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ANALYSIS OF REVERSE LOGISTICS IMPLEMENTATION ON THE PRODUCTIVITY OF LOCAL CRAFT PRODUCTS IN BALI USING THE OBJECTIVE MATRIX (OMAX)

Dynes Rizky Navianti[1]*, Ahmad Soimun[2], Anggun Prima Gilang Rupaka[3], Handoko[4]
[1]Logistic Management, Politeknik Transportasi Darat Bali, Jl. Cempaka Putih, Samsam, Kerambitan, Tabanan, Bali, 82161, Indonesia
[2]Politeknik Perkeretaapian Indonesia, Jl. Tirta Raya, Pojok, Nambangan Lor, Manguharjo, Madiun, East Java 63129, Indonesia
*dynes@poltradabali.ac.id

ABSTRACT

Reverse logistics has become a critical component of modern logistics systems, particularly through recycling processes. At the same time, production productivity is an essential aspect that must be continuously evaluated by business owners. This study aims to explore the implementation of reverse logistics in the local craft industry and to identify production stages that require performance evaluation. Data were collected through direct field surveys, including interviews and questionnaires administered to local craft business owners. Using a holistic approach and data analysis based on the Objective Matrix (OMAX) method, this study seeks to obtain accurate and relevant results aligned with the research objectives. Therefore, this research emphasizes the importance of identifying reverse logistics practices, particularly recycling processes, and assessing the productivity of local craft production.

Keywords: objective matrix; OMAX; productivity; reverse logistics

INTRODUCTION

The local craft industry in Bali is rich, diverse, and deeply rooted in local cultural wisdom. This industry not only serves as a primary source of livelihood for local communities but also represents cultural identity through products such as wood carvings, ceramic crafts, and traditional textiles. Economically, the craft sector makes a significant contribution to the regional economy, accounting for more than 10% of Bali's Gross Regional Domestic Product (GRDP) in 2022 and approximately 30% of total tourism revenue. These figures underscore the importance of the craft industry in supporting the local economy.

Nevertheless, the craft industry in Bali faces a range of complex challenges, including limited access to high-quality raw materials, production inefficiencies, competition from synthetic products, increasing environmental pressures, and growing consumer demands for sustainable business practices. Waste management has emerged as a critical issue, particularly for industries closely linked to local products. Evidence indicates that many artisans still struggle to manage production waste effectively, which directly affects operational efficiency and overall productivity.

One approach considered relevant to addressing these challenges is the implementation of reverse logistics. Reverse logistics refers to the process of managing product flows from consumers back to producers for recycling, repair, or value recovery, thereby contributing to sustainability and operational efficiency. Numerous studies have shown that effective reverse logistics implementation can significantly reduce production costs and enhance competitiveness. However, its adoption remains constrained by limited awareness, insufficient managerial commitment, and inadequate operational and infrastructural support.

Within the craft industry context, reverse logistics extends beyond product returns to include recycling processes that add value to used materials. In practice, many local artisans have not fully understood or implemented this concept, resulting in productivity gaps within the industry. Therefore, an evaluation of the factors influencing the implementation of reverse logistics and its impact on local craft productivity is necessary.

This study focuses on analyzing the productivity of local craft enterprises in Bali that implement reverse logistics, particularly recycling processes, using the Objective Matrix (OMAX) method. OMAX is selected due to its ability to systematically and quantitatively measure production performance across multiple criteria. The objectives of this research are to assess production performance, identify key factors influencing productivity, and provide practical recommendations for artisans and stakeholders. It is expected that the findings will contribute both theoretically and practically to the development of sustainable reverse logistics practices and enhance the competitiveness of local craft products in an increasingly competitive global market.

METHOD

Data Collection

The survey in this study was conducted through direct visits to local craft business locations in Bali. A semi-structured interview technique was employed, in which a set of guided questions was prepared while still allowing flexibility for additional questions that emerged during the interview process. The research subjects consisted of owners of local craft enterprises in Bali.

Data Analysis Technique

The data analysis in this study employed descriptive analysis to examine the implementation of reverse logistics, particularly recycling processes, within local craft enterprises. This was followed by quantitative analysis to measure the productivity of local craft products using the Objective Matrix (OMAX) method. The analysis enabled the identification of production processes applied in local craft manufacturing and an assessment of the productivity performance achieved by local craft business owners.

Objective Matrix (OMAX)

This study employs the Objective Matrix (OMAX) method, which is used to measure partial productivity and is designed to monitor productivity levels within an organization or across individual work units based on criteria tailored to the characteristics of each unit. The method was developed by an American productivity expert, Professor James L. Riggs. The OMAX approach enables productivity measurement through a combination of multiple criteria that are weighted according to their relative importance to the organization. Consequently, this method facilitates the identification of components that have significant or minimal influence on productivity improvement.

