Design logistics performance measurement model of automotive component industry for strengthening competitiveness of dealing AEC 2015

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Abstract. As the free trade Asean Economic Community (AEC) causes the tougher competition, it is important that Indonesia’s automotive industry have high competitiveness as well. A model of logistics performance measurement was designed as an evaluation tool for automotive component companies to improve their logistics performance in order to compete in AEC. The design of logistics performance measurement model was based on the Logistics Scorecard perspectives, divided into two stages: identifying the logistics business strategy to get the KPI and arranging the model. 23 KPI was obtained. The measurement result can be taken into consideration of determining policies to improve the performance logistics competitiveness.

1. Introduction
As the free trade ASEAN Economic Community (AEC) causes the tougher competition, it is important that Indonesia’s automotive industry have high competitiveness as well. A model of logistics performance measurement was designed as an evaluation tool for automotive component companies to improve their logistics performance in order to compete in AEC. The design of logistics performance measurement model was based on the Logistics Scorecard perspectives, divided into two stages: identifying the logistics business strategy to get the KPI and arranging the model. 23 KPI was obtained. The measurement result can be taken into consideration of determining policies to improve the performance logistics competitiveness.

Indonesia supply base is still weak compared to other ASEAN countries, namely Thailand, the number of parts and materials suppliers in Indonesia and Thailand were 709 in 1965 [6][12]. Automotive components industry also still has limited capacity to meet the demand, such as the requirements of Quality, Cost and Delivery (QCD), and the ability of human resources and technology. The unsatisfactory national logistics performance was caused by the high logistics costs and length of delivery time, also the supply chain management and logistics [15]. An effective and efficient logistics system is necessary for competition in the AEC [11]. This research was focused on designing a model of logistics performance measurement for the automotive component industry, which can be a tool of evaluation and guidelines for the improvement of its logistics activities in order to compete in the era of AEC.

The previous researches [5] and [23] developed a method of performance measurement in the application of the supplier relationship management using benchmarking framework. This study was
strengthened by [14] who examined the practice of supply chain management and its impact on the performance of a manufacturing company in Ghana. Balanced Scorecard approach [4] and [20] used the in measuring the supply chain performance. Economic Value Added and ABC classification [17] used for evaluating supply chain performance. Others had applied the Supply Chain Operations Reference (SCOR) model [3], [16] and[10] . Anatan conducted based on [13] a research of the effect of implementation of supply chain management practices to the achievement of competitive advantage and performance of the supply chain.

The measurement the competitiveness of some Thailand industries using Logistics Scorecard model [18] and [19], which can provide information of how industries should improve its performance to improve its business matters. This resulted a competitiveness index based on KPIs which were determined and compared between industry with other industries, providing guidance for the proposed increase in the performance ratio of logistics industry competitiveness.

This study was aimed to design a logistics performance measurement model for the Indonesian automotive component industry in order to increase competitiveness in dealing with AEC integration. Logistics Scorecard’s perspective of [18] and [19] which consists of five perspectives: business strategy, capacity and planning work, the efficiency and productivity of logistics, information technology and supply chain collaboration.

Logistics mission is to meet the needs of the goods corresponding to the right place, at the right time and in the desired conditions, thereby providing benefits for the company [8] . It takes a long time for companies to realize the importance of logistics in order to develop a competitive advantage over competitors [20] and [21]. Research by [9] resulted that the logistics service performance takes effect on customer satisfaction, which is depends on the quality of the management of the flow of goods and services in order to face the free market integration AEC [9].

SCM-Logistics Scorecard (LSC) has been developed since 2001 by Tokyo Institute of Technology with Japan Institute of Logistics System. LSC has been an efficient tool which analyzed relationship between company’s supply chain performance and managerial performance [7], investigated the correlation between company’s environment and supply chain execution [2], identified influencing factors that determine the performance of the implementation of supply chain management and dan its effect to bottom-line financial index [13], evaluation tool for supply chain operational performance to know potential factors which could improve the efficiency of supply chain operational performance [8].

The key index of competitiveness used [19] classified with the perspectives which are: business strategy orientation, capacity planning and execution, logistics efficiency and productivity, information technology implementation, and supply chain collaboration. The five perspectives measurement with 23 KPIs are designed about supply chain practices within the organization by using the rating scale or 1-5 level (Level 1 = very bad business processes on the performance, level 5 = indicates that the businesses do the best logistics activities). The strategic planning is carried out starting from identification of organizational vision and mission statement, internal environment analysis, analysis of internal and external environment of the organization, determine the opportunities and threats / challenges [2], [10].

