E-ISSN : 2963-4946
Vol. 1 No. 11 August 2023

Asian Journal of Social and Humanities
https://ajosh.org/

Operator Performance Analysis Using Overall Labor Effectiveness Method with Root Cause Analysis Approach

Pratiwi Rahmadiani[1], Elisa Kusrini[2]
[1,2] Master of Engineering Industrial, Faculty of Industrial Technology, Universitas Islam Indonesia
Email: pratiwi.rahmadiani@gmail.com

* Correspondence: pratiwi.rahmadiani@gmail.com

KEYWORDS
Operator Performance Production, Overall Labor Effectiveness (OLE), Root Cause Analysis (RCA), House Of Quality (HOQ).

ABSTRACT
The growth of the manufacturing sector in Indonesia has slowed down due to the increase in COVID-19 cases, which has led to a decrease in the production volume of companies. This impact needs to be reassessed by each company, and one way to address it is by continuously improving company productivity. PT X is one of the companies in the manufacturing sector that has a program to continuously enhance its productivity, with its production result being pianos. This study focuses on the performance of operators in a specific production area that has consistently not met the company's productivity target over a period. The objective is to determine the effectiveness of the operators in that area using the Overall Labor Effectiveness (OLE) method. Subsequently, the obtained OLE results will be analyzed using the Root Cause Analysis (RCA) method, and improvement proposals will be provided, supported by the House of Quality (HOQ) method and previous literature. The research results indicate issues in one of the OLE variables, namely the performance ratio. Root cause analysis was conducted to identify the underlying issues, assisted by brainstorming tools, the 5-why method, and a fishbone diagram. This analysis revealed three main problems. Furthermore, two design proposals were formulated using the HOQ framework, and an additional proposal was based on previous research findings.

Introduction

Human resource performance analysis is important to increase company productivity. Factors such as recruitment, training, and work environment have less effect on worker productivity (Yani & Lina, 2015). Companies must routinely pay attention to the human aspect to achieve optimal results (Agustina & Riana, 2011).

PT X is a piano instrument manufacturing company with three departments: woodworking, painting, and assembly. The assembly department has part A which is responsible for assembling type A pianos. Piano A is differences from regular pianos because it involves assembling electrical materials and electrical arrangements that require precision. Assy A's share has not reached the target of increasing productivity by 15% (0.32 - 0.37 units/person/hour). Figure 1.1 shows the current state.

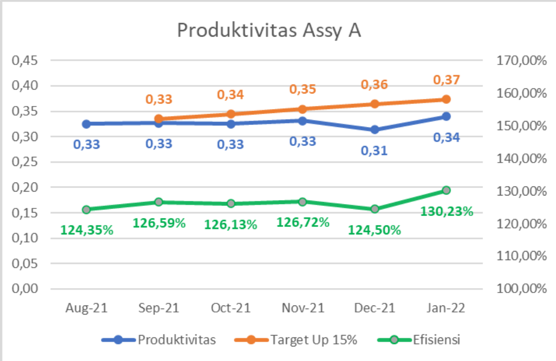


Figure. 1 Productivity Graph of Assy A Section

Problems also occur because the output of workers during 8 hours of effective work has not reached the company's target. Thus, an additional 12% increase in working time or overtime is needed to cover the shortfall.

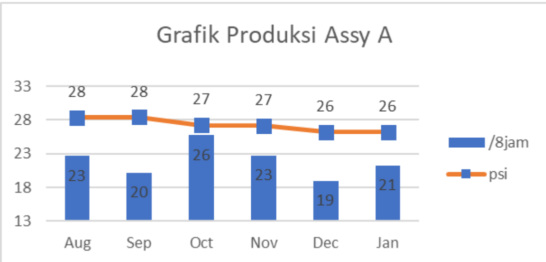


Figure. 2 Production Chart of Assy A Parts

It can be seen that production in Assy A Section has not reached the company's target. The operator's performance in the section is still not optimal, which is estimated due to slow work speed and lack of following efficient work methods. Carrier changes can also affect performance. This study aims to analyze the effectiveness of operators in Section A Assy during effective working hours to identify problems and provide appropriate solutions.

