Evaluation of Supply Chain Performance through Integration of Hierarchical Based Measurement System and Traffic Light System: A Case Study Approach to Iron Sheet Factory

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***Abstract*- Some of literature shows that the SCM model is effective enough in evaluating and measuring whether the enterprise is went well, efficient and effective. Nevertheless, the available literature is still quite limited in offering perspective in integrating various methods in evaluating and the measurement of SC performance easily and simply. The SCOR model as one of approach in measuring the SC performance, operationally still need to be integrated with another method. This is intended to reveal the clarity of the target and the result of measurement in more effectively, comprehensively, and accountably. In this study, it would be conduct a measurement of SC performance of iron sheet factory enterprise within using the SCOR model through the hierarchical integration based measurement system with traffic light system. The results of this study indicate that the integration of several methods such as Hierarchical Based Measurement System and Traffic Light System can provide a solution for management to evaluate and measure company performance more effectively, comprehensively, accountably and integrated.**

Key Words -- *Supply chain performance measurement,* SCOR *Model, Analytical Hierarchy Process, Traffic Light System, comprehensive integrated*

1. Introduction

The business competition in the roof industry in Indonesia is currently quite high. This is triggered by different types of variety and forms of the roof that available on the market. One of the kinds of roofs that have been widely known by the public is the iron roof. But the increasingly rigorous competition required enterprises to regroup their daily business strategies and tactics. The essence of this competition is how the enterprise is better, cheaper, and faster than the competitors. Therefore, in this series of work, an enterprise must be able to improve its performance in order to continue competing and progressed.

Supply Chain Management (SCM) can help to monitor and assessed whether the company is went well, efficient, and effective. SCM is a unified process and production activity starting from raw material from suppliers, value added process (production), inventory storage process (inventory), until the costumer's delivery process [1]. Some of literature shows that the SCM model is effective enough in evaluating and assessing whether the enterprise is went well, efficient and effective. Nevertheless, the available literature is still quite limited in offering perspective in integrating various methods in evaluating and the measurement of SC performance easily and simply. Some of metric that used in SC are increasingly irrelevant to the business community at this time because its coverage is too tight to effectively handle the range of activity involved. Besides, most of the available metric are the singular measures which is necessary to measure the performance of the entire SC area. Thus, there is a need for new metric that related with management of SC efficiently [2]**.** In some SC Literature, it is still rare to find attempts to determine the performance of SC [3]. There is some performance measure now has been widely used in SC performance evaluation model. Such as sales maximization [4]**,** profit

maximization [5], maximization of benefit supplier-costumer [2], and others.

Nevertheless, the academics have much yet to offer a comprehensive model of approach in evaluating and measuring the performance of SC on an enterprise by bringing all the information together. In addition, also considers the involvement of every department and management level in an organization to integrate and coordinate the streams, both within and among the organization. It began with the process of procuring raw materials from suppliers, realization of product in production floor to the goods delivery to costumer by implicating all management level in an organization integrated. In view of system integration perspective, the role of each management level in supporting the performance of SC is very decisive, though on a different scale. It means that if one function at the management level does not make a significant contribution as its role in the step of SC process, then it will impact the whole SC performance.

Ref. [6] elaborates the characteristic of an effective performance measurement system, that is: unify all units, compare the range of operations, the required measurability data and keep consistency with organizational purpose. While Ref. [7] states that the performance measurement should be well defined, fairly concise to make an ease understanding, ensuring a combination of financial and non-financial indicators with use of minimal metric. This idea is supported by the research discovery result of Ref. [8] which said that the lack of clarity of targets and results is the only challenge that can hinder and affect the development of the measuring system and the accountability of performance.

Based on the study above, the SCOR model is one of the most well-known and has been widely applied by researchers [2]. The SCOR model provides a systemic approach to identify, evaluate and monitor the SC performance by performance attribute and metrics [9]. This model not only provides an opportunity to see how the company does it, but also becomes a general and language reference framework throughout the SC area[10]. However, the SCOR model as one of approach in measuring SC performance, operationally still needs to be integrated with other approaches. This was intended to reveal the clarity of the target and the result of measurement in more effectively, comprehensively and accountably. From the literature review conducted by Ref. [11], here are various models of approach and framework that can be used for the measurements of SC's performance: supply chain balanced score card system, supply chain operations reference model, hierarchical based measurement system, function based measurement system, efficiency based measurement system, generic performance measurement system, interface-based measurement systems, medori and steeple's framework, performance prism.

