

Designing Performance Measurement System PT X with Integration of Balanced Scorecard Method and Analytical Hierarchy Process

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Abstract:-PT X is a company that has a commitment to become the best flexible packaging company and focus on consumer satisfaction, which is engaged in plastic packaging printing by using rotogravure system. Rotogravure is one of the technology in the world of printing. Intense competition in the current era encourages companies to be able to improve the company's performance continuously. Currently PT X only focuses on the assessment of the financial aspects only because it has not had a performance measurement by management. This results in vision and mission tending to be just a slogan, without being supported by proper strategic planning. This study aims to design and implement performance measurement system at PT X with the company's vision and strategic mission. The method used in designing performance measurement system in this research is Balanced Scorecard (BSC). Performance measurement in this research is also supported by Analytical Hierachy Process (AHP) method as a method to determine the weighting between perspectives, between strategic objectives and between KPI in priority scale. The design of this performance measurement system, resulting in 16 strategic objectives and 24 indicators of performance measurement (KPI). Implementation of the design in this study resulted in the performance value obtained from scoring Objective Matrix (OMAX) showed that the value of Current Performance Indicator that has been achieved PT X for the first half of 2017 is 6.53 which is at level 4-7 and if symbolized traffic light system classified as yellow. This indicates that PT X is in sufficient performance, in other words the performance of PT X has not reached the target and still needs improvement in achieving the expected target.

Keywords:-Performance Measurement System, Balanced Scorecard (Bsc), Analytical Hierarchy Process (Ahp) Objective Matrix (Omax), Traffic Light System.

I. INTRODUCTION

As the times and the increasing economic growth are marked by the rapidly growing industrial world, especially in Indonesia, the demand for plastic packaging is also increasing. This encourages every company to continue to compete by improving the company's performance continuously.

PT X is a company that has a commitment to become the best flexible packaging company and focus on consumer satisfaction, which is engaged in plastic packaging printing by using rotogravure system. Intense competition in the current era encourages companies to be able to improve the company's performance continuously. Currently PT X only focuses on the assessment of the financial aspects only because it has not had a performance measurement by management. This results in vision and mission tending to be just a slogan, without being supported by proper strategic planning.

Performance measurement system is an important management tool. The importance of performance measurement system in the company, encourage PT X to re-analyze the problems faced by the company today, in order to perform the design of company performance measurement system that is expected to be implemented and can maintain stability and improve company performance in order this and will come.

Balanced Scorecard (BSC) and Analytical Hierarchy Process (AHP) in this research is conducted to design performance measurement system. The application of BSC and AHP stems from the vision and mission of PT X, and in determining strategic objectives and performance measurement indicators in validation by conducting interviews and distributing questionnaires with related PT X heads as decision makers and experts within PT X.

This research is expected to produce and implement performance measurement system based on scoring system Objective Matrix (OMAX) symbolized by traffic light system at PT X as a guidance in maintaining performance performance stability because there is no performance measurement at the company, so the company is able to determine a formulation of

appropriate strategic plans in an effort to improve the company's performance in the future.

II. METHOD

In this study, Balanced Scorecard (BSC) and Analytical Hierarchy Process (AHP) is conducted to design performance measurement system. While the results from the implementation of performance measurement system based on Objective Matrix scoring system (OMAX) which symbolized with Traffic light system.

Detail method in this research explained in list below:

A. Balanced Scorecard (BSC)

Balanced Score Card (BSC) was first introduced by Robert S Kaplan and David P Norton as in 1992. This model is the most popular model in the world and in Indonesia both among academics and practitioners (Vanany 2009).

The Balanced Scorecard (BSC) approach aims at strategic and performance indicators based on the company's strategic vision and mission that responds to an organization's desire for performance measurement through a contemporary strategy management system consisting of four perspectives:

- Financial
- Customer
- Internal business process
- Learning and Growth.