Literature Review

Performance Measurement

Kaplan and Norton (1996) state that performance measurement is important because without measurement, control is impossible. Performance measurement has a crucial role for organizations that want to survive and succeed in today's industry competition (Kurniawan, 2017). Performance reflects individual or group achievements that have an impact on the quality and quantity of the organization (Ainanur & Tirtayasa, 2018). Therefore, companies need to pay attention to operator performance and improve knowledge, skills, attitudes, and other factors to improve operator performance and company productivity (Sari et al., 2020) (Rosmaini & Tanjung, 2019).

Overall Labor Effectiveness (OLE)

To achieve optimization of workforce performance, companies need to adopt methods to measure, diagnose, and predict workforce performance. One of the methods used is *Overall Labor Effectiveness* (OLE), which is a *Key Performance Indicator* (KPI) to measure the efficiency of labor productivity in the manufacturing industry. OLE combines three important elements, namely *availability,* performance*, and quality*, *to evaluate the cumulative effect on the company's production output (Kronos Incorporated, 2008).*

Availability

The percentage of time in which labor contributes effectively in the production process (Devani & Syafruddin, 2018). It is calculated by dividing the operator's productive working time by the available working time. Productive working time is the time during which the operator works without rest, while the available working time is set by the company (Susendi et al., 2021). Generally, the recommended working time is 40 hours per week, and lost work time can occur due to employee absenteeism or damage to production machinery (Yani & Lina, 2015).

$$A = 100\% - \frac{LT_n}{WYT} \quad (2.1)$$

A = *Availability Ratio*
LTn = Loss of Working Hours
WYT = Available Time

The data used for the *availability ratio* is in the form of data on loss of working hours such as loss of working hours which can be seen from supporting data in the form of absenteeism*, non-production time*, and *transfer out (in)* data during working days effective in November 2021 – January 2022.

Performance

Performance is the number of products produced by labor (Devani & Syafruddin, 2018). It is also a measurement of labor performance based on actual *output* compared to the target set by the company (Anjani & Pratiwi, 2021).

$$P = \sum_{n=1}^{k} \frac{P_n}{T} \times 100\% \quad (2.2)$$

P = Average *Performance Ratio*
K = Number of observations
Pn = Day n production result
T = Production target

The data used for the *performance ratio* is in the form of actual production output data along with the production target every day for eight working hours on working days effective from November 2021 – January 2022.

Quality

Quality is the percentage of defective products that are produced or can be sold (Devani & Syafruddin, 2018).

$$Q = \sum_{n=1}^{k} \frac{P_n - D_n}{P_n} \times 100\% \quad (2.3)$$

Q = *Quality Ratio*
K = number of observations
Pn = n-day production result
Dn = number of defective products produced on the nth day

The data used for the *quality ratio* is in the form of production results that experience *defects* during effective working days in November 2021 – January 2022.

***Root Cause Analysis* (RCA)**

Root Cause Analysis (RCA) is a problem-solving process that aims to identify the root cause of an accident, problem, concern, or nonconformity that occurs (Irawati et al., 2019). RCA involves a structured investigation to identify the true cause of the problem and take the necessary actions to address the problem (Haq & Purba, 2020). The identification process in RCA includes steps such as identifying the problem, determining the problem, understanding the problem, identifying the root cause, taking corrective action, and monitoring the system (Nu'man & Ria, 2023). Some tools that can be used to find the root cause of the problems that arise in this study, namely 5-Why's Analysis, brainstorming and Fishbone Diagram (Dewi et al., 2021).

Fishbone *Diagram*

The identification process in fishbone diagrams involves brainstorming sessions to look for causation that may be related to the problem (Indrasari, et al., 2021). Fishbone diagrams are used as a focus tool to identify problems in a general category known as the 5M's: Man, Methods, Machine, Materials/Tools, and Milieu/Environment (Kuswardana et al., 2017).

Five-Why's Analysis

5-why's *analysis* is a structural approach to identifying the root of a problem by constantly asking the source "why." Each answer will lead to the next question up to five times or until it cannot be asked again (Wirawan, 2021). *5-why's* analysis is done simultaneously with *brainstorming* and refers to the categories used in the *fishbone diagram method*.

Brainstorming

Brainstorming is a group discussion method used to generate various new ideas in a short time and encourage creativity. Brainstorming is done by involving related parties in the problem-solving process. In the context of fishbone diagrams and 5-why's analysis, brainstorming is done simultaneously to identify various potential causes of problems and find creative solutions.