Based on the description above, the purpose of this study is to measure the supply chain performance through integration of hierarchical based measurement system with traffic light system. The results of this study are expected to provide solutions to the evaluation and measurement of enterprise performance in more effectively, comprehensively and accountably.

2. Literature Review

In this section, some of relevant literature that behind the need to conduct an evaluation of supply chain performance by integrating hierarchical based measurement systems with traffic light systems will be reviewed.

Now there is a need for new metrics related to management of SC in efficiently [2]. Where there is a shift from functional of SC to processes that are oriented towards developing measurement holistically [12]. Ref. [6] elaborates the characteristic of an effective performance measurement system, that is: unify all units, compare the range of operations, the required measurability data and keep consistency with organizational purpose. Furthermore, the performance measurement should be well defined, fairly concise to make an ease understanding, ensuring a combination of financial and non-financial indicators with use of minimal metric [7]. Base on the result of literary review conducted by Ref. [11] a various approach models can be used to measure the SC performance, some of them which are used as the framework in the research will be described below.

Supply Chain Operations Reference Model (SCOR Model). There are some models that have been applied to business analyses, the SCOR model is one of the most well-known and has been widely applied by researchers [2]. The SCOR model is a method to measure and assess supply chain performance which link to business process, technology and best practices[13]. It provides standard of management processes such as plan, source, make, deliver, and return[14] . Marginally, The SCOR model is a cross-functional framework

related to the performance measure, the best practices and the specification of the software in detail [14]. The SCOR model states SC in the five main assimilated processes, *i.e.*, Plan, Source, Make, Deliver and Return. While the procedure of performance is measured out of five perceptions: Reliability, Responsiveness, Flexibility, Cost and Asset.

Hierarchical Based Measurement System (HBMS), This concept is development by a measurement framework of Ref. [15] . It is developed by classifying measurement as a strategic, tactical, and operational measurement [15]. Its main principle related to the proper management rate to facilitate a quick and accurate measurement [16]. Furthermore, metrics can be described based on financial and non-financial criteria and then connect them together and interpret the hierarchical of performance measurements and SC maps. In addition, HBMS can also accurately measure the enterprise goal. By combining a mathematical model or Analytical Hierarchical Process (AHP) technique in SCPM, it is expected to be very useful [7, 17].

Hybrid of SCOR and Balanced Scord Card (BSC) according to Ref. [18], it requires a model that involves the identification of purpose and business procedure, the performance and the definition of an upgrading opportunity, and the optimizing process to analyze the SC. This measurement approach combines SCOR measurements by adapting the balanced scorecards. The concept, material and product flow can be defined and run by SCOR metrics while the BSC is used to represent business purpose with a top-down control approach to keep the SC on track to realize business strategies and achieve an improvement. The main objectives of the SCOR and BSC integrated approach are to ensure greater effectiveness of the performance management system and provide a clear definition about the type of process (planning, implementation and other possibilities)

Objective Matrix (OMAX) is a partial productivity measurement system. OMAX aims to monitor productivity in every part of the enterprise with productivity criteria that corresponds to its existence (objective). The advantages of OMAX in measuring enterprise productivity, besides being relatively simple and easy to understand are also able to combine productivity criteria into an integrated and related to each other. Furthermore, this model involves all levels of the enterprise, from subordinates to superiors.

Traffic Light System (TLS) is closely linked to the scoring system. TLS serves as a sign whether the Key Performance Indicator (KPI) score requires an improvement or not. The indicators of TLS are presented with some of colors, which are:

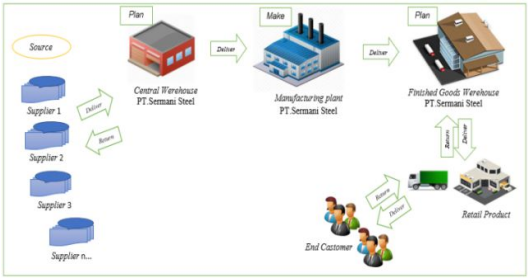
- Green color, the achievement of a performance indicator has been achieved
- Yellow color, the achievement of a performance indicator has not been achieved, even though the score is close to the target. Thus, the management must be careful about the possibilities
- Red color, the achievement of a performance indicator is really below the predetermined target and requires an immediate improvement.