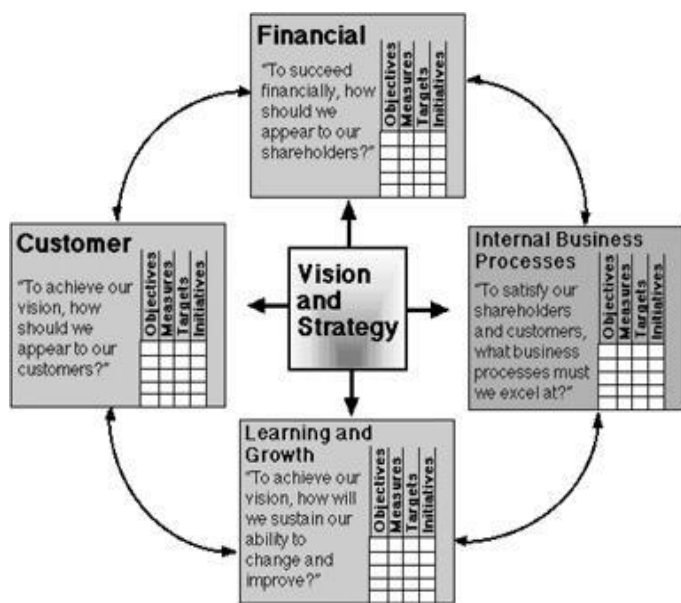


Fig. 1. Perspective from Balanced Scorecard (Wikireedia.net)

B. Analytical Hierarchy Process (AHP)

The application of Analytical Hierarchy Process (AHP) method is to arrange and analyze the weighting based on the preference of decision making (directors and managers) on the

priority level of each perspective related to the performance of a company.

Procedures in the preparation of Analytical Hierarchy Process (AHP) method in this study consists of three (3) steps:

a). Preparation of Hierarchy

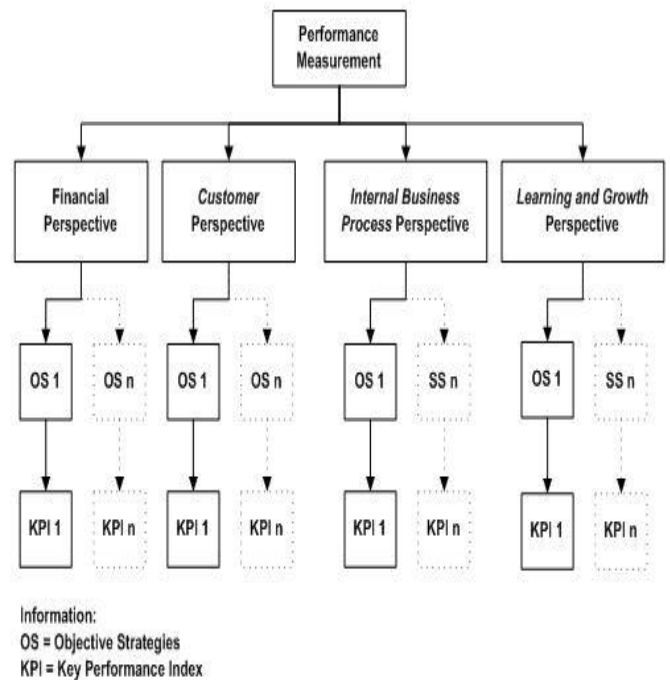


Fig. 2. Hierarchy from AHP (Author Document)

b). Pair-Wise Comparison

The Fundamental Scale for Pairwise Comparisons		
Intensity of Importance	Definition	Explanation
1	Equal importance	Two elements contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favor one element over another
5	Strong importance	Experience and judgment strongly favor one element over another
7	Very strong importance	One element is favored very strongly over another, its dominance is demonstrated in practice
9	Extreme importance	The evidence favoring one element over another is of the highest possible order of affirmation

Intensities of 2, 4, 6, and 8 can be used to express intermediate values. Intensities 1.1, 1.2, 1.3, etc. can be used for elements that are very close in importance.

Table 1. Pair-Wise Comparison (en.wikipedia.org)

c). *Checking Consistency*

$$\text{Consistency Index (CI)} = \left(\frac{\lambda_{max} - n}{n - 1} \right)$$

Information:

n = dimension of the matrix

$$\text{Consistency Ratio (CR)} = \text{CI/RI}$$

Information:

RI = Random Index from index

n	3	4	5	6	7	8	9	10
RI	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

Table 2. Random Index

C. *Objective Matrix (OMAX) with Traffic Light System*

The OMAX model is a model developed in the 1980s by Professor James. L. Riggs from the Department of Industrial Engineering at Oregon State University. The Objective Matrix (OMAX) method is a scoring system method that takes into account the measurement metrics of existing KPIs by consolidating the metric into a single measure often called the Current Performance (Vanany, 2009).