***House of Quality* (HOQ)**

House of Quality (HOQ) is an approach used in QFD (*Quality Function Deployment*) to design management to match product specifications according to customer needs (Andriani et al., 2018). The steps of filling HOQ include identifying consumers (operators), determining consumer needs, designing products based on these needs, determining assessment relationships, and designing products using data analyzed using the HOQ method (Wibowo, 2016).

Research Methods

In this study, data processing was carried out using the OLE method which multiplies the three elements in it, namely availability ratio, performance ratio and quality ratio. After obtaining the OLE value, then an analysis of the problems that occur using the RCA method can be carried out with fishbone diagram tools, 5-why's analysis, and brainstorming to get conclusions and answer the objectives in the study.

Then, results were obtained in the form of the root of the problem that occurred and several proposals were given that could overcome the problem with the help of the HOQ framework and previous research collections.

Results and Discussions

The results of the calculation of OLE values based on the collected data, it is known that 48 of the 63 data are below the *international standard* which is 85%. This means clearly showing that data that is below the standard is more dominant than data that is above or equivalent to the standard value. Similarly, the average obtained in the OLE calculation is still below the OLE standard, which is 71%. This value can be concluded that the assy A section does not yet have good labor effectiveness.

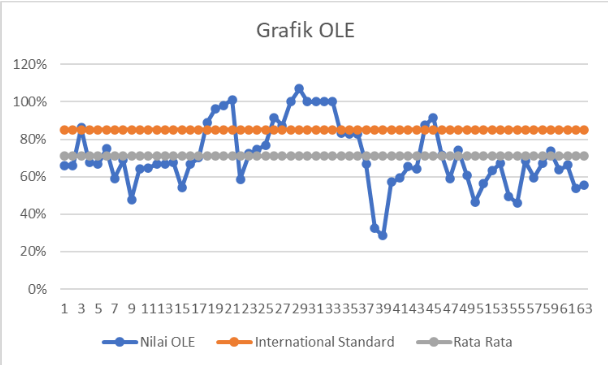


Figure. 3 The OLE standard

In the picture above, it shows clearly that data that is below the standard is more dominant than data that is above or equivalent to the standard value. For the highest OLE value, namely in the 29th data with the OLE value reaching 107% and this is influenced by *output* that has succeeded in achieving the target of eight hours of work per day. As for the lowest value, namely in the 39th data of 29%, this is due to the *output* produced so little that it cannot reach the target that has been set.

Ratio	**Bagian *Assy* A**	***International Standard***
Availability	93%	90%
Performance	76%	95%
Quality	100%	100%
Overall Labor Effectiveness	**71%**	**85%**

Figure. 4 Three OLE variables

From the results of data processing of the three OLE variables above, the average variable availability ratio and quality ratio have reached international value standards. Meanwhile, the performance ratio value is still below the international value standard, therefore the variable needs to be reviewed so that it can be given an improvement to optimize production results and have a good influence on productivity in Assy A.

Then, deepening the problem at the performance ratio is used Root Cause Analysis (RCA) with 5 why's analysis tools and brainstorming with related parties visualized in a fishbone diagram to get a comprehensive final result as follows: (Lestari et al., 2021)

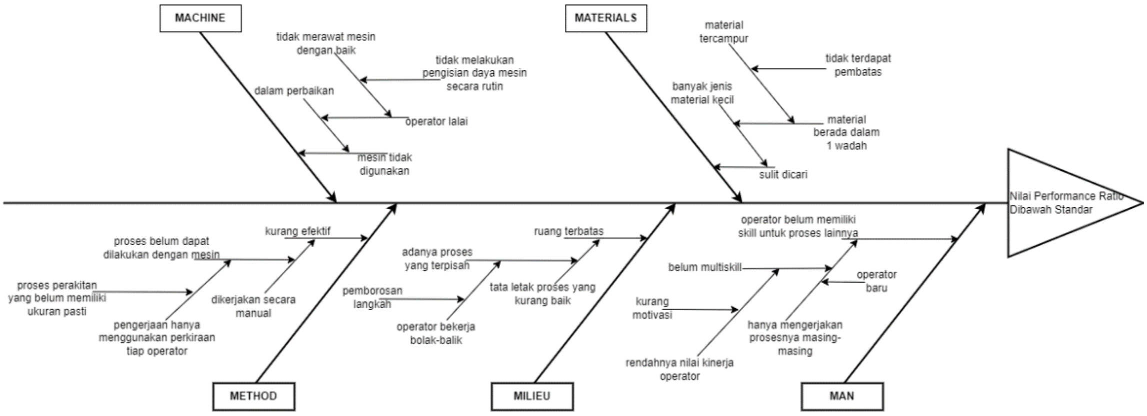


Figure. 5 The fishbone diagram

The fishbone diagram above is the result of visualizing the results of the 5-why analysis and brainstorming in order to find the root of the problem broadly. Furthermore, it is necessary to understand the nature of the problems that occur. According to (Rizki & Saputra, 2022) that not all problems are 'meaningful' and need to be eliminated in order to leave the main problem.

