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Performance Evaluation of a Department in the Manufacturing Industry Based on Balanced Scorecard

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A B S T R A C T

The success of a company, especially in the manufacturing industry, is closely linked to the performance of each department. The final objective of this research is to determine KPIs, measure department performance on each KPI based on the perspective of a Balanced Scorecard-based performance assessment approach, and then determine achievements. The process of generating Key Performance Indicators (KPIs) commences with conducting unstructured interviews to get KPIs for each perspective. Subsequently, a survey was devised to conduct a systematic evaluation of Key Performance Indicators (KPIs) for each perspective, employing the Analytical Hierarchy Process methodology. The computations yielded weights for the four perspectives: financial, customer, learning, and internal business process. Each perspective was assigned a weight value of 0.25, 0.50, 0.125, and 0.125, respectively.

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INTRODUCTION

The manufacturing industry is a very important economic sector, and has a significant impact on a country's economic growth, as well as contributing positively to job creation for local communities. The operational continuity of the manufacturing industry in a country is closely related to the performance of each company operating in that industrial sector, including in competing with similar industries in other countries. In the increasingly fierce competition in this era of globalization, manufacturing companies are required to always improve their performance, both in terms of efficiency, productivity, innovation and service to customers. One method that has been implemented by many world companies to measure and improve their performance is by using the Balanced Scorecard (BSC) method. The Balanced Scorecard, devised by Robert Kaplan and David Norton in the early 1990s, is a comprehensive methodology for assessing corporate performance. It encompasses four primary viewpoints: finance, customers, internal business processes, and learning and growth. This approach enables firms to find pertinent Key Performance Indicators (KPIs) within each of these viewpoints, while also formulating suitable strategies and activities to enhance their performance.

In a manufacturing company, the performance of each department will contribute to the overall success of the company. Therefore, it is important to measure and evaluate the performance of each department objectively and comprehensively. In this context, the application of the Balanced Scorecard at the department level in the manufacturing industry becomes relevant and useful, because it can provide a comprehensive picture of departmental performance and help companies identify areas that need improvement. Company A operates in the electronic components manufacturing sector. The company is headquartered in the SiJoRi triangle (Singapore - Johor - Riau) and primarily targets the Chinese and Taiwanese markets. Company A operates a manufacturing facility, specifically located on Bintan Island in Indonesia, within the Bintan Industrial Estate (BIE) industrial zone. The primary items manufactured by this industrial facility consist of electronic device components, such as MHF receptacles, plugs, and wire harnesses.

Although manufacturing plant B has adopted a performance measuring system for its existing departments, this method is not deemed to provide a balanced assessment of department performance. It primarily focuses on successes related to Product Delivery and Product Quality. Hence, it is imperative to adopt an alternative methodology to evaluate the performance of manufacturing plant B belonging to business A, to obtain a more comprehensive overview of the firm's performance and attainment of goals. This research will analyze the use of the Balanced Scorecard to assess the performance of Department B at manufacturing plant B of Company A. The objective is to identify key performance indicators (KPIs) and create a departmental performance evaluation system based on the four perspectives of the Balanced Scorecard. Additionally, recommendations will be provided to enhance the department's performance from these four perspectives. Hence, this study will

be titled "Performance Assessment of a Department in the Manufacturing Sector Using a Balanced Scorecard".

LITERATURE REVIEW

Performance Measurement

Mulyadi (2007) performance is a statement regarding the success achieved or obtained by employees or individual contributors in an organization, in realizing or creating strategic targets based on four perspectives, namely finance, customer service, internal business processes, and growth and development. These four perspectives are based on the Balanced Scorecard (BSC) concept which has recently developed into the Sustainability Balanced Scorecard concept (Mio et al, 2021). Based on this understanding, performance is an individual activity within a company or organization that is influenced by external and internal factors and is carried out to achieve a company goal within a certain time span (Listiani, T, 2011).