Objective Matrix (OMAX) model in which there is a matrix consisting of:

1. *Criteria*
Criteria in it is a performance measurement indicator (KPI) to be measured.
2. *Performance*
It is an achievement of performance measurement indicators (KPI) as the basis of comparison.
3. *Matrix items*
It is an achievement level that stretches to 10 levels, from lowest to highest, level 0-10.
4. *Score*
The measurement results of achievement data are classified according to the closest performance level.
5. *Weight*
The weight of each performance measurement indicator (KPI) that has been obtained from the weighting step with AHP
6. *Value*
It is the result of a multiplication of Score with Weight
7. *Performance Indicator*
The result of the total sum of all Value of each KPI that has been calculated.
8. *Score Performance*
Scores consisting of a range score of 0 to 10, the following explanation:
 - Score 0, the lowest conditions specified by agreement
 - Score 3, normal or standard conditions taken from the previous actual data as the reference base

- Score 10, the highest condition determined by the target or realistic estimates that the company wants to achieve
- Score 1.2, done by interpolation calculation between Score 0 and 3
- Score 4 to 9, performed by interpolation calculations between Score 10 and 3.

<i>Criteria</i>					
<i>Performance</i>					
<i>Score</i>	10				
	9				
	8				
	7				
	6				
	5				
	4				
	3				
	2				
	1				
0					
<i>Score</i>					
<i>Weight</i>					
<i>Value</i>					

Fig. 3. Framework Objective Matrix (OMAX)

There are 3 categories of Traffic Light System according to Prianto (2003) include:

- *Green Color*
Indicators are in the green color category when the result of achieving a performance indicator has been reached or succeeded according to the target set. This category, if the result of the assignment is at a value between 8 - 10
- *Yellow Color*
The indicator is in the yellow category when the outcome of a performance indicator has not been achieved or has not succeeded but its value is close to the target so it is advisable for the company to be careful to avoid any possibility. This category, if the result of the assignment is at a value between 4 - 7.
- *Red Color*
Indicators are in the red category when the outcome of the achievement of a performance indicator is far below the target set by the company so it is advisable that the company immediately make improvements. This category, if the result of the assignment is at a value between 0 - 3.

III. RESULT AND DISCUSSION

A. Designing Performance Measurement System

Data were collected based on discussion and distribution of questionnaires to the expert respondents.

a). Objective Strategies

Objective Strategies are obtained by distributing questionnaires to the respondents who have been determined based on vision and mission. The first of the questionnaire is aimed at establishing agreed objectives strategies through interviews and discussion based on the level of importance.

Perspective	Code O. Strategies	Objective Strategies
Financial	SS.K.1	Increased in corporate profits
	SS.K.2	Decrease in operating costs
	SS.K.3	Utilization of effective corporate investments
Customer	SS.P.1	Customer Acquisition
	SS.P.2	Customer Satisfaction
	SS.P.3	Customer Retention
	SS.P.4	Increased in volume order
Internal Business Process	SS.PBL1	Maximize the ability of production process
	SS.PBL2	Improved distribution services
	SS.PBL3	Development of innovation and technology
	SS.PBL4	Maximize the availability of raw materials
	SS.PBL5	Apply "Eco Energy" program in production process
	SS.PBL6	Implementing Occupational Safety and Health program
Learning & Growth	SS.PP.1	Improving the quality of human resources
	SS.PP.2	Increased efficiency of the number of employees
	SS.PP.3	Increased employee productivity

Table 3. Objective Strategies

b). Key Performance Index (KPI)

Key performance index are obtained by distributing questionnaires to the respondents who have been determined based on objective strategies. The second of the questionnaire is aimed at establishing agreed KPI through interviews and discussion based on the level of importance.

