Performance measurement using Balance Score Card and Analytic Network Process in Elastomer Switch Keypad Manufacturer Indonesia

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Abstract. Elastomer Switch or rubber keypad are manufactured from silicon rubber properties to make button on cars, cellphone seals and TV remote buttons. From the sales analysis report show that trends that occur in company's sales volume are declining in recent years with an average of 204 complaints per year, so the measurement of company performance needs to be done. In this study, company performance is measured by applying the Balance Scorecard which provides a multi-dimensional evaluation framework and weighting calculations based on the Analytic Network Process (ANP). A KPI Performance Aplication Design is generated from this research to help companies know what perspectives affect the company. The results of performance measurement using the Balance Scorecard Method show that the total performance of the company has a value of 2.741 which means that the company's performance is still not good, but it is almost close to good enough value. So it needs some improvement for the future.

Keywords: Performance Measurement, Balanced Scorecard, ANP

1. Introduction
Performance measurement using the Balanced Scorecard method based on Analytical Network Process has been widely used, such as at PT. X under the auspices of PT.PLN [1] and PT. Telemedia Network Horizon [2]. Performance measurement can also be done using Human Resource Scorecard to measure the performance of human resources [3] and use the Integrated Performance Measurement System (IPMS) method to measure performance related to stakeholder's requirements [4]. From previous studies it was found that this performance measurement produces information in the form of weights from each of the existing perspectives and can provide levels from the perspective that is not too influential to the most influential. Judging from the company's financial data that has decreased profits and increasingly fierce competition, PT.Polymatech Indonesia feels the need to re-arrange the strategy by reviewing the strategy objectives in the competition and evaluating the company's internal capabilities because currently the company's performance measurements are only using the system performance measurement that emphasizes financial aspects. This can occur due to many things such as lack of consumers, the existence of defective goods in shipping, and poor employee performance. In previous studies, the Balanced Scorecard system has a role for management as a vehicle for planning the company's long-term performance, helping management carry out and carry out its mission [5]. So this research wants to help solve company problems by using the Balanced Scorecard Method and weighting using the Analytic Network Process.
2. Methods

2.1 Balanced Scorecard
The Balanced Scorecard (BSC) is one of the performance measurement system models with strategy as a starting point translating into performance measures. Developed by Robert S. Kaplan and David P. Norton of Harvard Business School [6]. Basically the Balanced Scorecard is a management system for companies to invest in the long term for customers (Customer), Learning and employee growth, including management (Learning and growth), internal business processes (Systems) in order to obtain financial results that enable the development of business organizations rather than just managing your bottom line for short-term results [7].

2.2 Analytical Network Process
The Analytical Network Process (ANP) approach is largely ignored compared to the Analytical Hierarchy Process (AHP) approach which is linear in structure and does not accommodate feedback. This is because AHP is relatively simpler and easier to implement, whereas ANP is deeper and more suitable for complex, complex decision making and requires a variety of interactions and dependencies. [8]. Analytical Network Process (ANP) method is the development of the AHP method. ANP allows for interaction and feedback from elements in the cluster (inner dependence) and between clusters (outer dependence) [9].

2.3 Key performance Indicator (KPI)
Key Performance Indicators (KPI) are a series of key indicators that are measurable and provide strategic target information that has been imposed on an organization successfully achieved [10].

3. Result and Discussion
Strategy maps can provide a framework that shows the causal relationships, vision and mission, and the company's strategy, and strategic objectives for each perspective. In this study the strategy map for PT. Polymatech Indonesia can be seen in Figure 1.

![Strategy map](image-url)
To measure performance at elastomer switch keypad manufacturing with the Balanced Scorecard method it is necessary to first assess the performance of each strategic goal from every perspective that exists in the Balanced Scorecard method. Table 1 shows an assessment of the company’s current performance.

