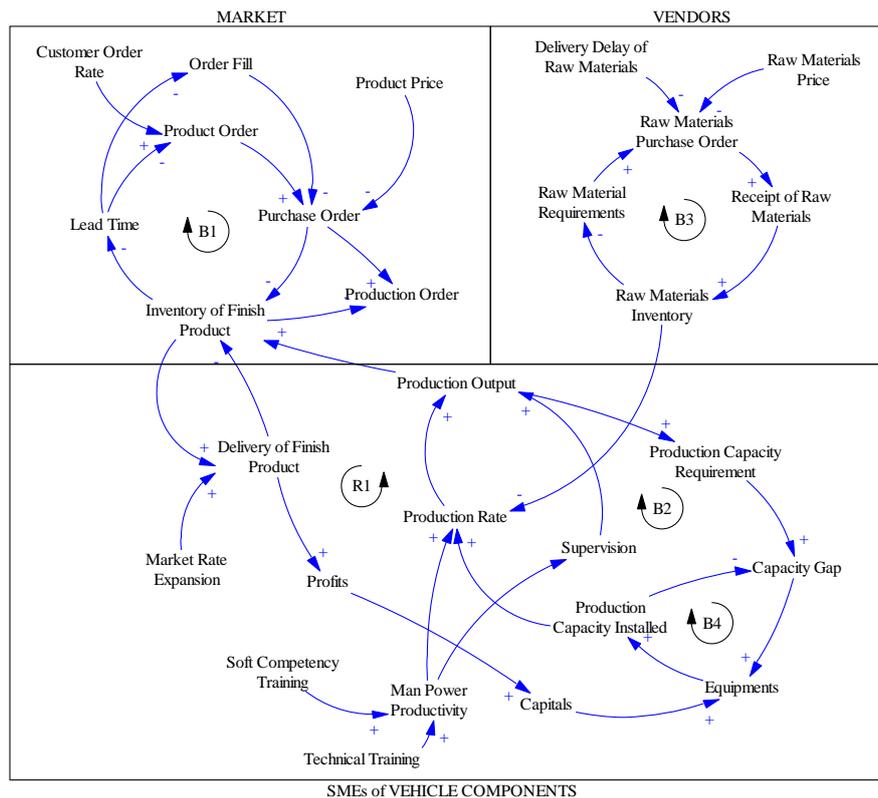


Figure 2. CLDs of SMEs Vehicle Components

#### 4. SCENARIOS DEVELOPMENT OF SMES VEHICLE COMPONENTS

##### 4.1 Scenario Development Policy

Policy scenarios to be built is to get the dynamic behavior of a guaranteed supply of vehicle components stably and continuously. Therefore, this scenario will be simulated in a relatively long period of time is over 50 weeks. The basic scenario is an attempt to see the dynamic behavior of the parameters that were examined in the future. The basic scenario is also the dynamic response of the system variables that give an indication of which policy can be developed in the future (Sushil, 1993).

##### a. Scenario 1

Based on the constraints faced by SMEs in terms of capital, this policy scenario focuses on efforts to reduce the interest rate of the loan. The purpose of scenario 1 is that SMEs can improve their working capital with the addition of raw materials and production capacity. With scenario 1, the rate of production of vehicle components can be increased.

##### b. Scenario 2

Scenario 2 was built with the policy on improving labor productivity. Increasing productivity is done by improving the competence of the workforce through training that is both hard skills and soft skills.

##### c. Scenario 3

Scenario 3 is built by combining the scenario 1 and scenario 2.

#### 4.2 Implementation Of Policy Scenarios

##### a. Basic Model Scenario

Basic scenario illustrates the borrowing rate by 16% so that the loan amount can be received only Rp. 200,000,000. At this level of the amount, SMEs can only meet the needs of raw materials by 26%, but production capacity can not be increased or remained at Rp 500,000,000. Labor productivity on the basis of this scenario only provide additional value of 2.29 of the value of raw materials. At this level of productivity, the pattern of the examination of the final product is done with a very tight and generates 18% rejection. The low labor productivity of SMEs from vehicle

components affect the delivery time, which is for 4 weeks in totals.

