# Designing Model of Performance Measurement System of Sugar Industry Cluster based on Integrated Performance Measurement System Approach

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**Abstract.** The Indonesian need for sugar is not balanced with domestic sugar production. This is reinforced by the fact that Indonesia is still a sugar importing country since the 1990s. Since 2010 - 2014, Indonesia's import value reaches 1.7 million US $ every year. This situation indicates mismatch with the roadmap of the sugar industry which is expected by 2015 to 2020. East Java as one of the largest contributor of Indonesian sugar with a contribution percentage of 52.31% of the overall national production has an important role in the development of the sugar industry. Therefore, a comprehensive sugar industry cluster development strategy is needed to be developed. The design of performance measurement system with Integrated Performance Measurement System (IPMS) approach was chosen by selecting PT 'X' as the core agent. The research stages are identification of sugar industry cluster system, stakeholder requirement and objective, Key Performance Indicator (KPI) formulation and model development. Development of performance measurement model by determining aspects and criteria of success of industrial cluster, weighting on each element using Analytical Hierarchy Process (AHP), and designing scoring board to facilitate implementation. There were 4 aspects in performance measurement, 9 criteria, 3 sub criteria and 45 KPI's.

## 1. Introduction

Sugar as an agricultural commodity of Indonesia is one of the important basic needs for the people of Indonesia. Sugar has become a mandatory ingredient that must always be in the household kitchen. Similar to the industrial world, almost all food industries include sugar as one of the composition of the material. The importance of sugar for the people of Indonesia can also be seen from the high consumption of them as shown in Table 1.

The high demand above is not balanced with domestic sugar production. Indonesia has been a sugar importer since the 1990s. Since 2010 - 2014, Indonesia's import value reaches 1.7 million US $ every year. Even in 2015 Indonesia recorded imports of 2.7 million tons. This is not in line with the sugar industry roadmap proclaimed by the government, which states that the target is expected in 2015-2020 Indonesia has been able to meet domestic sugar needs, while in 2020-2025 Indonesia is expected to be a sugar supplier for ASEAN countries.

**Table 1** Sugar consumption in Indonesia

| No | Year | Number of Consumption (kg) |
|---|---|---|
| 1 | 2002 | 92,0321 |
| 2 | 2003 | 90,6764 |
| 3 | 2004 | 89,2686 |
| 4 | 2005 | 88,8514 |
| 5 | 2006 | 80,3521 |
| 6 | 2007 | 86,2443 |
| 7 | 2008 | 84,315 |
| 8 | 2009 | 79,0486 |
| 9 | 2010 | 76,9107 |
| 10 | 2011 | 73,8343 |
| 11 | 2012 | 64,7614 |
| 12 | 2013 | 66,4821 |
| 13 | 2014 | 64,0836 |

East Java as one of the largest contributor of Indonesian sugar with a contribution percentage of 52.31% (1) of the overall national production has an important role in the development of the sugar industry. One of the sugar factories in East Java that has a vital role is PT. X. Companies that earn healthy company labels for five consecutive years have the best productivity compared to other sugar factories. However, it does not mean getting a healthy label out of trouble. In fact, the performance of the company has ups and downs. For example, in 2012-2013 there is a decrease in profits up to 38% of companies.

The characteristic of the sugar industry business process that relies heavily on external stakeholders is the reason the sugar industry is seen as an industrial cluster. For example, in the raw material section, sugarcane used as a production material is a sugar cane which is managed independently by the community with a partnership system with a sugar factory. In the partnership system, the community has the right to apply for a loan with the sugar factory as collateral. The mutual relation between the three stakeholders makes the system will not run maximally without its third role.

The industry cluster is a set of companies and institutions that are adjacent and geographically close together and then work together because of commonalities and mutual needs (2). Hanafi (3) states that the industrial cluster is an agglomeration of companies that work together strategically and complementary and have intensive relationships. The sustainability of an industrial cluster is determined by the cluster's commitment as well as the ability of the cluster to manage its performance. Therefore, it is necessary to design a performance measurement system that accommodates all the performance of cluster members as a system called comprehensive performance measurement (4). According to Armstrong and Baron (5), performance measurement is a step by step strategy and an integrated approach to produce sustainable success in an organization with improved performance of the people working on it and by developing team and individual contributions.

This study aims to design the right performance measurements to assess the performance of sugar industry clusters, so that clusters obtain enough information to improve in the future. In addition, also designed scoring board to facilitate the calculation of performance measurement calculations.

## 2. Research Methodology

The stage of identification and problem formulation consists of brainstorming and identification of existing conditions in the sugar industry cluster, determining problem formulation and research objectives, and conducting literature studies and field studies. Data and information needed are industrial cluster system, stakeholder requirement, and stakeholder objective. This data collection is done by designing a questionnaire and asking a number of experts to fill it.