Possible Root Cause	***Discussion***	***Root Cause?***
Material		
Tidak terdapat pembatas dalam wadah material	Penempatan material di satu wadah tanpa adanya pembatas, menjadikan operator sulit dalam pencarian material yang akan digunakan	Y
Machine		
Tidak melakukan pengisian daya mesin secara rutin	Mesin yang digunakan harus diperbaiki sebelum waktunya dikarekan operator yang tidak merawat mesin dengan baik	N
Man		
Operator baru	Operator masih dalam masa pengembangan skill di 1 tahun pertama	N
Kurang motivasi	Operator hanya bekerja karena sebuah rutinitas dan kewajiban sehari-hari	Y
Milieu		
Pemborosan langkah	Ruang yang terbatas membuat beberapa proses terpisah untuk pengerjaannya dan memnyebabkan operator harus bekerja bolak-balik	Y
Method		
Proses perakitan belum memiliki ukuran pasti	Pihak perusahaan belum memiliki ukuran pasti pada proses tersebut, sehingga pekerjaan hanya dapat dilakukan dengan *'feeling'* tiap operator	N

Based on the table above, it can be said that the root of the problem found is:

a. There are no barriers or anything like that in the material container

The material container contains components for the *assembly process of* the lower part of the piano. However, the container is also used to remove the remaining paper waste from one of the components. This causes the operator to have to look for material when carrying out the process.

b. Waste of steps

Operators have to work back and forth due to separate assembly processes and suboptimal room layouts. As a result, the sensor key assembly on the upper assembly becomes separate.

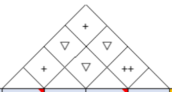
c. Lack of motivation

The operator on Assy A does not yet have enough skills for the core process in

the section. They do work only because of daily routines and obligations, without the encouragement to increase knowledge. Companies want operators to be able to do all the core processes in each part so that they can replace each other in the event of an idle. Operators rely solely on hereditary experience and refuse repairs because they consider ordinary work easier. Low operator performance, as mentioned in research (Ainanur &; Tirtayasa, 2018) that work motivation has an effect on employee performance.
Thus, a proposal for improvement can be given, in the form of:

a. Material container design

The proposed modification of the material container will be designed with the help of the HOQ method. The design of this container is carried out with the help of questionnaires that have been filled out by the head of the section and the operator concerned to suit the needs of the operator during the process and obtained the following HOQ results:



Relative weight	Operator Importance	Maximumm Relationship	Design / Operator Requirements	Komposisi	Model sesuai kebutuhan	Safety	Pemilihan bahan baku	Op. Comp Assesm: New Product	Op. Comp Assesm: Old Product
15%	5	5	Tidak tercampur	Δ	●			3	1
15%	5	5	Mempercepat proses		Δ			2	2
14%	4,5	5	Penempatan fleksibel		○	●		2	3
15%	5	5	Space sampah terpisah		○			3	1
14%	4,5	5	Bisa muat banyak	●	○	○		2	3
14%	4,5	5	Daya tahan	Δ			●	3	2
12%	4	5	Meminimalisir kesalahan	Δ				3	1
100%	32,5							**18**	13
			Max Relationship	3	4	6	9	21,80	
			Technical Importance Rating	166,2	283,1	166,2	124,6	740,00	
			Relative Weight	22,5%	38,3%	22,5%	16,8%	100%	
			Technical Competitive Assesment						
			New Product (A)	2	3	3	2	**10**	
			Old Product (B)	1	1	2	2	6	

Keterangan:		
++	:	Sangat berhubungan
+	:	Berhubungan
▽	:	Tidak berhubungan
●	:	9
○	:	3
Δ	:	1
Tingkat Competitive Assesment		
1	:	Sulit
2	:	Sedang
3	:	Mudah

Figure. 6 The conclusion of the HOQ

The conclusion of the HOQ above is that the proposed new product has a higher importance rating value than the old product, indicating the potential for higher operator demand. In the technical competitive assessment section, new products also have higher value and better desired design potential. Then, in designing the product, idealized based on the results of weighting in HOQ in the order of the highest value, namely: models tailored to actual needs, *safety (*safety for pianos & operators), selection of raw materials, and composition (appropriate size).

