

IOP Conference Series: Materials Science and Engineering

Table of contents

Volume 847

2020

◀ Previous issue Next issue ▶

12th ISIEM (International Seminar on Industrial Engineering & Management): "Industrial Intelligence System on Engineering, Information, and Management" 17-19 March 2020, Batu, Malang - East Java, Indonesia

Accepted papers received: 20 April 2020

Published online: 27 May 2020

Preface

OPEN ACCESS

Preface

+ Open abstract

[View article](#)[PDF](#)

011001

OPEN ACCESS

The Committee

+ Open abstract

[View article](#)[PDF](#)

011002

OPEN ACCESS

Logo

+ Open abstract

[View article](#)[PDF](#)

011003

OPEN ACCESS

Peer review statement

+ Open abstract

[View article](#)[PDF](#)

011004

OPEN ACCESS

Warehouse Layout Designing of Cable Manufacturing Company using Dedicated Storage and Simulation Promodel

W Septiani, G A Divia and S Adisuwiryo

+ Open abstract

[View article](#)[PDF](#)

012054

OPEN ACCESS

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

C O Doaly, L L Salomon and A K J Arta

+ Open abstract

[View article](#)[PDF](#)

012055

OPEN ACCESS

A conceptual framework for Servitisation of the manufacturing companies to deliver Product–Service Systems solutions: A study case of the Indonesian Motorcycle Industry

D R S Dewi, S Pittayachawan and E Tait

+ Open abstract

[View article](#)[PDF](#)

012056

OPEN ACCESS

Ergonomic Intervention to Improve The Productivity of Brick Press Tool in Small and Medium Entreprise (SME) Akheng Kobar Lamto Widodo, Silvi Ariyanti and Andreas Jason

012057

✓

OPEN ACCESS

012060

Determination of Multi-Product Distribution using Capacitated Vehicle Routing Problem (CVRP) and Product Cubication Dimensions Restriction

Yogi Yogaswara and Neng Resi Andriyani

[+ Open abstract](#)[View article](#)[PDF](#)

OPEN ACCESS

012061

Reducing Waste in Manufacturing Industry using Cost Integrated Value Stream Mapping Approach

Wilson Kosasih, C O Doaly and Shabara

[+ Open abstract](#)[View article](#)[PDF](#)

OPEN ACCESS

012062

Measurement of Feasibility and Risk Level on Modern Embroidery Kebaya Boutique Establishment in Jakarta

R W Hanaa and E Chumaidiyah

[+ Open abstract](#)[View article](#)[PDF](#)

PAPER • OPEN ACCESS

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

To cite this article: C O Doaly *et al* 2020 *IOP Conf. Ser.: Mater. Sci. Eng.* **847** 012055

View the [article online](#) for updates and enhancements.

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

C O Doaly^{1,2}, L L Salomon^{1,3} and K J Arta A^{1,4}

¹Universitas Tarumanagara, Jl. S. Parman No. 1 Jakarta Barat, Indonesia

²carlaol@ft.untar.ac.id, ³lithrones@ft.untar.ac.id, ⁴kholidarta@gmail.co.id

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 Application 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 Analytic 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.



Content from this work may be used under the terms of the [Creative Commons Attribution 3.0 licence](#). Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.

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 feed-back. 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.

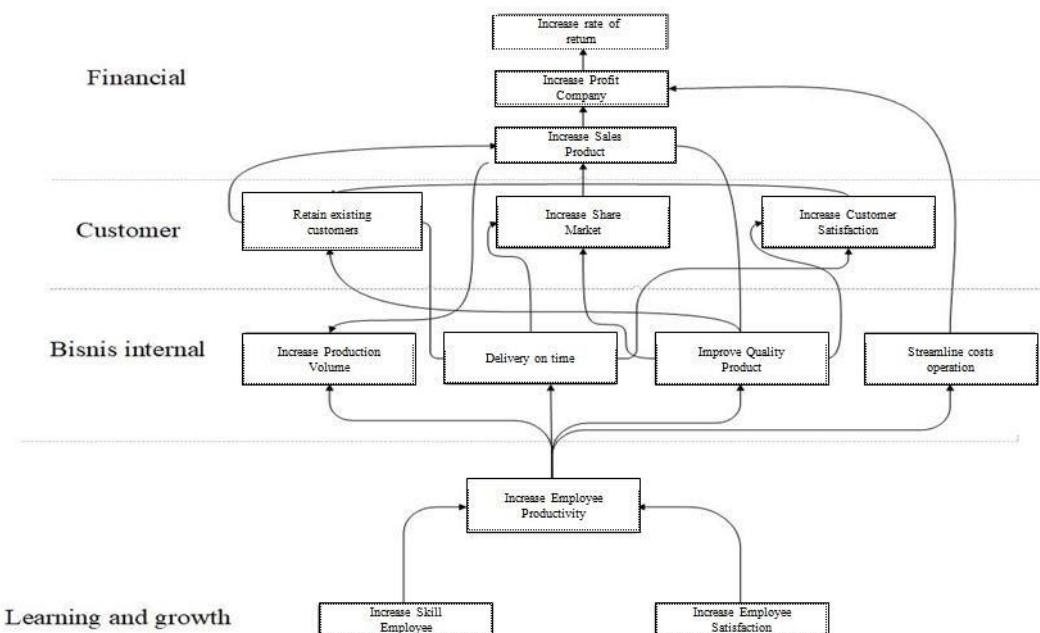


Figure 1. Strategy map

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.