In the Data Processing Stage is divided into several stages of KPI exploration, KPI properties, exploration aspects, criteria and subcriteria, weighting of performance measurement elements, scoring board model design, and performance measurement test. Data processing is done by using expert choice with pairwise comparison principle to get the weight of all aspect, criteria and subcriteria which is determined to determine the priority of interest in determining the performance of sugar industry cluster.

Analyzes conducted include analysis of sugar industry cluster condition, analysis of cluster strategic objectives, analysis of aspect preparation, criteria and subkirteria, weighted analysis of performance. Collecting data required by the author to be processed in the next stage. The data needed are industrial cluster system, stakeholder requirement, and stakeholder objective

## 3. Results and Discussion

### *3.1. Data collection*

Description of the cluster system is done through two approaches, namely the cluster industry stakeholder model and IPMS business level structure. Figure 1 presents a model of industry cluster stakeholders and IPMS business level structures.

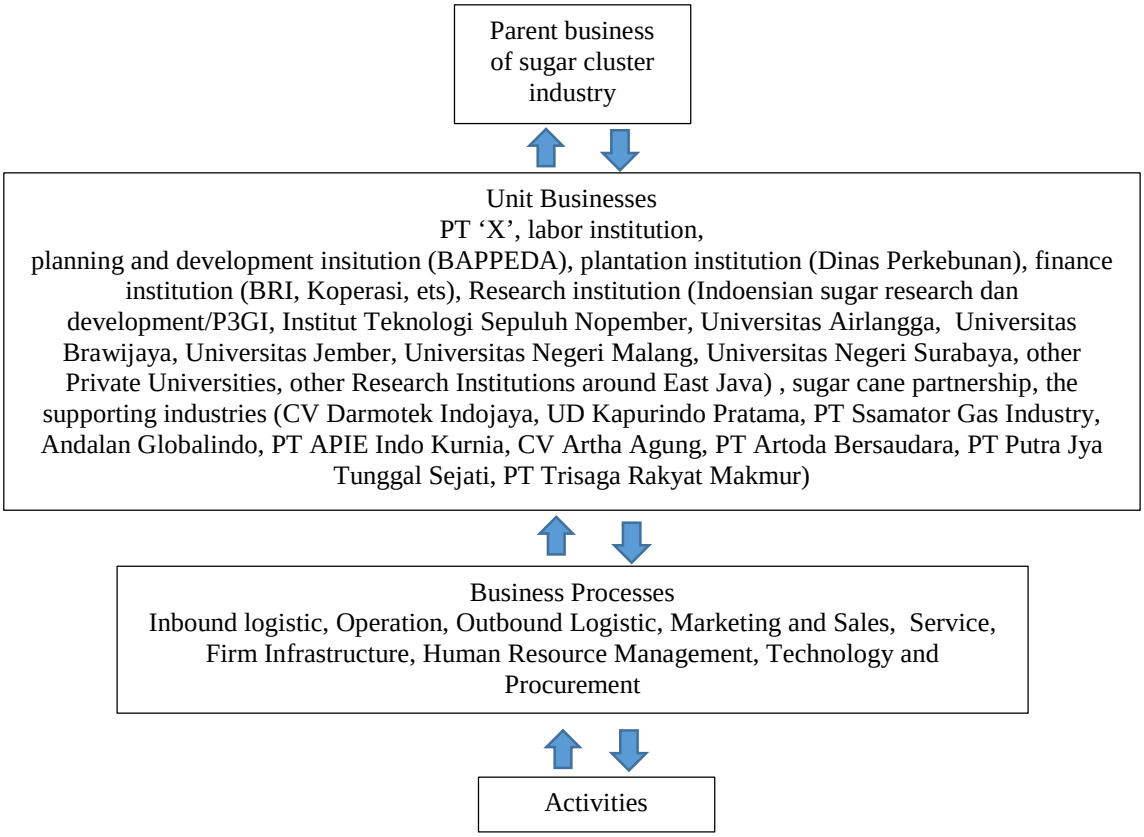


**Figure 1.** IPMS Business Level Structure

### *3.2. Stakeholder requirement and objectives*

There are four stakeholder needs, namely creation of value chain and partnership network between cluster actors from upstream to downstream that ensures industrial sustainability, enhanced competitiveness of national sustainable sugar industry, economic development and business growth of cluster actors, and improvement of supporting infrastructure of industrial activities. The results of identification of stakeholder objectives are presented on Table 2.