3. Methodology

In the early stages, the classification of SC activities was conducted base on the SCOR model approach by involving the five SC perspectives to identify KPI in each perspective (Picture 1)

Picture 1. The supply chain in iron roofing industry

Next, it conducts a mapping SC enterprise from the results of observations and interviews with the enterprise management that are classified into five main processes, i.e., Plan, Source, Make, Deliver and



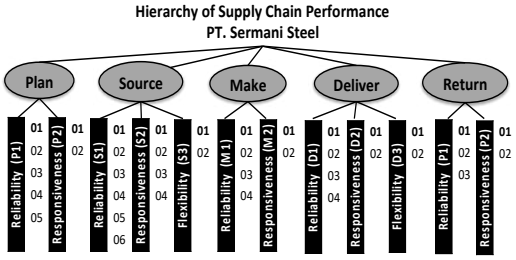
Return on SCOR version 10.0. Then, determine the KPI of each SCOR perspective using the three main measures as in Table 1.

Table 1. Key Performance Indicator of SC enterprise

Reliability	Indicator of Performance
Plan (P1)	Forecast accuracy (P1.01), Percentage of adjusted production quality (P1.02), Inventory accuracy (P1.03), Planning employee reliability (P1.04), Internal relationship (P1.05)
Source (S1)	On time delivery (S1.01), Source fill rate (S1.02), Source specified (S1.03), Percentage of correct delivery quantity (S1.04), Supplier

	relationship (S1.05), Supplier reliability (S1.06)
Make (M1)	Delivery fill rate (M1.01), In process failure rates (M1.02), Percentage of trouble of machine (M1.03), Manufacturing employee reliability (M1.04), Company quality system (M1.05)
Deliver (D1)	Delivery fill rate (D1.01), Percentage of order delivered on time (D1.02), Number of order ready to be taken by costumer (D1.03), Costumer relationship (D1.04), Marketing employee reliability (D1.05)
Return (R1)	Reject rate(R1.01), Number of costumer complaint (R1.02), Percentage of accurate product replacement (R1.03)
Responsiveness	**Indicator of Performance**
Plan (P2)	Time to produce a production schedule (P2.01), Planning response and flexibility (P2.02)
Source (S2)	Source of lead time (S2.01), Source volume responsiveness (S2.02), Source item responsiveness (S2.03), Purchase order cycle time (S2.04)
Make (M2)	Make volume responsiveness (M2.01), Trouble of machine (M2.02), Make item responsiveness (M2.03), Change over time (M2.04)
Deliver (D2)	Delivery lead time (D2.01), Time to fulfill order (D2.02)
Return (R2)	Costumer repair time (R2.01), Time to solve a complaint (R2.02)
Flexibility	**Indicator of Performance**
Source (S3)	Source volume flexibility (S3.01), Source item flexibility (S3.02)
Deliver (D3)	Deliver change over flexibility (D3.01), Change of product delivery (D3.02)

The hierarchical relationship of SCOR model of each KPI can be illustrated as in Picture 2.



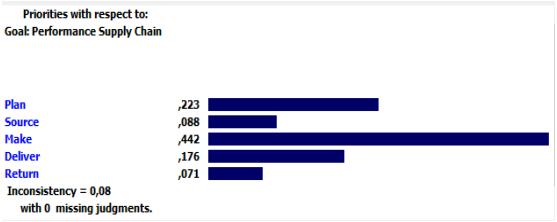
Picture 2. The supply chain in iron roofing industry

4. Data Analysis

4.1. KPI weighting

KPI weighting aims to scores the level of importance between one KPI and another in measuring the SC's performance using AHP.

In AHP, the average calculation of weighting the result of relativity valuation on KPI priority level conducted by using Expert Choice. The result weight of each KPI is considered valid when the Consistency Ratio (CR) ≤ 10% *(Picture 3)*.