Table 1. Current company performance

Perspective	Strategic Target	KPI	Target	Assessment	Score	Current Achievements	Results
Finance	Increase Return Rate	ROA	10 %	ROA > 10 %	5		
				8% ≤ ROA < 10 %	4		
				6% ≤ ROA < 8 %	3		
				4% ≤ ROA < 6 %	2		
				ROA < 4%	1		
	Increase Company Profit	NPM	8 %	NPM > 8 %	5		
				5% ≤ NPM < 8 %	4		
				2% ≤ NPM < 5 %	3		
				0% ≤ NPM < 2 %	2		
				NPM < 0%	1		
Customer	Increase Product Sales	Increase in Sales	5%	PP > 5 %	5		
				3% ≤ PP < 5 %	4		
				1% ≤ PP < 3 %	3		
				-2% ≤ PP < 1 %	2		
				PP < -2%	1		
	Retain existing customers	Customer Reference	95 %	RP ≥ 95 %	5		
				90% ≤ RP < 95 %	4		
				85% ≤ RP < 90 %	3		
				80% ≤ RP < 85 %	2		
				RP < -2%	1		
Internal business	Increase Market Share	Market Growth Supply	25 %	NPP ≥ 25 %	5		
				20% ≤ NPP < 25 %	4		
				15% ≤ NPP < 20 %	3		
				10% ≤ NPP < 15 %	2		
				NPP < 10 %	1		
	Increase Customer Satisfaction	Number of Customer Complaints	<100	JKT ≤ 100 %	5		
				100% ≥ JKT > 200 %	4		
				200% ≥ JKT > 300 %	3		
				300% ≥ JKT > 400 %	2		
				JKT > 400 %	1		
	Delivery of goods on time	% Delays in delivery	5%	KP ≤ 5 %	5		
				5% ≥ KP > 10 %	4		
				10% ≥ KP > 15 %	3		
				15% ≥ KP > 20 %	2		
				KP > 20 %	1		
	Make all Operations Cost effective	Operating costs	Rp 1,3 B	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		
	Increase the volume of the Company's production	Production Volume	50000 /day	VP ≥ 50000	5		
				40000 ≤ VP < 50000	4		
				30000 ≤ VP < 40000	3		
				20000 ≤ VP < 30000	2		
				VP < 20000	1		
	Improve Product Quality	% Number of Product Defects	5 %	CP ≤ 5 %	5		
				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	Rp 32.917.351,-	3
				30 M ≤ RE < 40 M	3		
				20 M ≤ RE < 30 M	2		
	Increase employee quality	Learning days	4 days	RE < 20 M	1		
				LD ≥ 4 day	5		
				3 day ≤ NPP < 4 day	4	2 days	3
				2 day ≤ NPP < 3 day	3		
				1 day ≤ NPP < 2 day	2		
Employee satisfaction	Employee turn over	Employee turn over	0 %	NPP < 1 day	1		
				TOK ≤ 0	5		
				0% ≥ TOK > 0,25 %	4		
				0,25% ≥ TOK > 0,5 %	3	0,15 %	4
				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 Limitting Supermatrix

After the Weighted Supermatrix calculation process is complete, a Limitting 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 Limitting 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 <i>Unweighted Supermatrix</i>	Weight <i>Weighted supermatrix</i>	Weight <i>Limitting Supermatrix</i>
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
Learning and Growth	Streamline the operating costs	0,373	0,049	0,022
	Increase employee productivity	0,330	0,025	0,011
	Improve employee quality	0,679	0,051	0,023
Learning and Growth	Increase employee satisfaction	0,321	0,024	0,011
	TOTAL		2,211	1