| Perspective | Strategic Target | KPI | Target | Assessment | Score | Current Achievements | Results |
|-------------|-----------------|-----|--------|------------|-------|----------------------|---------|
| Finance     | Increase Return Rate | ROA | 10 %   | ROA > 10 % | 5     |                       | 7 %     |
|             |                 |     |        | 8% ≤ ROA < 10 % | 4     |                       |         |
|             |                 |     |        | 6% ≤ ROA < 8 % | 3     |                       |         |
|             |                 |     |        | 4% ≤ ROA < 6 % | 2     |                       |         |
|             |                 |     |        | ROA < 4% | 1     |                       |         |
|             |                 |     |        | NPM > 8 % | 5     |                       |         |
|             | Increase Company Profit | NPM | 8 %   | ROA > 10 % | 5     |                       |         |
|             |                 |     |        | 5% ≤ NPM < 8 % | 4     |                       |         |
|             |                 |     |        | 2% ≤ NPM < 5 % | 3     |                       |         |
|             |                 |     |        | 0% ≤ NPM < 2 % | 2     |                       |         |
|             |                 |     |        | NPM < 0% | 1     |                       |         |
|             |                 |     |        | PP > 5 % | 5     |                       |         |
|             |                 |     |        | 3% ≤ PP < 5 % | 4     |                       |         |
|             |                 |     |        | 1% ≤ PP < 3 % | 3     |                       | -15%    |
|             |                 |     |        | -2% ≤ PP < 1 % | 2     |                       |         |
|             |                 |     |        | PP < -2% | 1     |                       |         |
|             |                 |     |        | RP = 95% | 5     |                       |         |
|             | Retain existing customers | Customer Reference | 95 % | Customer Reference | 92% | 4 |         |
| Customer    | Increase Market Share | Market Growth Supply | 25 % | Market Growth Supply | 3 | -8 % | 1 |         |
|             | Increase Customer Satisfaction | Number of Customer Complaints | <100 | Number of Customer Complaints | 204 | 3 |         |
|             |                 |     |        | RO ≥ 95% | 5     |                       |         |
|             |                 |     |        | RO > 100% | 4     |                       |         |
|             |                 |     |        | RO > 200% | 3     |                       |         |
|             |                 |     |        | RO > 300% | 2     |                       |         |
|             |                 |     |        | RO > 400% | 1     |                       |         |
|             |                 |     |        | RO > 500% | 5     |                       |         |
|             |                 |     |        | RO ≥ 5% | 5     |                       |         |
|             |                 |     |        | 10% ≥ KP > 15% | 3     |                       | 20%     |
|             |                 |     |        | 15% ≥ KP > 20% | 2     |                       |         |
|             |                 |     |        | KP ≥ 20% | 1     |                       |         |
|             |                 |     |        | BO ≥ 1,3 B | 5     |                       |         |
|             |                 |     |        | 1,3 B ≥ BO > 1,6 B | 4     |                       |         |
|             |                 |     |        | 1,6 B ≥ BO > 1,9 B | 3     |                       |         |
|             |                 |     |        | 1,9 B ≥ BO > 2,2 B | 2     |                       |         |
|             |                 |     |        | BO > 2,2 M | 1     |                       |         |
|             |                 |     |        | VP ≥ 50000 | 5     |                       |         |
|             | Delivery of goods on time | % Delays in delivery | 5% | % Delays in delivery | 20% | 2 |         |
|             | Make all Operations Cost effective | Operating costs | Rp 1,3 B | Operating costs | Rp 1,7 B | 3 |         |
|             |                 |     |        | 1,3 B ≥ BO > 1,6 B | 4     |                       |         |
|             | Increase the volume of the Company's production | Production Volume | 50000 /day | Production Volume | 3600/day | 3 |         |
|             |                 |     |        | 40000 ≤ VP < 50000 | 4     |                       |         |
|             |                 |     |        | 30000 ≤ VP < 40000 | 3     |                       |         |
|             |                 |     |        | 20000 ≤ VP < 30000 | 2     |                       |         |
|             |                 |     |        | VP < 20000 | 1     |                       |         |
|             | Improve Product Quality | % Number of Product Defects | 5% | % Number of Product Defects | 20% | 3 |         |
|             |                 |     |        | 5% ≥ CP > 15% | 4     |                       |         |
|             |                 |     |        | 15% ≥ CP > 25% | 3     |                       |         |
|             |                 |     |        | 25% ≥ CP > 35% | 2     |                       |         |
Table 1. Current company performance

| Perspective                  | Strategic Target | KPI                      | Target                      | Assessment          | Score | Current Achievements | Results |
|------------------------------|------------------|--------------------------|-----------------------------|---------------------|-------|----------------------|---------|
| **Growth and learning**      |                   |                          |                             |                     |       |                      |         |
| Increase Employee Productivity|                  | Revenue / Employee       | Rp 50 M                     | CP > 35 %           | 1     |                      |         |
|                              |                  |                          |                             | RE > 50 M           | 5     |                      |         |
|                              |                  |                          |                             | 40 M ≤ RE < 50 M    | 4     |                      |         |
|                              |                  |                          |                             | 30 M ≤ RE < 40 M    | 3     |                      |         |
|                              |                  |                          |                             | 20 M ≤ RE < 30 M    | 2     |                      |         |
|                              |                  |                          |                             | RE < 20 M           | 1     |                      |         |
|                              |                  |                          |                             | LD ≥ 4 day          | 5     |                      |         |
| Increase employee quality    |                  | Learning days            | 4 days                      | 3 day ≤ NPP < 4 day | 4     | Rp 32.917.351,-      | 3       |
|                              |                  |                          |                             | 2 day ≤ NPP < 3 day | 3     |                      |         |
|                              |                  |                          |                             | 1 day ≤ NPP < 2 day | 2     |                      |         |
|                              |                  |                          |                             | NPP < 1 day         | 1     |                      |         |
|                              |                  |                          |                             | TOK ≤ 0             | 5     |                      |         |
| Increase employee satisfaction|                  | Employee turn over       | 0 %                         | 0% ≥ TOK > 0,25 %   | 4     |                      |         |
|                              |                  |                          |                             | 0,25% ≥ TOK > 0,5 % | 3     |                      |         |
|                              |                  |                          |                             | 0,5% ≥ TOK > 0,75 % | 2     |                      |         |
|                              |                  |                          |                             | TOK > 0,75 %        | 1     |                      |         |