Picture 3. Consistency Ratio of KPI

The Partial weighting results and consistency scores of metric for each level in the SC performance hierarchy can be seen in Table 2. In Table 2, from 38 KPI each of them has different levels of priority, where the greater weight they have, it indicates that the KPI is increasingly important. The entire KPI has a CR score <0.1 so that it can be concluded that the score is consistent (valid).

Table 2. The weight of each KPI

	KPI	Weight	No	KPI	Weight	No	KPI	Weight	No	KPI	Weight
1	P1 01	0,164	11	S1 04	0,214	21	M1 02	0,268	31	D2 02	0,200
2	P1 02	0,100	12	S1 05	0,381	22	M1 03	0,163	32	D3 01	0,750
3	P1 03	0,070	13	S1 06	0,049	23	M1 04	0,497	33	D3 02	0,250
4	P1 04	0,305	14	S2 01	0,152	24	M2 01	0,750	34	R1 01	0,238
5	P1 05	0,361	15	S2 02	0,441	25	M2 02	0,250	35	R1 02	0,136
6	P2 01	0,750	16	S2 03	0,117	26	D1 01	0,112	36	R1 03	0,625
7	P2 02	0,250	17	S2 04	0,290	27	D1 02	0,505	37	R1 01	0,667
8	S1 01	0,174	18	S3 01	0,333	28	D1 03	0,135	38	R1 02	0,333
9	S1 02	0,105	19	S3 02	0,667	29	D1 04	0,248			
10	S1 03	0,077	20	M1 01	0,073	30	D2 01	0,800			

4.2. Scoring System Using OMAX

The Scoring system by using OMAX aims to determine the target's highest score (optimist) and the lowest score (pessimist) which was achieved of each KPI. As for the setting of the target's highest score and the lowest score achieved of each KPI is defined subjectively by the enterprise with considering the condition of the enterprise (Table 3). Next, scoring system calculation is conducted. The score of each level will be determined so that the performance achievement of each KPI can be known in what level and then categorized according to TLS. The goal performance for each criterion is determined based on the target of the enterprise itself. The goal

performance is an agreement between the top management in the enterprise in accordance with the mechanism the target setting in the enterprise. In OMAX, if the level of performance achievement has an optimistic score (best practice) then it is ranked at level 10, the pessimist scores are ranked at level 0, and the realization of performance in the previous year is ranked at level 3 to get the middle score. Whereas for the other scores is filled by using interpolation from the score of the nearest performance indicator with the linear scale formula as follows:

$$\Delta X_{L-H} = \frac{Y_H - Y_L}{X_H - X_L}$$ Equation 1

With:

ΔX_{L-H} *:The interval between high and low level*
X_H : *High level high,*
X_L : *low level*
Y_H : *The number on high level,*
Y_L : *the number on low level*

For example, based on data in table 2 and 3 by using the equation (1) it gets the interval score between the highest middle and lowest level to KPI P1.01, i.e., the optimist score (level 10) = 9,5, the pessimist score (level 0) = 16, the realization of the previous period (level 3) = 13,25, realization (*performance*) = 11,33, Thus, the interval is between level 10 and 3 = - 0,679, and interval between Level 3 and 0 = -0,583. After the score of each level is obtained (from level 0 to level 10), next the charging score is conducted, that is the result of the actual data measurement which is compared with the nearest performance by using interpolation formula. For example, the result calculation for KPI P1.01 with score performance 11,335 is in the level (x) = 6,58. In the same way, the result calculation of each KPI is obtained.