Perspective	Code O. Strategies	Code KPI	Key Performance Index (KPI)
Financial	SS.K.1	KPI.K.1.1	Company revenue amount
		KPI.K.1.2	The number of company profits
	SS.K.2	KPI.K.2.1	Total cost of goods sold
	SS.K.3	KPI.K.3.1	ROI (Return On Investment)
Customer	SS.P.1	KPI.P.1.1	Number of new customers who order
	SS.P.2	KPI.P.2.1	Number of product quality complaints
		KPI.P.2.2	Number of complaints from service
	SS.P.3	KPI.P.3.1	The ratio of the number of regular customers who order
	SS.P.4	KPI.P.4.1	Total order volume of the whole customer
Internal Business Process	SS.PBL1	KPI.PBL.1.1	Production capacity
		KPI.PBL.1.2	Ratio of production capability in fulfilling order
		KPI.PBL.1.3	Number of reject products
	SS.PBL2	KPI.PBL.2.1	Timely delivery order delivery rate
	SS.PBL3	KPI.PBL.3.1	Number of new products
		KPI.PBL.3.2	Number of new machine usage
SS.PBL4	KPI.PBL.4.1	The ratio of the amount of unused raw materials	
SS.PBL5	KPI.PBL.5.1	The amount of electrical power used for production	
	KPI.PBL.5.2	Number of complaints from the community regarding waste	
	SS.PBL6	KPI.PBL.6.1	Number of work accidents
Learning & Growth	SS.PP.1	KPI.PP.1.1	Number of Training programs for employees
		KPI.PP.1.2	Number of employees affected by sanctions
	SS.PP.2	KPI.PP.2.1	Number of incoming employees
		KPI.PP.2.2	Number of outgoing employees
	SS.PP.3	KPI.PP.3.2	Employee productivity ratio

Table 4. Key Performance Index (KPI)

c). Preparation of Hierarchy

Preparation of hierarchy aims to classify KPI, strategic objectives in the performance measurement system in accordance with 4 BSC perspectives that are supported by the concept of Analytical Hierarchy Process (AHP) method.