Each perspective in the balanced scorecard is related to one another in accordance with the concept of the Analytical Network Process. ANP functions to see the amount of contribution made by each perspective and each of these strategic objectives.

3.1 Weighting using ANP Method
This weighting is done by forming a supermatrix, where the supermatrix consists of sub-matrices which are composed of a set of relationships between the two levels contained in the model. There are 3 stages of supermatrix in ANP.

3.1.1 Unweighted Supermatrix
This supermatrix contains an eigenvector generated from the whole paired comparison matrix in the network. The results of the Unweighted Supermatrix in this study can be seen in Table 2.

3.1.2 Weighted supermatrix
This supermatrix is obtained by multiplying all the weights in the unweighted supermatrix by the weight of each cluster. Weighted Supermatrix calculation results in this study can be seen in Table 2.

3.1.3 Limiting Supermatrix
After the Weighted Supermatrix calculation process is complete, a Limiting Supermatrix calculation is performed to obtain a stable priority value. This is done by normalizing the weights on each strategic goal to get the contribution of each strategic goal. The results of Limiting Supermatrix in this study can be seen in Table 2.

3.2 Performance measurement of the Balanced Scorecard Method
Performance measurement from each perspective, namely financial, customer, internal business, as well as learning and growth, is done by multiplying the results of the assessment of company performance in each perspective with the weights obtained from the analysis of current company performance. Performance measurements from four perspectives can be seen in Table 3.

After the performance value of each perspective is known then overall company performance is measured. This measurement is done by multiplying the results of the performance evaluation of each perspective with the weight of each perspective itself, then after adding them up, the company
performance results are seen on a Likert scale, namely (1-5). The results of measurements of the overall performance of the company can be seen in Table 4.

Table 2. Weighting of ANP

| Perspective       | Strategic Target               | Weight Unweighted Supermatrix | Weight Weighted Supermatrix | Weight Limiting Supermatrix |
|-------------------|--------------------------------|--------------------------------|-----------------------------|----------------------------|
| Finance           | Increase rate of return        | 1                              | 0.563                       | 0.255                      |
|                   | Increase company profits       | 1                              | 0.563                       | 0.255                      |
|                   | Increase product sales         | 0.648                          | 0.365                       | 0.165                      |
| Customer          | Retain existing customers      | 0.268                          | 0.062                       | 0.028                      |
|                   | Increase market share          | 0.794                          | 0.183                       | 0.083                      |
|                   | Increase Customer Satisfaction | 0.353                          | 0.081                       | 0.037                      |
| Internal business | Increase production volume     | 1                              | 0.132                       | 0.060                      |
|                   | Delivery on time               | 0.293                          | 0.039                       | 0.018                      |
|                   | Improve product quality        | 0.567                          | 0.075                       | 0.034                      |
|                   | Streamline the operating costs | 0.373                          | 0.049                       | 0.022                      |
| Learning and Growth| Increase employee productivity| 0.330                          | 0.025                       | 0.011                      |
|                   | Improve employee quality       | 0.679                          | 0.051                       | 0.023                      |
|                   | Increase employee satisfaction | 0.321                          | 0.024                       | 0.011                      |
|                   | TOTAL                          | 2,211                          | 1                           |                            |