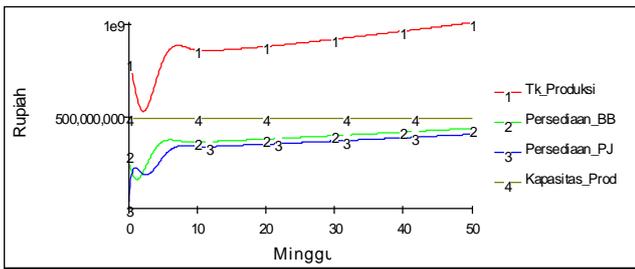


Figure 3 Basic model behavior

Existing behavior of the level of production, raw materials, and finished product inventories continue to show instability. This instability is characterized by fluctuations that occur at the beginning of the week on production levels, inventories of raw materials and finished product inventory. The behavior of the level of production following the availability of finished products. However, the condition of these three variables will be stable after the 10th week until the last week characterized by the same behavior of these three variables.

b. Scenario 1

In figure 4 shows that the intervention in the interest rate from 16% to 10% has resulted in significant behavioral change, where production capacity, production levels, supply of raw materials and finished product inventories increased. This increase occurs because the ability of SMEs increase of the amount of capital up to Rp. 480 million as a result of a decrease in interest rates. Therefore, the availability of raw materials can be increased up to 55%. Additional capital obtained above has been used primarily to provide raw materials by 91.2% and 8.8% to increase the production capacity. The behavior of the variables in scenario 1 is shown in Figure 4 below.

The increasing demand of raw materials resulted in the behavior of inventories of raw materials increased to exceed the installed capacity at the beginning of the week until week 15. But the excess of inventory may go hand in hand with the production capacity starting at week 15 and so on until week 50, the end of the simulation period.

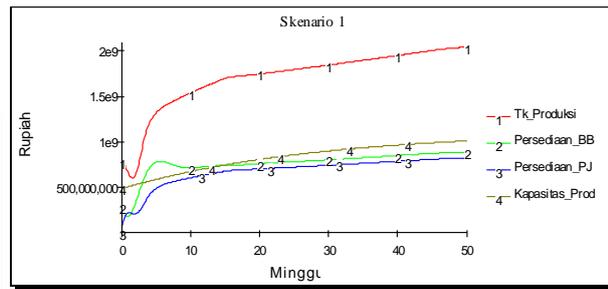


Figure 4 Change of behavior on the model due to scenario 1

At the end of the year or week 50 in scenario 1, the supply of raw materials has been able to reach Rp. 900,399,321 and production capacity has increased from stagnant conditions amounting to Rp 500,000,000 in basic conditions to Rp. 1.02 billion with production rates reaching Rp 2.05 billion. As for the finished product inventory has increased to reach Rp. 837, 433,042.

c. Scenario 2

The second scenario focuses on efforts to increase labor productivity by increasing the number of training followed by employment of SMEs of vehicle components. Field research suggests that training carried over government assistance just as much as 1 to 2 times a year, in the form of technical training course. While the work of mental training is held only when there is a desire of SMEs as well as from industry associations. In scenario 2, the training increased to 3 times for hard skills and 2 times for mental work. This is done to see the changes and their impact on the base model.

The simulation showed that the addition of the hard and soft skills training can improve labor productivity, ie from 2.29 in the baseline scenario to 4 times greater than the value of the raw material in scenario 2. This further results in the ability of SMEs to speed of delivery time of orders into the market, from 2 to less than 1 week or 0.8 weeks. These changes are also able to improve the level of product quality inspection in which the end product rejection rate decreased from 18 to 5%. The behavior of the variables in scenario 2 is shown in the following figure 5 :