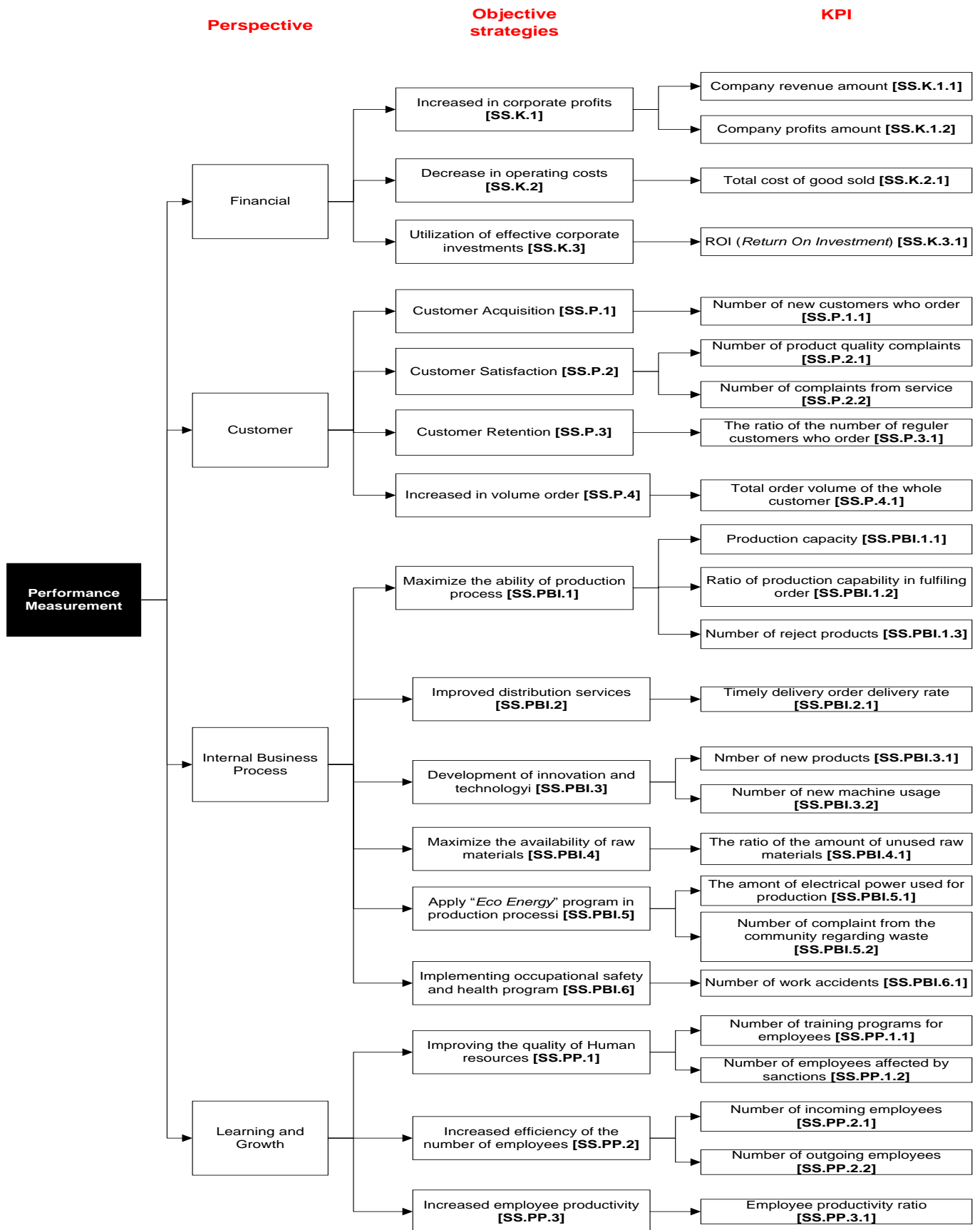


Fig. 4. Hierarchy of Performance Measurement

d). *Strategy Maps*

The Strategy Map is a summary of the links between strategic objectives, the causal relationships and the effects of each Balance Scorecard perspective. 4 Balance Scorecard

perspectives from bottom to highest are growth and learning perspectives, internal business process perspective, customer perspective, and financial perspective.