Table 3. Target Score, Realization, Optimist, and Pessimist Each KPI

KPI	Target	Realization		Optimist Score	Pessimist Score	Unit	Information	
		Before	After				Target	Achievement
P1.01	10	13,25	11,33	9,5	16	%	*Sib*	*Tt*
P1.02	7	6,78	6,55	6,5	10,5	%	*Sib*	*T*
P1.03	1	2,45	1,35	1	5	%	*Sib*	*Tt*
P1.04	95	81,52	93,76	95	80	%	*Lib*	*Tt*
P1.05	95	94,75	94,99	95	90	%	*Lib*	*T*
P2.01	1	2	1,5	1,5	7	Day	*Sib*	*T*
P2.02	1	2	1,5	1,5	7	Day	*Sib*	*Tt*
S1.01	95	93,88	92,75	95	80	%	*Lib*	*Tt*
S1.02	95	94,7	95	95	80	%	*Lib*	*T*
S1.03	95	95,22	95	95	80	%	*Lib*	*T*
S1.04	95	95,15	95	95	80	%	*Lib*	*T*
S1.05	95	94,5	94,9	95	80	%	*Lib*	*T*
S1.06	95	95,05	95	95	80	%	*Lib*	*T*
S2.01	30	48	37	30	60	Day	*Sib*	*Tt*
S2.02	2	3	2,3	2	7	Day	*Sib*	*T*
S2.03	2	3	2,15	2	7	Day	*Sib*	*T*
S2.04	3	2,5	2,9	3	7	Day	*Sib*	*T*
S3.01	1	1,5	1	1	7	Day	*Sib*	*T*
S3.02	1	1,5	1	1	7	Day	*Sib*	*T*
M1.01	100	99,55	99,97	100	90	%	*Lib*	*Tt*
M1.02	1	2	1,15	1	7	%	*Sib*	*T*
M1.03	1	1,5	1,2	1	7	%	*Sib*	*Tt*
M1.04	95	94,85	94,97	95	80	%	*Lib*	*Tt*
M2.01	1	1,15	1	1	7	Day	*Sib*	*T*
M2.02	0	0,5	0,1	0	3	Day	*Sib*	*T*
D1.01	100	99,8	99,97	100	90	%	*Lib*	*T*
D1.02	100	99,5	99,9	100	89	%	*Lib*	*Tt*
D1.03	100	99,8	99,95	100	90	%	*Lib*	*T*
D1.04	95	95,25	95,02	95	85	%	*Lib*	*T*
D2.01	2	3	2	2	7	Day	*Sib*	*T*
D2.02	1	1,5	1	1	7	Day	*Sib*	*T*
D3.01	2	1,5	1,9	2	7	Day	*Sib*	*T*
D3.02	10	11,25	10,22	9,55	15	%	*Sib*	*Tt*
R1.01	1	2	1,2	1	10	%	*Sib*	*T*
R1.02	0	5	3	0	14	Times	*Sib*	*Tt*
R1.03	1	2	1	1	10	%	*Sib*	*T*
R2.01	2	2	1	1	8	Day	*Sib*	*T*
R2.02	2	2	1,15	1	8	Day	*Sib*	*T*

Source: PT. Sermani Steel

Information credit:
(Sib) : Smaller is better, (Lib) : Large is better, (T) : achieved, (Tt) : not achieved

4.3. Traffic Light System

Base on the objective of this study, measuring the performance through the hierarchical integration based measurement system dengan traffic light system, so other than scoring, the weighting KPI with

HP is conducted. Traffic light system is conducted to help make decision of improvement and evaluation. Traffic light system used OMAX to monitor productivity in each part of the company with criteria.The Integration between the score and AHP will obtains value,that is the multiple calculation from score and weight. For example, In table 2. The weight value for KPI P1.01 is 0.164, with level (X) = 6,58, so that, the value is 1,079*(Table4)* and so on for the other KPI.

Table 4a. Scoring Perspective *Plan*

KPI	P1 01	P1 02	P1 03	P1 04	P1 05	P2 01	P2 02
Performance	11,33	6,55	1,35	93,76	94,99	1,50	1,50
10	9,50	6,50	1,00	95,00	95,00	1,50	1,50
9	10,04	6,54	1,21	93,07	94,96	1,57	1,57
8	10,57	6,58	1,41	91,15	94,93	1,64	1,64
7	11,11	6,62	1,62	89,22	94,89	1,71	1,71
6	11,64	6,66	1,83	87,30	94,86	1,79	1,79
5	12,18	6,70	2,04	85,37	94,82	1,86	1,86
4	12,71	6,74	2,24	83,45	94,79	1,93	1,93
3	13,25	6,78	2,45	81,52	94,75	2,00	2,00
2	14,17	8,02	3,30	81,01	93,17	3,67	3,67
1	15,08	9,26	4,15	80,51	91,58	5,33	5,33
0	16,00	10,50	5,00	80,00	90,00	7,00	7,00
Level (score)	6,58	8,75	8,31	9,35	9,72	10	10
Bobot *(weight)*	0,164	0,100	0,070	0,305	0,361	0,750	0,250
Value	1,079	0,875	0,582	2,852	3,509	7,500	2,500