Analytical Hierarchy Process

Analytical Hierarchy Process (AHP) adalah sebuah metode pengambilan keputusan yang diusulkan oleh (Saaty, 1980). Pendekatan AHP merupakan sebuah pendekatan yang memperkenalkan langkah-langkah terstruktur untuk memecahkan sebuah masalah kompleks, menjadi masalah-masalah yang lebih kecil dan dapat diselesaikan menggunakan aspek yang berdasarkan pada pendekatan penyelesaian secara kualitatif, maupun secara kuantitatif (Alam Syah, A.D.P, 2014).

Balanced Scorecard

The balanced scorecard is a notion initially described by Norton and Kaplan. The technique proposed by Kaplan and Norton (1992) is an alternative method employed by firms to thoroughly measure company performance, rather than only focusing on financial performance. This approach can serve as a managerial tool for performance management during the development process. It guides and assists organizations in translating the company or organization's vision and strategy into tangible business actions. These actions are supported by achievement indicators that are interconnected in a cause and effect relationship.

Financial Perspective

According to the original introduction by the creator of the BSC approach, organizations must assess success in financial terms. This financial performance indicator is typically the primary, though not exclusive, metric in a profit-driven organization. This perspective will determine whether a company's strategic planning or execution has a favorable influence on the intended financial success metrics. Figure 6 depicts a financial perspective plan.

Customer Perspective

The customer perspective in the balanced scorecard (BSC) examines the relationship between the company and its customers within a certain market segment. Hence, the client perspective holds significance as it delineates the sustainability prospects of the company's business operations.

Internal Business Process Perspective

From an internal business process perspective, it is described that companies will generally carry out operations, innovation and after-sales service activities for customers. This perspective measures these activities, to provide an overview of the effectiveness and efficiency of an internal business process. In general, this perspective will try to assess internal business processes. that provide added value to the activities carried out by the company.

Learning and Growth Perspective

Perspective focused on acquiring knowledge and developing oneself. This perspective seeks to assess the performance of an organization, in order to ensure that all components of the organization continue to undergo learning and development. An organization consists solely of individuals who are affiliated with it. Subsequently, this capability transforms into a shared capability of the organization.

METHODOLOGY

Research Methods

The research will utilize a balanced approach assessment by employing the Balanced Scorecard, and a systematic multilevel problem-solving method through the Analytical Hierarchy Process (AHP) approach.

Population and Sample

The research utilizes performance data from a manufacturing corporation situated in Pulan Bintan, encompassing performance data up to 2022.

Data Analysis Techniques

The data will be analyzed by looking at statistical indicators, such as the mean. Non-quantitative data will be analyzed by carrying out pairwise comparisons, to obtain quantitative data.

Analysis of Unstructured Interview Results

Analysis of the results of unstructured interviews is by taking performance assessment criteria from the performance indicators presented during the interview. At the time of conducting the research, there were several performance indicators to see the company's achievements, but they were not structured specifically in the four perspectives of the Balanced Scorecard. This analysis also places the KPIs that will be used into a special perspective. From the results of this research, a questionnaire was prepared.

Analysis of Questionnaire Results

To obtain the weight values from the questionnaire that has been carried out, a pairwise comparison matrix is created, to compare the value of each KPI against other KPIs. From the results of this matrix, the final weight value for each perspective and KPI will then be calculated using the Analytical Hierarchy Process approach.

Performance Calculations

Then, for performance calculations, the results of the performance indicators that have been determined will be used. For KPI assessment, a value of 0 will be given when the achievement is the same as the worst achievement in the company's history. A score of 7 will be given when the achievement is the same as the average achievement so far. A score of 10 is given when the achievement meets the target. The score between 0 to 7 and 7 – 10 is the prorated score between the two achievements.

RESEARCH RESULT

Development of Performance Indicators

This preparation was executed by interviewing with one of the executives at manufacturing plant B. The outcomes of this interview were subsequently utilized as the foundation for formulating performance indicators. The subsequent subsection provides a comprehensive description of these stages.