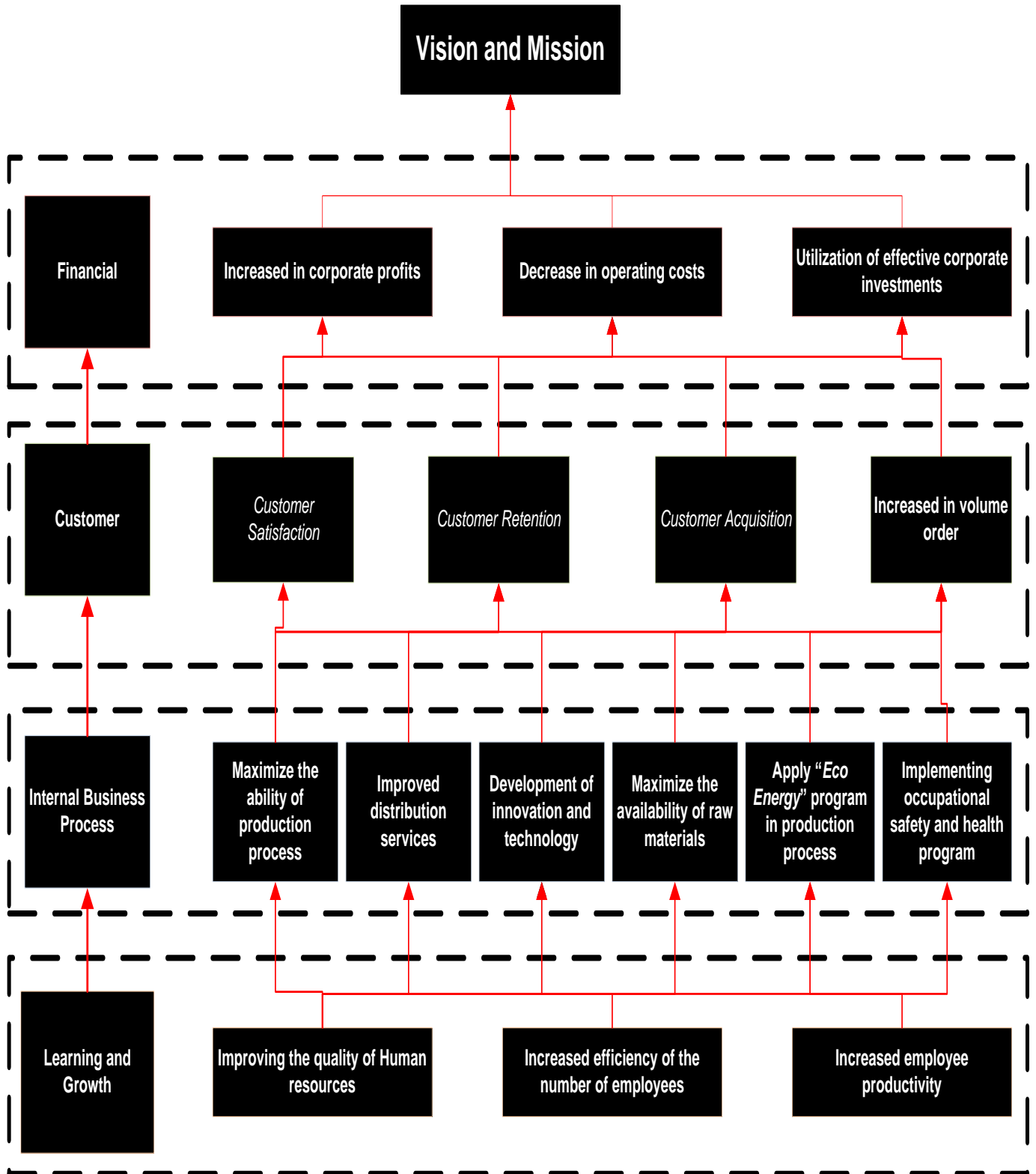


Fig. 5. Strategy Maps

e). Weighting Perspective, Objective Strategies, and KPI

Weighting Perspective, objective strategies and KPI using Analytical Hierarchy Process (AHP) method with the help of Expert Choice application. This weighting is needed to

determine the importance of each perspective variable, strategic objectives and KPI. The higher the priority of the variable then the value of the higher the weight also.

Perspective	Weight Perspective	CR	Code OS	Weight Local Objective Strategies	CR OS	Weight Global Objective Strategies	Code KPI	Weight Local KPI	CR KPI	Weight Global KPI	
Financial	0.546	0.08	SS.K.1	0.550	0.05	0.300	KPL.K.1.1	0.675	0	0.098	
			SS.K.2	0.116			KPL.K.1.2	0.325		0.203	
			SS.K.3	0.334		0.063	KPL.K.2.1	1		0.063	
Customer	0.193		SS.P.1	0.115	0.06	0.183	KPL.K.3.1	1	0	0.183	
			SS.P.2	0.364			0.022	KPL.P.1.1		1	0.022
			SS.P.3	0.245		0.070	KPL.P.2.1	0.878		0	0.062
			SS.P.4	0.276		KPL.P.2.2	0.122	0		0.009	
Internal Business Process	0.188		SS.PBL1	0.163	0.08	0.031	KPL.P.3.1	1	0	0.047	
							KPL.P.4.1	1		0.053	
							KPL.PBL1.1	0.775		0.01	0.024
			KPL.PBL1.2	0.123		0.004					
			KPL.PBL1.3	0.103		0.003					
		SS.PBL2	0.096	0.018		KPL.PBL2.1	1	0		0.018	
		SS.PBL3	0.192	0.036		KPL.PBL3.1	0.839	0		0.030	
						KPL.PBL3.2	0.161			0.006	
SS.PBL4	0.190	0.036	KPL.PBL4.1	1	0	0.036					
SS.PBL5	0.116	0.022	KPL.PBL5.1	0.657	0	0.014					
			KPL.PBL5.2	0.343		0.007					
SS.PBL6	0.244	0.046	KPL.PBL6.1	1	0	0.046					
Learning and Growth	0.073	SS.PP.1	0.527	0.06	0.039	KPL.PP.1.1	0.884	0	0.034		
						KPL.PP.1.2	0.116		0.005		
		SS.PP.2	0.122		0.009	KPL.PP.2.1	0.580	0	0.005		
						KPL.PP.2.2	0.420		0.004		
SS.PP.3	0.351	0.026	KPL.PP.3.1	1	0	0.026					

Table 5. Weighting Perspective, objective strategies and KPI

B. Result with scoring OMAX and Traffic Light System

The result of performance measurement calculation by using OMAX scoring system can be known the achievement value of each perspective and the overall achievement value (Current Performance Indicator).