The structure of the Objective Matrix consists of several main stages. The first stage involves determining productivity criteria, which include input efficiency, output quality and quantity, operational consistency, and other factors indirectly related to the measured productivity level. Each criterion must be independently measurable and must not depend on other criteria. The second stage is the determination of performance levels, which involves measuring the achievement of each criterion based on actual data and recording the results in the performance row of the OMAX matrix.

The subsequent stage is the determination of the matrix scale, which serves as a standard for evaluating the performance of each criterion. The assessment scale generally ranges from level 0, representing the lowest or least optimal condition, to level 10, which represents the target or optimal efficiency level. Intermediate levels, from level 1 to level 9, indicate varying degrees

of performance between the lowest condition and the optimal target. The values for intermediate scale levels are calculated using specific formulas to ensure proportional representation of performance improvement. The calculations for scale levels 1–2 and 4–9 are performed using the following formulas:
skala (1-2)=(level 3-level 0)/((3-0))
skala (4-9)=(level 10-level 3)/((10-7))

Efficiency scores or performance levels are presented as numerical values placed in the score row at the bottom of the Objective Matrix. These performance values can subsequently be converted into comparative scores in order to align actual performance measurements with the corresponding matrix cells associated with specific scores. This process enables objective comparisons across different periods as well as among criteria based on a uniform evaluation standard.

The next stage in the OMAX method is the determination of weights, which involves assigning the relative importance of each productivity criterion in percentage terms. This weighting reflects the contribution of each criterion to the overall efficiency of the analyzed production unit, with the total weight of all criteria required to equal 100 percent.

The selection of the Objective Matrix (OMAX) method in this study is based on consideration of its strengths and limitations. In general, OMAX is regarded as an effective approach for providing a comprehensive quantitative assessment of partial productivity through the use of measurable criteria and flexible weighting. Therefore, despite its limitations, this method is considered appropriate and relevant for achieving the research objective of systematically analyzing productivity performance.

RESULT AND DISCUSSION

This section presents the results of the study obtained from the conducted data analysis. The research employed data collection methods including surveys, interviews, and questionnaires. Data were collected from six local MSME craft enterprises in Bali that have implemented reverse logistics, particularly in the recycling process. The enterprises involved in this study are Manaya, Guna Arta, Caloe Angel, Red Rock, Dewata, and Daijobu. The interviews were conducted in a structured and phased manner to ensure the accuracy and relevance of the data in accordance with the research objectives.

OMAX Score

To evaluate the productivity of reverse logistics implementation using the Objective Matrix (OMAX) method, data were collected from six local craft MSMEs in Bali. The assessment was structured around two main dimensions: efficiency and effectiveness. Effectiveness in this study refers to the extent to which reverse logistics improves productivity and product quality in local craft production. Accordingly, three criteria were used to measure effectiveness: number of finished products, number of products sold, and number of defective products.

Efficiency, on the other hand, reflects the ability of the reverse logistics system to generate productive output using optimal resources. This dimension emphasizes cost, time, and resource savings resulting from reverse logistics implementation. The efficiency criteria assessed include production time, material usage efficiency, and number of workers. Data for all six criteria were collected from the six selected local craft MSMEs in Bali through questionnaires and structured interviews. The complete dataset obtained from the respondents is presented as follows.

Table 1.
OMAX criteria

No	Business Name/Criteria	Number of Finished Products (Units)	Number of Products Sold (Units)	Number of Defective Products (Units))	Average Production Time (Units)	Efficiency of Raw Material Usage (%)	Number of Production Workers (People)
1	Manaya	700	500	20	120	60	4
2	Guna Artha	1200	1100	80	60	90	40
3	Caloe Angel	200	180	25	90	75	8
4	Red Rock	350	300	50	60	70	10
5	Dewata	800	780	20	75	85	30
6	Daijobu	500	450	50	80	80	15

Based on the table above, it can be observed that each of the six local craft MSMEs exhibits distinct strengths and weaknesses across the assessed criteria. For instance, Guna Arta records the highest number of finished products and sales, with 1,200 units produced and 1,100 units sold per month. In contrast, Caloe Angel shows the lowest production and sales figures, producing 200 units per month with 180 units sold. Regarding product defects, Manaya and Dewata report the lowest number of defective products, each with 20 units, while Guna Arta records the highest number of defective products at 80 units.

In terms of production time efficiency, Guna Arta and Red Rock demonstrate the fastest average production time at 60 minutes per unit, whereas Manaya has the longest production time at 120 minutes per unit. Guna Arta also outperforms others in raw material usage efficiency, achieving 90%, while Manaya records the lowest efficiency at 60%. Concerning labor utilization, Manaya operates with the fewest workers (four employees), whereas Guna Arta employs the largest workforce, totaling 40 workers.