2. Research Methodology

The design of logistics performance measurement model is Logistics Scorecard by using the determined indicators business strategy and analysis system. The collected data were including conditions and situations that automotive component industries in the AEC are facing, the measurement model designed, both small-medium scale industries with local ownership and large scale industries with foreign ownership, and also the related agency or institution (PIKKO). The logistics performance measurement using the designed model, for qualitative assessment and quantified methods, and weights for the KPI are determined in order to obtain the output score of overall performance to know how the position of the company’s competitiveness.

Designing The Model. The design of the logistics performance measurement model is divided into two stages: (i) identify the logistics business strategy of automotive component company to obtain indicators of logistics performance suitable with the logistics strategy, (ii) create a logistics
performance measurement model (Figure 1: Logistics Scorecard) using indicators that have been determined. The performance indicators are identified based on the strategy that had been developed. It is determining the performance indicators along with the targets for each of the strategies that have been grouped in the perspective of Logistics Scorecard (Table 1). Those performance indicators validated by using Delphi technique by interviewing five experts consist of the company Director, Head of the Warehouse & Logistics Department, the academics expert in the field of supply-chain logistics, the practitioners of other automotive components, and also the automotive practitioners from distributor. The result summary of the Delphi technique obtained was the five respondents were giving the similar assessment for ‘all indicators are required’ more than 60% proportional answers [7].

![Figure 1. Design of Logistics Performance Measurement Model](image)

| Table 1. Strategy, Performance Indicator, Target |
|------------------------------------------------|
| **Strategy** | **Performance Indicator** | **Target** |
| Business-Oriented Strategy Perspective | | |
| Create on point logistic business strategy | Logistics business strategy | Correct and clear business strategy that supports SCM-logistics activity |
| Contract determination and clear information exchange with supplier | Contract agreement and information exchange with supplier | A formal written agreement with suppliers, sharing activity and stable supplier planning development |
| Determine contract agreement with a clear information exchange with customer | Contract agreement and information exchange with customer | A formal written agreement with customers, sharing activity and stable customer satisfaction planning development |
| Customer satisfaction system improvement | Customer satisfactory measurement and improvement system | Measuring system enhancement and customer satisfaction improvement, the result will be used as product development and service improvement information |
| Employee training and evaluation system enhancement | Workers training and evaluation system | Training system and worker evaluation enhancement, knowledge management for knowledge sharing |

3. Results and Discussion

Strategic planning begins with identifying vision and mission statement, analyzing the internal and external environment. Then, by using SWOT, the organizational strengths, weaknesses, opportunities and threats are evaluated. The next step is the strategy formulation into five Logistics Scorecard perspectives and arrangement of Logistics Scorecard Strategy Map (case study SME PIKKO, PT. XYZ).

3.1. Designing The Logistics Scorecard

The logistics performance measurement metrics is arranged including the blank column provided to be filled in. KPI priority determination is carried out by sorting the final weight of each KPI from the most high.
**Table 2. The Scale of Performance Measurement**

| Logistic Business Strategy | 1 | 2 | 3 | 4 | 5 |
|----------------------------|---|---|---|---|---|
| Have not yet formulized SCM-logistic strategy, logistic is not considered as important by company | | | | | |
| Clear and precise business strategy, supporting system for SCM-logistic activity is available | | | | | |

Final weights obtained by multiplying the weight of each KPI with the weight of perspective in which KPIs are grouped. Figure 3 shows the KPI priority based on its weight. The measurement scale used is the descriptive graphic rating scale, with 1 to 5 range of scale (Table 2).

Below are grouping of the performance score categories based on scale rating [19]:

- **Level 1**: a very poor logistics performance, in which the company was not involved in logistics activity
- **Level 2**: a poor logistics performance
- **Level 3**: a good enough logistics performance, but overall still need much improvement
- **Level 4**: a good logistics performance
- **Level 5**: an excellent logistics performance, in which companies do their best in logistics activities

Then the results can be made a diagram to map their performance. This will provide some inputs to the evaluation of the company in determining the logistics performance improvement initiatives [5] (Gong et al., 2011).