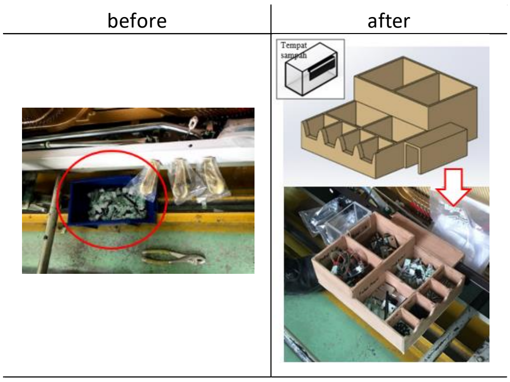


Figure. 7 The design of cabinet design

This proposal is expected to simplify and speed up operators in the process. Thus, it can increase the performance level of the Assy A section because it will have an impact on the performance of operators and companies.

b. Sensor key *cabinet design*

The design of cabinet design is carried out with the help of HOQ as in the previous material container design and the final design is obtained as follows:

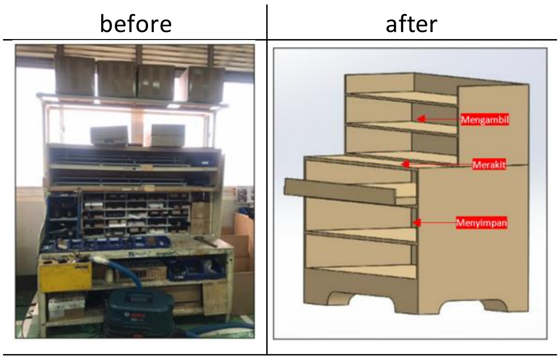


Figure. 8 The final design

Proposed improvements to the key sensor assembly cabinet can be done in the hope of increasing the performance level value on the *Assy* A section because it will reduce step waste.

c. Work motivation

The last proposal is based on studies that have been tested to improve operator performance due to the provision of work motivation, namely the provision of achievement motivation, power motivation, and affiliate motivation to operators.

Conclusion

The conclusions obtained are: 1. The level of labor effectiveness in the Assy A section has not been effective because the OLE value obtained is 71% where the value is still below the international standard of 85%. 2. The problem found is in the value of the variable performance ratio with a value of 76% which is quite far below the OLE international standard of 95%. This value is based on the production results in Assy A which did not reach the company's target for 8 hours of work per day. The cause of the problem that arises is the difficulty of finding material in the lower assy material container because there is no barrier in it, the narrow room causes a waste of steps in the upper assy process, and operators who are not multiskilled due to lack of work motivation owned by operators. 3. The proposed improvements are obtained based on some previously discovered problems. The proposed improvements are in the form of material container design for the lower assembly process, cabinet design for key sensor assembly, and work motivation in the form of achievement motivation, power motivation, and affiliation motivation to operators.

References

Agustina, F., & Riana, N. A. (2011). Analisis Produktivitas Dengan Metode Objective Matrix (Omax) Di Pt. X. *Teknik Dan Manajemen Industri*, *6*(2), 150–158.

Ainanur, A., & Tirtayasa, S. (2018). Pengaruh Budaya Organisasi, Kompetensi Dan Motivasi Terhadap Kinerja Karyawan. *Maneggio: Jurnal Ilmiah Magister Manajemen*, *1*(1), 1–14.

Andriani, D. P., Choiri, M., & Desrianto, F. X. B. (2018). Redesain Produk Berfokus Pada Customer Requirements Dengan Integrasi Axiomatic Design Dan House Of

Quality. *Jurnal Ilmiah Teknik Industri*, *17*(1), 71–82.

Anjani, R., & Pratiwi, I. (2021). Analisis Efektivitas Tenaga Kerja Di Masa New Normal Pada Departemen Finishing Menggunakan Overall Labor Effectiveness (Ole)(Pt Iskandar Indah Printing Textile, Surakarta). *Seminar Nasional Teknik Dan Manajemen Industri*, *1*(1), 232–239.