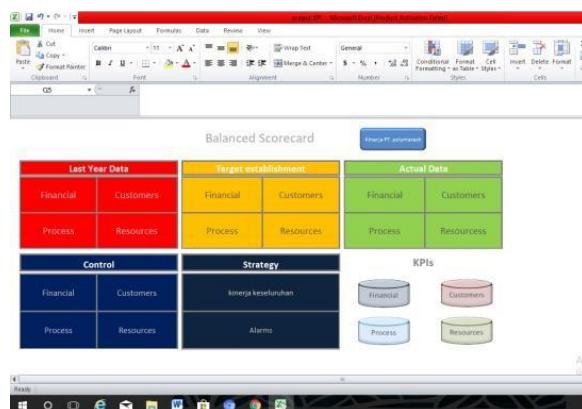
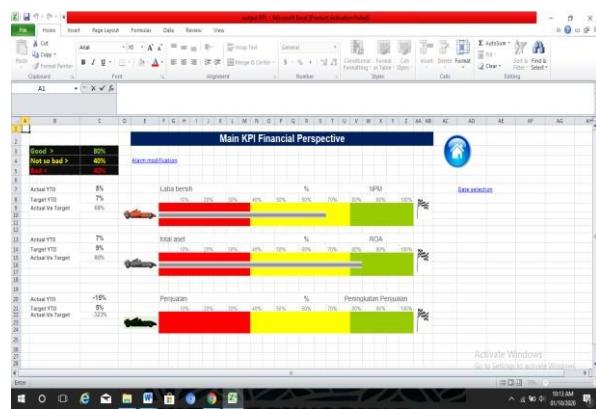
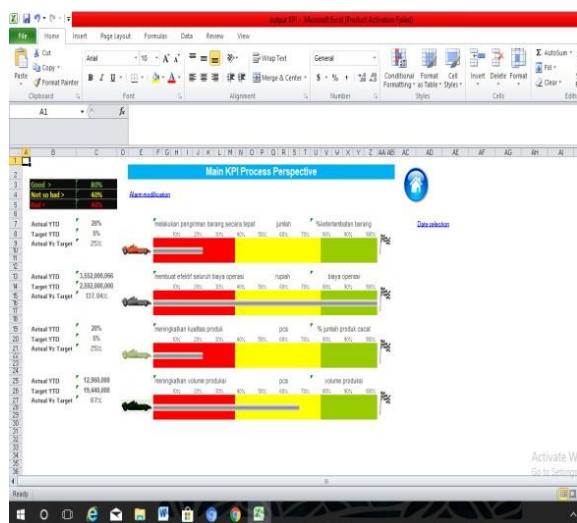
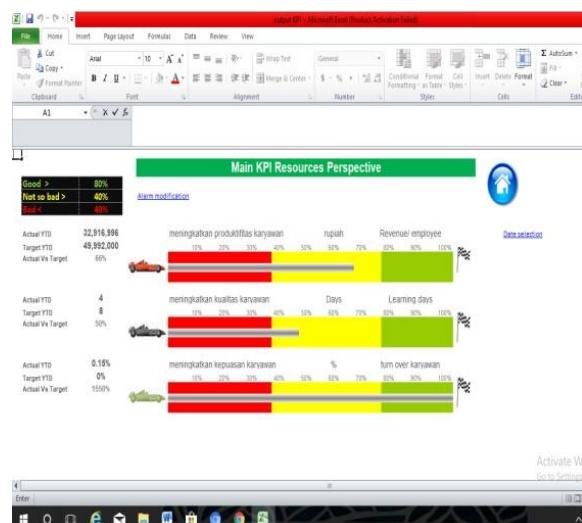
Table 3. Performance measurement results

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 Complaints	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 costs	Operating costs	3	0,022	0,067
	Increase Company Production Volume	Production Volume	3	0,060	0,179
	Improve Product Quality	% Number of Defects	3	0,034	0,102
Learning and Growth	Total			0,12	0,35
	Performance Value of Internal Business				3
	Increase Employee Productivity	Revenue / Employee	3	0,011	0,034
	Improve Employee Quality	Learning Days	3	0,023	0,069
Learning and Growth	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

**Figure 2.** KPI output display**Figure 3.** Perspective financial display**Figure 4.** Perspective process display**Figure 5.** Display of perspective resources

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).



NOTIFICATION OF PAPER ACCEPTANCE

Dear Respected Authors,

It is a pleasure to inform that your submission (detailed below) is *accepted* at the 12th International Seminar on Industrial Engineering and Management (12th ISIEM). As you are aware of, 12th ISIEM will be held on March 17-20, 2020 in Batu-Malang, Indonesia.

Author(s) : **Carla Olyvia Doaly, Lithrone Laricha Salomon and Kholid Jabal Arta A**

Title : **Performance Measurement Using Balance Score Card and Analytic Network Process in Elastomer Switch Keypad Manufacturers Indonesia**

Paper Code : 030

Review result : **Accepted, with revision**

Kindly refer to Reviewers' and Editor's comments for any necessary revision. Please submit the final version of your manuscript on or before January 20, 2020. Please ensure that the submitted final version of your manuscript is in accordance with the prescribed format. Presented papers will be submitted to *IOP conference series: Material Science and Engineering*. The result will be announced between 4-6 weeks after ISIEM Conference via e-mail.

On behalf of the Organizing Committee of 12th ISIEM, I would like to *congratulate you for the acceptance of your paper and to thank you for participating in 12th ISIEM*.

Other arrangements regarding the conference will be informed through you or updated through the website. Should you have any inquiry, please do not hesitate to contact us. Looking forward to see you in Batu-Malang for 12th ISIEM.

Jakarta, January 28th, 2020

12th International Seminar on Industrial Engineering and Management
committee Chairman,



Vivi Triyanti, ST, MSc.
(+62816762609)