The Logistics KPI Determination based on Logistics Scorecard Perspectives. All indicators are really needed in logistics performance measurement of automotive components company since those indicators are able to show in detail the supply-chain logistics business process of the company. The next step is formulate the KPI logistics in the form of a hierarchy to make it easier to see the picture of the logistics performance measurement model based on Logistics Scorecard perspectives. Then the performance measurement results of some companies can be made a diagram to map their performance. This will provide some inputs to the evaluation of the company in determining the logistics performance improvement initiatives. Figure 2 shows the flow of logistics performance measurement system from input to the output. The metric of logistics performance measurement is on the Figure 3.

| Perspective | Perspective score | Code | Criteria | Criteria score | Final score |
|-------------|-------------------|------|----------|----------------|-------------|
| Business Strategy Orientation | 0.43 | BSO1 | Logistic business strategy | 0.46 | 0.1984 |
| | | BSO2 | Contract agreement and information exchange with supplier | 0.07 | 0.0281 |
| | | BSO3 | Contract agreement and information exchange with customer | 0.08 | 0.0352 |
| | | BSO4 | Measuring system and customer satisfaction improvement | 0.24 | 0.1042 |
| | | BSO5 | Worker training and evaluation system | 0.15 | 0.0644 |
| Capacity Planning and Execution | 0.27 | CPW1 | Strategies to optimize logistic resources | 0.33 | 0.0867 |
| | | CPW2 | Market trend and demand forecasting comprehension | 0.18 | 0.0483 |
| | | CPW3 | Ability to adjust planning according to SCM-logistic | 0.17 | 0.0460 |

| KPI Priority | Code | Criteria | Score |
|--------------|------|----------|-------|
| BSO1 | Logistic business strategy | 0.1984 |
| SCC1 | Collaboration on logistic development with similar business partner | 0.1072 |
| BSO4 | Measurement system and customer satisfaction improvement | 0.1042 |
| CPW1 | Strategy to optimize logistic system resources | 0.0867 |
| BSO5 | Employee training system and its evaluation | 0.0644 |
| CPW5 | Standardization in all business process | 0.0541 |
| SCC2 | Collaboration on logistic improvement with research and development institution, universities, etc. | 0.0529 |
| CPW2 | Market trend comprehension and demand forecast | 0.0483 |
### LOGISTIC PERFORMANCE MEASUREMENT FORM

**Company name**  
Person in Charge (Name/Department)

Please circle number 1, 2, 3, 4, or 5 according to the present company’s condition

| Code | Logistic KPI | Score | Score | Score |
|------|-------------|-------|-------|-------|
| **BSO** | **1** | Have not yet formulated SCM-logistics strategy, logistic is not considered as important by company | 2 | 3 | 4 | 5 | Clear and precise business strategy, supporting system for SCM-logistic activity is available | 0.1984 |

| **SCC** | **1** | Collaboration on logistic development with similar business partner | 2 | 3 | 4 | 5 | Formal agreement and clear procedure in the collaboration between business partner for company’s business development | 0.1072 |

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**Figure 2. KPI Priority based on Final Weight**

| Efficiency and Logistic Productivity | Score | Components | Score |
|-------------------------------------|-------|------------|-------|
| CPW4 Monitoring system and stock tracking | 0.06 | 0.0168 | CPW3 Ability to adjust planning according to SCM-logistic | 0.0460 |
| CPW5 Standardization in all business process | 0.20 | 0.0541 | BSO3 Contract agreement and information exchange with customer | 0.0352 |
| CPW6 Logistic department development | 0.05 | 0.0133 | LEP1 Logistic activity improvement | 0.0331 |
| LEP1 Logistic activity improvement | 0.36 | 0.0331 | ITM3 IT personnel development related with SCM-logistic | 0.0312 |
| LEP2 Supply cycle and cash-to-cash cycle time | 0.09 | 0.0083 | BSO2 Contract agreement and supplier information exchange | 0.0281 |
| LEP3 Customer lead time and load efficiency | 0.16 | 0.0148 | CPW4 Supply monitoring and tracking system | 0.0168 |
| LEP4 Product shipment quality and performance | 0.15 | 0.0138 | ITM1 Identification standard (code) to for product or process identification | 0.0148 |
| LEP5 Stock management system | 0.11 | 0.0098 | LEP3 Customer lead time and load efficiency | 0.0148 |
| LEP6 Working Environment Organization | 0.04 | 0.0138 | LEP4 Product shipment’s performance and quality | 0.0138 |
| LEP7 Total logistic cost | 0.08 | 0.0077 | CPW6 Logistic department development | 0.0133 |