Devani, V., & Syafruddin, S. (2018). Usulan Peningkatan Efektivitas Tenaga Kerja Dengan Menggunakan Metode Overall Labor Effectiveness. *Jurnal Ilmiah Rekayasa Dan Manajemen Sistem Informasi*, *4*(2), 150–155.

Dewi, L., Komari, A., & Lutfianto, S. (2021). Usulan Kinerja Green Logistic Dengan Pendekatan Root Cause Analysis Guna Meningkatkan Re-Order Point Yang Efektif. *Prosiding Seminar Nasional Teknik Industri*, *1*, 44–58.

Haq, I. S., & Purba, M. A. (2020). Kajian Penyebab Kerusakan Door Packing Pada Tabung Sterilizer Menggunakan Metode Root Cause Analysis (Rca) Di Sungai Kupang Mill. *Jurnal Vokasi Teknologi Industri (Jvti)*, *2*(2).

Irawati, H., Kusnandar, F., & Kusumaningrum, H. D. (2019). Analisis Penyebab Penolakan Produk Perikanan Indonesia Oleh Uni Eropa Periode 2007–2017 Dengan Pendekatan Root Cause Analysis. *Jurnal Standardisasi*, *21*(2), 149–160.

Kurniawan, B. (2017). Teori Kendala Sebagai Alat Pengukuran Kinerja. *Jurnal Akuntansi Bisnis*, *9*(2).

Kuswardana, A., Mayangsari, N. E., & Amrullah, H. N. (2017). Analisis Penyebab Kecelakaan Kerja Menggunakan Metode Rca (Fishbone Diagram Method And 5 Â€“Why Analysis) Di Pt. Pal Indonesia. *Conference On Safety Engineering And Its Application*, *1*(1), 141–146.

Lestari, D. V., Kamal, D. M., & Saputra, Y. M. D. E. (2021). Root Cause Analyisis Kerusakan Cylinder Liner Pada Block Silinder Mesin Generator Set 18 Kva Dengan Metode Diagram Fishbone Di Divisi Sumber Daya Air Pt. Barata Indonesia (Persero). *Seminar Nasional Teknik Mesin*, *11*(1), 1195–1205.

Nu'man, A. H., & Ria, A. (2023). Root Cause Analysis And Strategies To Improve Outpatient Pharmacy Services. *International Journal Of Engineering Business And Social Science*, *1*(05), 353–362.

Rizki, M., & Saputra, A. (2022). Analisa Risiko Supply Chain Management Dengan Metode Grey Failure Mode And Effect Analysis Dan Root Cause Analysis Di Pt Pertamina Fuel Terminal Meulaboh. *Jurnal Serambi Engineering*, *7*(1).

Rosmaini, R., & Tanjung, H. (2019). Pengaruh Kompetensi, Motivasi Dan Kepuasan Kerja Terhadap Kinerja Pegawai. *Maneggio: Jurnal Ilmiah Magister Manajemen*, *2*(1), 1–15.

Sari, E. K., Mustakim, M., Annisa, R., & Utami, N. (2020). Scoring Kinerja Operator Pengolahan Crude Palm Oil Menggunakan Metode Analytic Hierarchy Process. *Seminar Nasional Teknologi Informasi Komunikasi Dan Industri*, 187.

Susendi, N., Suparman, A., & Sopyan, I. (2021). Kajian Metode Root Cause Analysis Yang Digunakan Dalam Manajemen Risiko Di Industri Farmasi. *Majalah Farmasetika*, *6*(4), 310–321.

Wibowo, M. K. (2016). Edisi Ke 3, Jakarta: Pt. *Raja Grafindo*.

Wirawan, E. (2021). Penerapan Metode Pdca Dan 5 Why Analysis Pada Wtp Section Di Pt Kebun Tebu Mas. *Jurnal Penelitian Bidang Inovasi & Pengelolaan Industri*, *1*(01), 1–10.

Yani, N. S. N. F., & Lina, R. R. (2015). Usulan Perbaikan Efektivitas Kinerja Pekerja Di Departemen Veneer Dengan Menggunakan Overall Labor Effectiveness (Ole) Dan

Root Cause Analysis:(Studi Kasus: Pt. Asia Forestama Raya). *Majapahit Techno: Jurnal Ilmiah Dan Teknologi*, *5*(2), 7–14.