Interview with an Executive

This interview employed an unstructured interview format, wherein questions were posed to explore the four balanced scorecard viewpoints and potential strategic objectives aligned with these perspectives. A strategy map was created based on this interview, depicting the interconnection between several strategic objectives.

Strategic Diagram

Strategy maps, in conjunction with the balanced scorecard, serve to illustrate the interdependencies between strategic objectives. They demonstrate how a strategic objective can both impact and be influenced by other objectives, whether from the same or different perspectives, to attain the primary performance goal. Strategic maps are organized in a manner that depicts the cause-and-effect connections between different strategic objectives.

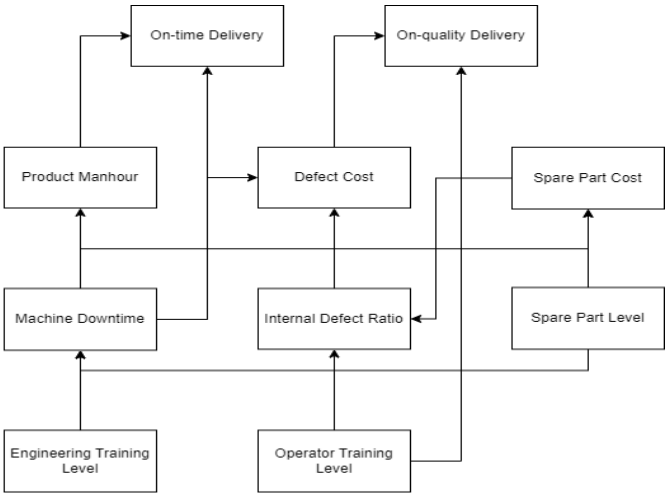

Figure 1 Strategy Map
(Source: Personal Data)

Perspective Weighting

To carry out balanced calculations for each perspective, a weight ratio is needed. The weight ratio of these perspectives is approached by interviews. The results of the interview were then quantified, to obtain the percentage value of the weighting results for each balanced scorecard perspective. These weight values are displayed in table 1.

Table.1 Weighting Between Perspectives

Perspektif	Weight (%)
Customer	50
Finance	25
Internal Business Processes	12,5
Learning	12,5

Table 1 indicates that the consumer viewpoint is given the highest priority in comparison to the financial perspective, internal business procedures, and learning. The primary and fundamental cause for this is that manufacturing plant B's position within the supply chain entails that any delivery issue would lead to subsequent complications downstream.

Weighting of Strategic Objectives

Once the perspectives have been weighted, the subsequent task is to assign weights to the strategic objectives. Table 2 presents the strategic objectives derived from the conversation, encompassing multiple views of the balanced scorecard.

Table 2. List of Strategic Objectives

Perspektif	Strategic Objective	Code
Customer	On-time Delivery	C1
Customer	On-quality Delivery	C2
Financial	Product Manhour	F1

Financial	Defect Cost	F2
Financial	Sparepart Cost	F3
PBI	Machine Downtime	I1
PBI	Internal Reject Ratio	I2
PBI	Spare Part Level	I3
Learning	Engineering Training Level	L1
Learnig	Operator Training Level	L2

Table 3. Weighting Between Strategy Objectives Financial Perspective

Code	*Strategy Objective:* **Finansial**	Weight (%)
F1	Product Manhour	80
F2	Defect Cost	10
F3	Sparepart Cost	10

From the financial perspective, it was found that strategic objectives F1, F2, and F3 had weight values of 0.8 respectively; 0.1; and 0.1, where this is because factors related to product manhour are identified as having a very significant impact on financial goals. Therefore, assessment and efforts towards actions that affect product manhours become more important and have a higher priority to carry out and evaluate their implementation.

Table 4. Weighting Between Strategy Objectives Internal Business Process Perspective

Code	Strategy Objective: Internal	Weight (%)
I1	Machine Downtime	59
I2	Internal Reject Ratio	16
I3	Sparepart Level	25

The internal business process perspective revealed that the strategic objectives of machine downtime, internal reject ratio, and spare parts level had weights of 0.60, 0.15, and 0.25, respectively. This indicates a heightened focus on endeavors to minimize machine downtime. This is evident in the strategic aim, where machine downtime contributes to the total manhours required for production. This is one of the factors that ensures timely delivery of products. Subsequently, an analysis of the viewpoint of the customer is conducted.