**Table 2.** Stakeholder objectives

| Req | Objectives |
|---|---|
| 1 | Establish mechanism of coordination among cluster actors<br>Establish a cluster evaluation system<br>Increase collaboration among clusters<br>Representation of supporting industries<br>Representation of supporting institution<br>Increase the contribution of each cluster actors |
| 2 | Improve quality and production capacity of sugar<br>Efficiency of sugarcane planting process<br>Improve the quality of cluster human resources<br>Improve technological development and innovation ability |
| 3 | Increase the income of cluster actors<br>Easy access to business financing for cluster actors |
| 4 | Diversification of cane-based products<br>Procurement of shared facilities between cluster actors<br>Increasing public support for the sugar industry<br>Procurement of industrial waste treatment facilities |

*3.3. Criteria, Sub criteria and Key Performance Indicators*

There are four aspects that influence the performance of industrial clusters. The weight for each aspect are Social (0,565), Engineering (0,118), Economics (0,262), Environment (0,55). The social aspect is derived in several criteria and sub criteria and identified key performance indicators, the deployment to the KPIs is shown in Table 3.

**Table 3.** Deployment of KPI's on Social Aspect

| Criteria | Sub critera | Key Performance Indicators | Weight |
|---|---|---|---|
| Institution (0.750) | Coordination Mechanism (0.279) | The existence of representative working groups of each cluster actors | 0.353 |
| | | Number of working group meetings in one year | 0.294 |
| | | Presentation of cluster members' presence in coordination forum | 0.353 |
| | Collaboration (0.649) | The existence of a strategic plan for the sugar industry cluster | 0.200 |
| | | Percentage of cluster work plan realized | 0.171 |
| | | There is a continuous cooperation system between the core industry and raw material suppliers | 0.171 |
| | | The existence of a continuous system of cooperation between the core industry and supporting industries | 0.114 |
| | | The existence of government policy to support cluster | 0.143 |
| | | Number of suppliers of non-cane raw materials that become cluster members | 0.200 |
| | Component completeness (0.072 | Number of companies supplying machinery | 0.156 |
| | | The number of sugar cane farmers who are members of the cluster | 0.094 |
| | | Number of shipping companies | 0.250 |
| | | Number of cluster financing institutions | 0.094 |
| | | Number of research and training institutions in cluster | 0.094 |
| | | Number of government institutions that play an active role in the cluster | 0.188 |
| | | Number of government institutions that play an active role in the cluster | 0.125 |

### *3.4. Discussion*

Weighting is done by the AHP method using pairwise comparison and scoring board is developed to facilitate users in calculation and performance evaluation. The elements shown in the scoring board are KPI, relative weight, normal weight, target, achievement, score system, relative score, normal score, absolute score, and status. In addition to making scoring board models, user interface is also created as an information portal and simplify the user.

### *3.5. Discussion*

The cluster of sugar industry is driven by PT 'X' as a champion main industry, has its own uniqueness in running its business process, when compared with other clusters. In general, these clusters are formed spontaneously on the basis of shared needs and business relationships. The relationships between core business player (core industry) with other stakeholders have their own issues and complexities. In this cluster, PT 'X' as a champion of the cluster and and sugar cane farmers, have a very big influence on the direction of cluster development, where relations between the two has to be maintained and managed optimally. The production of sugar is highly depend on the availability of cane supply both in sustainability of quantity and also the quality (yield).

Due to spontaneous formation, there are no cluster objectives agreed by stakeholders. Stakeholder requirements and stakeholder objectives are elaborated from the existing problems that occur in the cluster. In the stakeholder requirement, the needs of the value chain and cluster partnership network are still the key needs of this industry cluster, because the cluster system that has not been well established. The stakeholder mapping results also show that the majority of strategies are in the firm infrastructure where the category is an internal aspect and becomes the basis for the formation of an industrial cluster.

After the strategic objectives are obtained, formulated performance indicators (KPIs) to measure the achievement of industrial cluster performance. The KPIs are grouped into the aspects, criteria, and subcriteria of industrial cluster successes obtained from literature studies. Grouping of aspects is done to facilitate interpretation and to know the achievement of each aspect of performance so that improvisation. In addition to the grouping of KPIs into each aspect, it was also carried out a weighting to determine the level of contribution of each element in the achievement of industrial cluster performance. The result of weighting shows the aspect that contribute the most towards the achievement of performance is the social aspect. This aspect talks about the relationship between stakeholders of the sugar industry cluster both system and human resources. This is in accordance with the previous analysis in which the needs of the sugar industry cluster are still concerned with the internal and fundamental aspects of establishing an industrial cluster.

## 4. Conclusion

The designing model of sugar industry cluster measurement system with IPMS approach is able to identify industrial cluster system to design the right performance indicator for the achievement of industrial cluster performance. From the research result, there are 4 aspects of performance measurement, 9 criterias, 3 sub criterias, and 45 KPI according to hierarchy structure of performance. These KPI's will be measured periodically and used in continous improvement by.

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