Table 3. Performance measurement results

| Perspective       | Strategic target               | KPI                          | Results  | Weight | Rx W |
|-------------------|--------------------------------|------------------------------|----------|--------|------|
| Finance           | Increase Return Rate           | ROA                          | 3        | 0.25   | 0.76 |
|                   | Increase Company Profit        | NPM                          | 4        | 0.25   | 1.02 |
|                   | Increase product sales         | Increase in Sales            | 1        | 0.16   | 0.16 |
|                   | Total                          |                              | 0.67     | 1.95   |      |
|                   | Value of Financial Perspective Performance |                      | 2.88812 |        |      |
| Customer          | Retain existing customers      | Customer Retention           | 4        | 0.028  | 0.112|
|                   | Increase Market Share          | Market Growth Value          | 1        | 0.083  | 0.083|
|                   | Increase Customer Satisfaction | Number of Customer           | 3        | 0.037  | 0.110|
|                   | Total                          |                              | 0.15     | 0.30   |      |
|                   | Value of Customer Perspective Performance |                      | 2.06802 |        |      |
| Internal business | Delivery of goods on time      | % Lateness                   | 2        | 0.018  | 0.035|
|                   | Make effective all operating   | Operating costs              | 3        | 0.022  | 0.067|
|                   | costs                          |                              |          |        |      |
|                   | Increase Company               | Production Volume            | 3        | 0.060  | 0.179|
|                   | Production Volume              |                              |          |        |      |
|                   | Improve Product Quality        | % Number of Defects          | 3        | 0.034  | 0.102|
|                   | Total                          |                              | 0.12     | 0.35   |      |
|                   | Performance Value of Internal Business |                  | 3        |        |      |
| Learning and Growth| Increase Employee Productivity| Revenue / Employee           | 3        | 0.011  | 0.034|
|                   | Improve Employee Quality       | Learning Days                | 3        | 0.023  | 0.069|
|                   | Increase Employee Satisfaction | Turn over                    | 4        | 0.011  | 0.044|
|                   | Total                          |                              | 0.05     | 0.15   |      |
|                   | Value of Learning and Growth Perspective Performance |                      | 3.24112 |        |      |
Table 4. Company performance results

| Perspective | Score | Weight | Score x Weight |
|-------------|-------|--------|----------------|
| Finance     | 2,888 | 0.563  | 1,625          |
| Customer    | 2,068 | 0.230  | 0.476          |
| Business    | 3,000 | 0.132  | 0.397          |
| Growth      | 3,241 | 0.075  | 0.243          |
| Total       |       |        | 2.741          |

Based on the calculation, the total value of the company's performance is 2.741, which means that the company's performance has not been good, but it is almost close to good enough value, by making some improvements it is expected that the performance will be better. To be able to find out how the company's performance results are designed an application Key Performance Indicator (KPI) by considering the output, financial, Process and Resource aspects that can provide information on achieving strategic goals and perspectives of what is most influential in improving company performance. In Figure 2 shows the output of the KPI application output, Figure 3 for the financial perspective view, Figure 4 for the process perspective and Figure 5 for the Perspective Resources display.
4. Conclusion
Performance measurement using the Balance Scorecard Method in Elastomer Switch Keypad Manufacturer Indonesia is very useful. The results of the study show that the total performance of the company has a value of 2.741, which means the company's performance is still not good, but it is almost close to good enough value. So it needs some improvement for the future. Based on calculations made from 4 perspectives in the Balanced Scorecard method, namely finance, customers, internal business, and learning and growth, the weighting result for financial perspective is 0.566, Customer is 0.22, Internal Business Process is 0.13 and the weight value is Learning & Growth is 0.075. With this measurement, it is found that the strategic targets are not in accordance with the company's targets, namely increasing product sales, increasing market share, delivering goods on time, making all operating costs effective, and increasing employee productivity. strategy for PT. Polymatech Indonesia so that it can improve the performance of the company's KPIs to the maximum.

5. References
[1] Vanany, Iwan 2003 Analytic Network Process. Jurnal Teknik Industri. (Surabaya: Universitas Kristen Petra)
[2] Riza, Bob Subhan 2015 Pengukuran Kinerja Perusahaan Menggunakan Analytic Network Process. (Medan: Universitas Potensi Utama)
[3] Lorisa C, and Doaly CO 2017 Pengukuran Kinerja Sumber Daya Manusia Dengan Human Resource Scorecard di PT Trio Jaya Steel. Jurnal Teknik Industri, 7(3), pp. 132-146.
[4] Doaly C., Salomon L.L., and Steven C. 2018 Pengukuran Kinerja dengan Metode IPMS. Proc. Seminar Nasional Teknologi dan Sains III 2018, pp. 230-240.
[5] Gaol, CHR. Jimmy 2014 A to Z Human Capital Manajemen Sumber Daya Manusia. (Jakarta: PT.Grasindo)
[6] Kaplan, R. and D. Norton 1996 Translating strategic Into Action – The Balanced Scorecard. (Boston: Harvard Business School Press)
[7] Gaspersz, Vincent 2006 Sistem Manajemen Kinerja Terintegrasi Balanced Scorecard dengan Six Sigma. (Jakarta: PT. Gramedia Pustaka).
[8] Rusydiana, Aam S and Devi, Abrista 2013 Analytic Network Process Pengantar Teori Dan Aplikasi. (Bogor: Smart Publishing)
[9] Saaty, TL and Vargas, Luis G. 2006 Decision Making with The Analytic Network Process. (United States of America: Springer Science).
[10] Soemahadiwidjojo, Arini T 2015 Panduan Praktis Menyusun KPI. (Jakarta: RAS).