| Information Technology Implementation | Score | Components | Score |
|---------------------------------------|-------|------------|-------|
| ITM1 Identification standard (code) to for product or process identification | 0.28 | 0.0148 | LEP5 Supply management | 0.0098 |
| ITM2 Effective computer operation and decision making between company and business partner | 0.13 | 0.0071 | LEP2 Stock cycle and cash-to-cash cycle time | 0.0083 |
| ITM3 IT personal development in relation with SCM-logistic | 0.59 | 0.0312 | LEP7 Total logistic cost | 0.0077 |

| Supply Chain Collaboration | Score | Components | Score |
|---------------------------|-------|------------|-------|
| SCC1 Collaboration on logistic development with same business partner | 0.67 | 0.1072 | ITM2 Effective computer usage in operation and decision making between company and business partner | 0.0071 |
| SCC2 Collaboration on logistic development with research institutions, universities, etc. | 0.33 | 0.0529 | LEP6 Organization Working Environment | 0.0038 |

| Company name | Day/Date |
|--------------|----------|

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**Figure 2. KPI Priority based on Final Weight**

**LOGISTIC PERFORMANCE MEASUREMENT FORM**

**Company name**  
Person in Charge (Name/Department)

Please circle number 1, 2, 3, 4, or 5 according to the present company’s condition

| Code | Logistic KPI | Score | Score | Score |
|------|-------------|-------|-------|-------|
| **BSO** | **1** | Have not yet formulated SCM-logistics strategy, logistic is not considered as important by company | 2 | 3 | 4 | 5 | Clear and precise business strategy, supporting system for SCM-logistic activity is available | 0.1984 |

| **SCC** | **1** | Collaboration on logistic development with similar business partner | 2 | 3 | 4 | 5 | Formal agreement and clear procedure in the collaboration between business partner for company’s business development | 0.1072 |

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**Figure 2. KPI Priority based on Final Weight**

**LOGISTIC PERFORMANCE MEASUREMENT FORM**

**Company name**  
Person in Charge (Name/Department)

Please circle number 1, 2, 3, 4, or 5 according to the present company’s condition

| Code | Logistic KPI | Score | Score | Score |
|------|-------------|-------|-------|-------|
| **BSO** | **1** | Have not yet formulated SCM-logistics strategy, logistic is not considered as important by company | 2 | 3 | 4 | 5 | Clear and precise business strategy, supporting system for SCM-logistic activity is available | 0.1984 |

| **SCC** | **1** | Collaboration on logistic development with similar business partner | 2 | 3 | 4 | 5 | Formal agreement and clear procedure in the collaboration between business partner for company’s business development | 0.1072 |
| Measurement system and customer satisfaction improvement | 1 2 3 4 5 | 0.1042 |
|--------------------------------------------------------|------------|--------|
| Logistic system optimizing strategy                     | 1 2 3 4 5 | 0.0867 |
| Employee training system and its evaluation             | 1 2 3 4 5 | 0.0644 |
| Business process standardization                        | 1 2 3 4 5 | 0.0541 |
| Logistic development collaboration with research and development institution | 1 2 3 4 5 | 0.0529 |
| Market trend comprehension and demand forecast precision | 1 2 3 4 5 | 0.0483 |
| Adjusting ability with SCM-logistic planning            | 1 2 3 4 5 | 0.0460 |
| Contract agreement and information exchange with customer | 1 2 3 4 5 | 0.0352 |
| Logistic activity improvement                           | 1 2 3 4 5 | 0.0331 |
| IT personal development related to SCM-Logistic         | 1 2 3 4 5 | 0.0312 |
| Contract agreement and information exchange with supplier | 1 2 3 4 5 | 0.0281 |
| Monitoring system and supply tracking                   | 1 2 3 4 5 | 0.0168 |
| Identification standard (code) for process or product   | 1 2 3 4 5 | 0.0148 |
| Customer lead time and load efficiency                  | 1 2 3 4 5 | 0.0148 |
| Product shipping performance and quality                | 1 2 3 4 5 | 0.0138 |
Fixed shipping time and accuracy is unknown, hence company is facing a lot of customer complaints