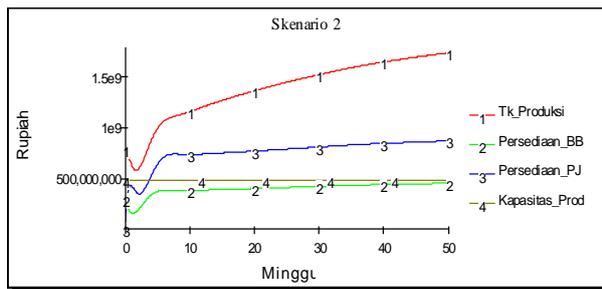


Figure 5 Change of behavior on the model due to scenario 2

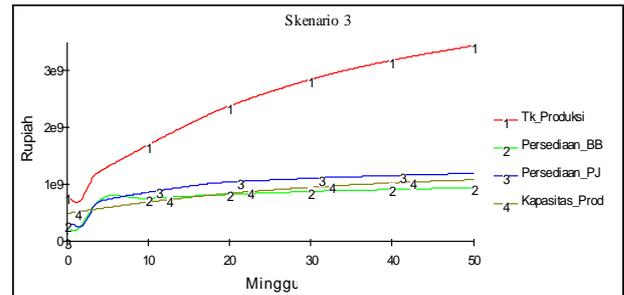


Figure 6. Change of behavior on the model due to scenario 3

Scenario 2 is able to provide a significant change in the production rates to more than Rp. 1.5 billion at the end of the year. However, attainment at the end of the year scenario 2 or week 50, not able to produce a greater change than the change achieved by scenario 1. This is shown by the inventory of raw materials amounting to Rp. 467,698,453 and Rp. 500,000,000 for production capacity. Meanwhile, production rates reached Rp. 1.72 billion as well as product inventory levels only reached Rp 886,535,506.

d. Scenario 3

Incorporation of scenarios 1 and 2 is a comprehensive approach in which low interest rates and an increasing number of SMEs training simultaneously included in the simulation process. The purpose of merging this scenario is to get a significant change in the basic model, and to know how big the difference of the results obtained when compared with the results in scenario 1 and 2. When the incorporation is done, scenario 3 has resulted in a faster reaction in response to the problems of SMEs vehicle components, see figure 6. Rising production rates from the beginning to the end of week 50, reaching over USD 3.45 billion.

Similarly, finished product inventory at week 50 reached Rp. 1.2 billion. While raw material inventory at week 50 was Rp. 956 526 960, as well as production capacity reached Rp. 1.09 billion in week 50. This performance was eventually able to further accelerate delivery times of orders into the market, which is only 2.8 weeks from 4 weeks that occurred on the base model.

5. CONCLUSION

System dynamics approach used in this study has been able to prove the results of previous studies of the authors. That there is a strong correlation between the interest rate of the loan and the level of competence of the employees of SMEs vehicle components with efforts to increase the level of production. Policies that must be taken to develop this industry in West Java is by considering the two variables simultaneously and comprehensively. The application of only one variable, it will not be able to optimally develop this small industry. When these small industry is able to increase the level of production, then it will be able to maintain continuity of supply with fast delivery times and the desired volume, so that the industry can guarantee its existence in the supply chain for a long period of time. The table below shows a resume of the dynamics of the system over the problems faced by SMEs vehicle components and the application of the three scenarios.

Tabel 1 Resume of the scenario development results

i	Basic Model	Scenario 1	Scenario 2	Scenario 3
Interest rate of loan	16%	10%	-	10%
Training frequency	1 Hard skill	-	3 HS + 2 Soft Skill	3 HS + 2 SS
Loan amount	Rp. 200 million	Rp. 480 million	Rp. 200 million	Rp. 480 million

Tabel 1 Resume of the scenario development results

i	Basic Model	Scenario 1	Scenario 2	Scenario 3
Raw Materials by	26%	55%	26%	55%
Production Capacity	Rp. 500 million	Rp. 500 million	Rp. 500 million	Rp. 500 million
Labor productivity	2.29 times of RM	4 times of RM	2.29 times of RM	4 times of RM
Product Rejects	18%	18%	5%	5%
Week reaction start	15	week 10	week 5	week 2
Delivery time	4 weeks	2 weeks	0.8 weeks	0.8 weeks
End of year (week 50)				
Raw Materials	Rp. 490,000,000	Rp. 900,399,321	Rp. 467,698,453	Rp. 956 526 960
Production capacity	Rp. 500,000,000	Rp. 1,020,000,000	Rp. 500,000,000	Rp. 1,090,000,000
Production rates	Rp. 900,500,000	Rp. 2,050,000,000	Rp.1,720,000,000	Rp. 3,450,000,000
Inventory of end product	Rp. 480,000,000	Rp. 837,433,042	Rp. 886,535,506	Rp. 1,200,000,000

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