Table 5. Weighting Between Strategy Objectives from a Customer Perspective

Code	Strategy Objective: Customer	Weight (%)
C1	On-time Delivery	67
C2	On-quality Delivery	33

From this viewpoint, it is determined that the punctuality of delivering manufactured items carries a somewhat more significance than the quality of the goods dispatched, as evidenced by the weight of 0.60 compared to 0.40. One of these distinctions arises from products that have reached a mature stage in their life cycle, with limited modifications and adjustments, resulting in a generally low defect rate, typically below 0.1%. Subsequently, an examination of different viewpoints on learning is conducted.

Table 6. Weighting Between Learning Objective Strategies

Code	Strategy Objective: Pembelajaran	Weight (%)
L1	*Engineering Training Level*	75
L2	*Operator Training Level*	25

From a learning standpoint, it was discovered that the strategic objective engineering training level carried more significance than the operator training level in terms of weight. This is due to the implementation of automation in the production process, resulting in production machines playing a more prominent role, while human operators primarily focus on quality control and sorting.

Key Performance Indicator Weighting

The next step is to weight the KPIs in each strategy objective. Some objective strategies only have one KPI so the weight is 1. For each objective strategy that has more than one KPI, weighting is carried out using AHP. The results of this weighting are shown in table 7.

Table 7. Weighting Between Key Performance Indicators

Code SI	Code KPI	*Key Performance Indicator*	Final Score (%)
C1	C1a	Delivery Performance	33.5
C2	C2a	Customer Claim	16.5
F1	F1a	DVC Manhour	10.0
	F1b	Non-DVC Manhour	10.0
F2	F2a	Scrap Cost	1.25
	F2b	Rework Cost	1.25
F3	F3a	Sparepart Cost	2.5

I1	I1a	Machine Running Hour	4.9
	I1b	Machine Maintenance Hour	2.5
I2	I2a	Internal Reject Ratio	2.0
I3	I3a	Spare Part Stock Level	3.1
L1	L1a	Engineering Qualification	9.4
L2	L2a	Operator Qualification	3.1

Once the weights for each Key Performance Indicator (KPI) have been established, the subsequent task is to conduct a performance evaluation using the specified KPI values. The forthcoming subchapter will provide an explanation of the performance assessment utilizing the generated Key Performance Indicators (KPIs).

Evaluation of performance

Performance assessment is conducted by quantifying accomplishments in each performance indicator. The targets and performance indicators will be transformed into an assessment scale ranging from 0 to 10 to evaluate performance based on a numerical value. The specific aims and accomplishments for each Key Performance Indicator (KPI) are detailed in table 8.

Table 8. Performance Goals and Achievements

Code KPI	Key Performance Indicator	Performance Goals	Achievements
C1a	Delivery Performance	92 %	87 %
C2a	Customer Claim	0	2
F1a	DVC Manhour per unit	0.23/k	0.25/k
F1b	Non-DVC Manhour per unit	0.05/k	0.047/k
F2a	Scrap Cost	0.1%	0.16%
F2b	Rework Cost	0.05%	0.02%
F3a	Sparepart Cost	335k	286k
I1a	Machine Running Hour	233.280 hr	221.442 hr
I1b	Machine Maintenance Hour	12.412	8.240
I2a	Internal Reject Ratio	0.05%	0.03%
I3a	Spare Part Stock Level	37k	26k
L1a	Engineering Qualification	2.0	1.27
L2a	Operator	2.0	1.13

	Qualification		

Computation of Performance Achievement Scores

Subsequently, an evaluation of performance accomplishments for each Key Performance Indicator (KPI) is conducted to derive a conclusive score on a 0-100% assessment scale. The percentage of achievement for each Key Performance Indicator (KPI) is subsequently displayed in Table 9.