On time shipping and order fulfillment accuracy have been accomplished, along with improvements attempts

Logistic department development

CPW 6
No one is responsible for company’s logistic activity

Personal development for employees (training, recruitment) in logistic department for sustainable improvement

0.0133

Stocking management system

LEP5
Good stocking management is unavailable, stock level target is undetermined

Good stock management system and fulfilled the target lowering stock level deviation

0.0098

Stock cycle and cash-to-cash cycle time

LEP2
Stock cycle or cash-to-cash cycle is not measured

Supply cycle measurement and all products cash-to-cash cycle time is available, sustainable improvement planning

0.0083

Total Logistic Cost

LEP7
Logistic cost is unknown for each process

Logistic cost reduction targeted in each process using predetermined strategy was accomplished

0.0077

Computer effective usage in operation and decision making between company and business partner

ITM2
TI devices (e.g. computer) is not implemented anywhere in the business

TI devices were implemented effectively during operation and decision making process

0.0071

Organizational Working Environment

LEP6
Working environment awareness and staff’s welfare concern are low

Incentive to create conducive, comfortable, and safe working environment. Certified (ISO 14000)

0.0038

Figure 3. Logistics Performance Measurement Metric (Logistics Scorecard)

3.2. Model Verification and Validation

Measurements were done with the interview to ask how the achievement of the company’s logistics business process activities which are specified in each logistics’ KPI in the model. The logistics performance score was 3.05 out of 5 scale range, which means the logistics performance is quite good, but still needs a lot of improvement overall. The verification results show that the designed performance measurement model has been verified to be used to measure the companies’ logistics performance in accordance with the conditions of business processes-supply chain logistics activities of the company by generating appropriate output. The validation was done using the face validity [21] are as follows: conformity of steps during determining KPI, which the KPI were obtained from strategy derived from vision-mission and analysis of internal and external factors. KPI is aligned with the demand to increase the logistics performance competitiveness and become a critical indicator for the improvement of logistics performance automotive components company. Logistics performance measurement model designed can be implemented in automotive components companies in Indonesia.

3.3. Model Implementation

The measurement result is shown on a bar chart in Figure 4. and a radar chart in Figure 5. to show overall logistics performance of each KPI.

Figure 4. Logistics Performance Score Comparison
Figure 5. Radar Chart of Logistics Performance Score of The Measured Companies

The small-medium scale automotive components company (PIKKO) was still at a lower level, the average yield of logistics performance appraisal automotive component industry is 3.9, and categorized as a good enough logistics performance. In general, companies have a weakness in the implementation of information technology such as the use of an integrated computer, the lack of IT staffs which related to logistics activities, and also a coding standard products and processes. The weak information technology can have an impact on other KPI, that the information technology has become an important factor which supports the business processes of logistics in both internal and external to the enterprise or business partners. National automotive components industry is also still weak in standardization of the entire business processes and logistics departments which still need to be developed.

4. Conclusions
The logistics performance measurement system is based on the logistics business activities strategy of the automotive component industry in facing the AEC by five Logistics Scorecard perspectives. There are 23 logistics KPI which are 5 for business strategy orientation perspective, 6 for capacity planning and execution perspective, 7 for logistics efficiency & productivity, 3 for information technology implementation perspective, and 2 for supply chain collaboration. KPI are used as a competitive logistics performance benchmarks. The priority order of five perspectives based on the highest weight is the business strategy orientation, capacity planning and execution, supply chain collaboration, logistics efficiency and productivity, and the last is information technology implementation. Priority KPI that has the highest final weight is the logistics business strategies from the perspective of business strategy orientation, before running the logistics activities. Designed model of performance measurement can be used to measure the logistics performance of automotive components company in Indonesia and also for other industries in which KPIs are flexible to be developed. In general, company has a low score on the KPI implementation of IT and business strategy, so that it can be taken into consideration for the improvement in technology, especially information technology and creating a better logistics business strategy. Suggestions related to the results of the study includes the model should be used by the related parties for the evaluation of the automotive component industry in order to improve the competitiveness of logistics performance (PIKKO, GIAMM etc).

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