Table 4b. Scoring Perspective *Source*

KPI	S1 01	S1 02	S1 03	S1 04	S1 05	S1 06	S2 01	S2 02	S2 03	S2 04	S3 01	S3 02
Performance	92,75	95,00	95,00	95,00	94,90	95,00	37,00	2,30	2,15	2,90	1,00	1,00
10	95,00	95,00	95,00	95,00	95,00	95,00	30,00	2,00	2,00	3,00	1,00	1,00
9	94,84	94,96	95,03	95,02	94,93	95,01	32,57	2,30	2,14	2,93	1,07	1,07
8	94,68	94,91	92,03	95,04	94,86	95,01	35,14	2,60	2,29	2,86	1,14	1,14
7	94,52	94,87	89,03	95,06	94,79	95,02	37,71	2,90	2,43	2,79	1,21	1,21
6	94,36	94,83	86,03	95,09	94,71	95,03	40,29	3,20	2,57	2,71	1,29	1,29
5	94,20	94,79	83,03	95,11	94,64	95,04	42,86	3,50	2,71	2,64	1,36	1,36
4	94,04	94,74	80,03	95,13	94,57	95,04	45,43	3,80	2,86	2,57	1,43	1,43
3	93,88	94,70	95,22	95,15	94,50	95,05	48,00	3,00	3,00	2,50	1,50	1,50
2	89,25	89,80	90,15	90,10	89,67	90,03	52,00	4,33	4,33	4,00	3,33	3,33
1	84,63	84,90	85,07	85,05	84,83	85,02	56,00	5,67	5,67	5,50	5,17	5,17
0	80,00	80,00	80,00	80,00	80,00	80,00	60,00	7,00	7,00	7,00	7,00	7,00
Level (score)	2,75	10	10	10	8,6	10	7,27	9	8,95	8,6	10	10
Bobot *(weight)*	0,174	0,105	0,077	0,214	0,381	0,049	0,152	0,441	0,117	0,29	0,333	0,667
Value	0,479	1,050	0,770	2,140	3,277	0,490	1,105	3,969	1,047	2,494	3,330	6,670

Table 4c. Scoring Perspective *Make*

KPI	M1 01	M1 02	M1 03	M1 04	M2 01	M2 02
Performance	99,97	1,15	1,20	94,97	1,00	0,10
10	100,00	1,00	1,00	95,00	1,00	0,00
9	99,94	1,14	1,07	94,98	1,02	0,83
8	99,87	1,29	1,14	94,96	1,04	1,67
7	99,81	1,43	1,21	94,94	1,06	2,50
6	99,74	1,57	1,29	94,91	1,09	3,33
5	99,68	1,71	1,36	94,89	1,11	4,17
4	99,61	1,86	1,43	94,87	1,13	5,00
3	99,55	2,00	1,50	94,85	1,15	0,50
2	96,37	3,67	3,33	89,90	3,10	1,33
1	93,18	5,33	5,17	84,95	5,05	2,17
0	90,00	7,00	7,00	80,00	7,00	3,00
Level (score)	9,53	9,05	7,20	8,60	10	8,88
Bobot *(weight)*	0,073	0,268	0,163	0,497	0,750	0,250
Value	0,696	2,425	1,174	4,274	7,500	2,220