Table 9. Score

Code KPI	Key Performance Indicator	Target	The final result	Achievements (%)
C1a	Delivery Performance	92 %	87 %	70
C2a	Customer Claim	0	2	60
F1a	DVC Manhour per unit	0.23/k	0.25/k	70
F1b	Non-DVC Manhour per unit	0.05/k	0.047/k	100
F2a	Scrap Cost	0.1%	0.16%	60
F2b	Rework Cost	0.05%	0.02%	100
F3a	Sparepart Cost	335k	286k	80
I1a	Machine Running Hour	233.280	221.442	70
I1b	Machine Maintenance Hour	12.412	8.240	60
I2a	Internal Reject Ratio	0.05%	0.03%	100
I3a	Spare Part Stock Level	37k	26k	100
L1a	Engineering Qualification	2.0	1.27	70
L2a	Operator Qualification	2.0	1.13	60

Table 10. Performance Composite Score

Code KPI	Key Performance Indicator	Score (%)	Weight KPI (%)	Final Score (%)
C1a	Delivery Performance	70	33.5	23.5
C2a	Customer Claim	60	16.5	9.9
F1a	DVC Manhour per unit	70	10.0	7.0
F1b	Non-DVC Manhour per unit	100	10.0	10
F2a	Scrap Cost	60	1.25	0.8
F2b	Rework Cost	100	1.25	1.3
F3a	Sparepart Cost	80	2.5	2.0

I1a	Machine Running Hour	70	4.9	3.4
I1b	Machine Maintenance Hour	60	2.5	1.5
I2a	Internal Reject Ratio	100	2.0	2.0
I3a	Spare Part Stock Level	100	3.1	3.1
L1a	Engineering Qualification	70	9.4	6.6
L2a	Operator Qualification	60	3.1	1.9

DISCUSSION

The composite table above indicates that the final performance score earned is 73%. Based on the comprehensive evaluation, the department has achieved a score of 73%, which is consistent with the results from the previous measurement period (last year). From a client standpoint, the delivery performance received the highest score of 70%. This value has the greatest proportion in determining the final assessment score, nevertheless, its accomplishments are very similar to those achieved in the preceding era, so it does not provide any additional superior value. Enhancing the performance of this indicator is crucial for ensuring optimal performance values in the future. From a financial standpoint, it was determined that the DVC per unit indicator had a substantial contribution to the final score, but the accomplishment value was only 70%. This setting does not provide any further contribution to the overall performance. In the future, it is crucial to prioritize the reduction of DVC expenses in order to enhance overall performance. The Non-DVC indicators achieved the aim and demonstrated the highest level of performance. The 100% value indicates a significant level of operational efficiency from the Non-DVC side. This accomplishment must be sustained in the upcoming period. In addition, there is the potential for this to be bolstered by an increase in DVC Manhour per unit.

CONCLUSIONS AND RECOMMENDATIONS

The criteria for KPIs for each balanced scorecard perspective have been successfully determined, resulting in 13 KPIs, namely 2 KPIs for the customer perspective, 5 KPIs for financial, 4 KPIs for customers, and 2 KPIs for learning. The measurement of department performance in 13 key performance indicators (KPIs) has been completed. The KPI Delivery Performance had the greatest achievement value, contributing 23.5% to the weight value. The lowest achievement value was reached in the KPI Scrap Cost with a contribution to the weight value of 0.75%. The department's performance achievement value is 73%; Then it is recommended that adjustments need to be made to KPI Customer

Claims and Machine Maintenance Hours to boost the accomplishment value. It is advisable to enhance the performance of the department on indicators that make a substantial impact. To mitigate the adverse effects on the composite performance score, it is imperative to enhance the subpar performance indicators. HR qualifications can be enhanced through the implementation of training.

ADVANCED RESEARCH

Still conducting further research to find out more about the Performance Evaluation of a Department in the Manufacturing Industry Based on the Balanced Scorecard.

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