Perspective	Weight Perspective	Performance
Financial	0.546	3.814
Customer	0.193	0.834
Internal Business Process	0.188	1.133
Learning & Growth	0.073	0.569
Total Current Performance	1	6.53

Table 6. Result Performance Measurement

Based on the results of the above table can conclude that the performance measurement at PT X resulted in performance values from the highest to low, ranging from a financial perspective of 3.814, internal business process perspective of 1.317, customer perspective of 0.834 and growth and learning perspective of 0.569. The summation of the four perspectives has resulted in the achievement of the overall performance or current performance indicator of 6.53.

Performance measurement results in the performance value of each KPI, so that with the measurement is known which performance will be the main priority in the future development of the company. The reading of performance measurements to make it easy, therefore each KPI of each perspective is grouped in Traffic Light System sign.

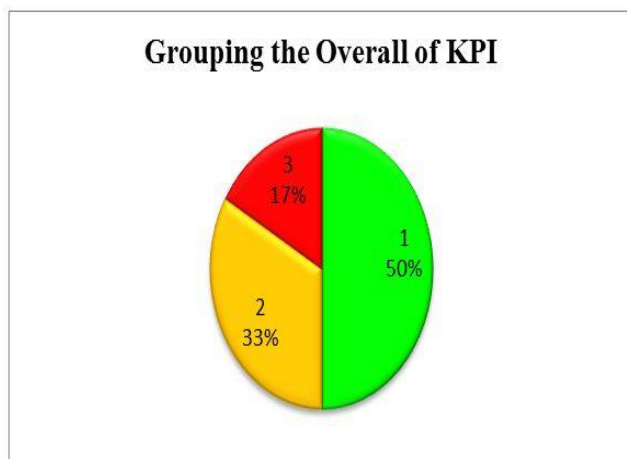


Fig. 6. Grouping the Overall of KPI

The fig. 6 is green, yellow and red, on the terms of the traffic light system. Image7 gives the information of the whole kpi in groups of green, yellow and red will produce a composition of 100% or some 24 kpi all in color as 50% or 12 kpi size, yellow color as much as 33% or some 8 kpi and red color as 17 % or 4 kpi size. The green color can still be offset the company's target, this gives the PT X information that has sufficient performance and this condition needs to experience and better repaired.

Achievement conditions that need to be considered compared to other color attainment conditions are red. Red color indicates the achievement of performance is still below the target therefore needs to be reviewed so that the cause can be set so that the improvement can be done as a solution to improve or minimize the performance that is in red.

IV. CONCLUSION AND SUGGESTION

A. Conclusion

- The design of performance measurement system at PT X is using 4 BSC perspectives that yield 16 strategic goals, and 24 indicators of performance measurement (KPI).
- Performance scores obtained from OMAX scoring indicate that the value of Current Performance Indicator achieved by PT X for the first semester of 2017 is 6.53

which is classified as yellow. This shows that PT X on performance measurement is enough in other words the performance of PT X has not reached the target and still needs improvement in achieving the expected target.

- Based on the measurement of performance reflected in the form of traffic light system, from 24 indicators of overall performance measurement found results with details, 12 KPI found green, 8 KPI found yellow and 4 KPI found red color.
- The red color that still exists in the performance of PT X indicates that there is still a performance achievement under the target therefore needs to be reviewed so that the cause can be fixed so that improvement can be done as a solution to improve or minimize the performance that is in red color.

B. Suggestion

1. For the Management of PT X

- It needs to do a review of the performance achievement that is still classified as red or still under the target.
- Providing more training among others about productivity to the workforce will support the achievement of desired performance targets.
- Implementation of this SPK needs to be formed a special team for the design of KPI and monitoring of existing activities, and support from the management is very necessary.

2. For Further Research

- In relation to the object of research, not only on the core business fine flexible packaging only, but can be done measurements on other core business.
- Further research, in determining strategic goals and KPIs may be better if involving external parties such as customers.
- Subsequent research, the authors suggest that perform performance measurement in each unit so that the resulting data more specific.

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