Table 4d. Scoring perspective *Deliver*

KPI	D1 01	D1 02	D1 03	D1 04	D2 01	D2 02	D3 01	D3 02
Performance	99,97	99,90	99,95	95,02	2,00	1,00	1,90	10,22
10	100,00	100,00	100,00	95,00	2,00	1,00	2,00	9,55
9	99,97	99,93	99,97	95,04	2,14	2,83	1,93	9,79
8	99,94	99,86	99,94	95,07	2,29	4,67	1,86	10,04
7	99,91	99,79	99,91	95,11	2,43	6,50	1,79	10,28
6	99,89	99,71	99,89	95,14	2,57	8,33	1,71	10,52
5	99,86	99,64	99,86	95,18	2,71	10,17	1,64	10,76
4	99,83	99,57	99,83	95,21	2,86	12,00	1,57	11,01
3	99,80	99,50	99,80	95,25	3,00	1,50	1,50	11,25
2	96,53	96,00	96,53	91,83	4,33	3,33	3,33	12,50
1	93,27	92,50	93,27	88,42	5,67	5,17	5,17	13,75
0	90,00	89,00	90,00	85,00	7,00	7,00	7,00	15,00
Level (score)	9	8,6	8,25	9,44	10	10	8,6	7,24
Bobot *(weight)*	0,112	0,505	0,135	0,248	0,8	0,2	0,75	0,25
Value	1,008	4,343	1,114	2,341	8,000	2,000	6,450	1,810

Table 4e. Scoring Perspective *Return*

KPI	R1 01	R1 02	R1 03	R2 01	R2 02
Performance	1,20	3,00	1,00	1,00	1,15
10	1,00	0,00	1,00	1,00	1,00
9	1,14	0,71	1,14	1,14	1,14
8	1,29	1,43	1,29	1,29	1,29
7	1,43	2,14	1,43	1,43	1,43
6	1,57	2,86	1,57	1,57	1,57
5	1,71	3,57	1,71	1,71	1,71
4	1,86	4,29	1,86	1,86	1,86
3	2,00	5,00	2,00	2,00	2,00
2	4,67	8,00	4,67	4,00	4,00
1	7,33	11,00	7,33	6,00	6,00
0	10,00	14,00	10,00	8,00	8,00
Level (score)	8,6	5,8	10	10	8,95
Bobot *(weight)*	0,238	0,136	0,625	0,667	0,333
Value	2,047	0,789	6,250	6,670	2,980

5. Result and Discussion

The scoring score of each perspective SC in metrics OMAX is represented by three colors as in traffic light system, *i.e., green, yellow and red*. For score 0-2, it is categorized as red color which shows that the achievement of an indicator of performance is truly under the predetermined target, thus it needs an improvement immediately. The score 3 – 7 is categorized as yellow color which shows that the achievement of an indicator of performance has not been achieved yet even though the score is very close to the target. Thus, the management should be careful within any possibility. While the score 8 – 10, it is categorized as green color which shows that the achievement of an indicator of performance has been achieved.

As for the achievement of the enterprise's SC performance measurement result (Table 4a - 4e) shows that the score of the lowest scoring system to perspective plan is on KPI P1.01with achievements 6,58. This KPI is categorized in yellow color. Thus, this KPI need to have an improvement progress to improve its performance. And so, in row for perspective *Source, Make, Deliver*, and *Return,* each one to KPI 2.01 (7,27), M1.03 (7,20), D3.02 (7,24), and R1.02 (5,8) are also categorized in yellow color.

This integrated method draw and measure the supply chain performance more specifically. Traffic Light System is conducted to determine priority factors that must be immediately evaluated and corrected. Next, based on the value of each perspective, then the improvement priority order of the enterprise's performance are change Product availability D3.02 (1,810), Percentage trouble of machine M1.03 (1,174), Source lead time S2.01 (1,105), Forecast accuracy P1.01 (1,079), and Number of complaint customer R1.02 (0,789).

6. Conclusion

The result show that the integrated model of HBSM and traffic light system can be used for measure and evaluate the performance of enterprise,

specifically in manufacturing company. From the discussion, it shows that the integration of hierarchical based measurement system with traffic light system in conducting an evaluation and enterprise performance measurement can give solution in more effectively, comprehensively and accountably. It is effective because it gives information about the performance indicator that prioritized to have an attention immediately. It is comprehensive and accountable because the measurement of performance involve all level of function in organization integrated. For further research, it needs more exploration in others types if industry.

7. Research Contribution

This study is expected to help management in conducting an evaluation and measurement of enterprise performance easily, informatively, comprehensively, and integrated.

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