These data were subsequently used to determine performance levels ranging from 0 to 10 as part of the OMAX assessment. Prior to assigning performance levels for each criterion, a priority scale calculation was conducted to determine the relative importance and urgency of each criterion. The resulting priority weight percentages applied in the OMAX evaluation are presented below:

Table 2.
Assesment Criteria and Weights in the OMAX Method

No	Criteria	Evaluation Direction	Weight (%)
1	Number of Finished Products	Higher is better	20
2	Number of Products Sold	Higher is better	15
3	Number of Defective Products	Lower is better	15
4	Production Time (average)	Lower is better	20
5	Raw Material Usage Efficiency	Higher is better	20
6	Number of Production Workers	Lower is better	10

The weights assigned to each OMAX criterion were determined based on their relative importance to production productivity. Weight allocation was established through a combination of literature review and field interviews with business owners. Based on the interview results and prior studies (Deni, 2022), the criteria of number of finished products, average production time, and raw material usage efficiency were assigned the highest weight (20%), as they directly influence production output and process efficiency. In contrast, the number of workers received the lowest weight (10%) since it functions primarily as a supporting factor for operational efficiency.

The scale serves as the basis for determining the actual position of the collected data using a range from 0 to 10. The scale values were derived using a linear interpolation formula between levels. Level 0 represents the lowest or poorest current condition, level 10 indicates the optimal or best achievable condition, and level 3 reflects the current average condition. The results in the table indicate that level 10 corresponds to the best performance among the local craft MSMEs, while level 0 represents the lowest performance. Level 3 was determined by calculating the overall average value of the collected data. The scale values for levels 0–10 were calculated using the following linear interpolation formula:
Linear Interpolation Formula for levels 0-3:

$$\boldsymbol{S\,(1-2) = L0 + \frac{(L3 - L0)}{(3-0)}\, x\, (Ln)}$$

Linear Interpolation Formula for levels 3-10:

$$\boldsymbol{S\,(4-9) = L3 + \frac{(L10 - L3)}{(10-3)}\, x\, (Ln-3)}$$

The formulas presented above apply to criteria where higher values indicate better performance. For criteria in which lower values represent better performance, the formulation differs only in the initial step, where a subtraction is applied after calculating the level range division and multiplying by the target level. This adjustment ensures that the resulting scale values correctly reflect inverse performance relationships in the OMAX evaluation.

Example of Level Calculation for the “Number of Finished Products” Criterion
For criteria where a higher value indicates better performance, the level calculation is performed using linear interpolation.

Level 1 Calculation (between Level 0 and Level 3):

$$\boldsymbol{S1 = 200 + \frac{(625 - 200)}{(3-0)}\, x\, 1}$$

$$\boldsymbol{S1 = 200 + \frac{425)}{3}\, x\, 1}$$

$$\boldsymbol{S1 = 398}$$

Level 8 Calculation (between Level 3 and Level 10):

$$\boldsymbol{S8 = 625 + \frac{(1200 - 625)}{(10-3)}\, x\, (8-3)}$$

$$\boldsymbol{S1 = 625 + \frac{(575)}{7}\, x\, 5}$$

$$\boldsymbol{S1 = 1036}$$

The calculated value for Level 8 under the number of finished products criterion is 1,036 units. The complete calculations for each criterion across all performance levels are presented as follows on table 3.

Based on the table 3, it can be observed that for the number of finished products criterion, level 0, which represents the worst condition, corresponds to 200 units. Meanwhile, level 10, which represents the expected or target condition, corresponds to 1,200 units. The current average condition, represented by level 3, has a value of 625 units.

Table 3.
OMAX Performance Levels for the Number of Finished Products Criterion

Level	Finished Products (units)	Description
0	200	Lowest condition – minimum production capacity
1	308	Slight increase in production
2	417	Production begins to stabilize
3	625	Current average production condition
4	707	Slightly above average
5	789	Improved efficiency
6	871	High production level
7	954	Very good production performance
8	1,036	Nearly optimal
9	1,118	Approaching maximum target
10	1,200	Ideal target (maximum)

The calculation of the OMAX value begins by multiplying the scores obtained for each criterion by their respective weights. All weighted scores are then summed to obtain the overall OMAX value. The formula is expressed as follows:

$$OMAX = \sum (Criterion\ score\ x\ Criterion\ weight)$$

$$OMAX = (PJ\ x\ 0.2) + (EB\ x\ 0.2) + (WP\ x\ 0.2) + (PL\ x\ 0.15) + (PC\ x\ 0.15) + (JP\ x\ 0.10)$$

As an example, the OMAX value calculation for the Guna Arta enterprise is presented as follows:

$$OMAX = \sum (Criterion\ score\ x\ Criterion\ weight)$$

$$OMAX\ GA = (PJ\ x\ 0.2) + (EB\ x\ 0.2) + (WP\ x\ 0.2) + (PL\ x\ 0.15) + (PC\ x\ 0.15) + (JP\ x\ 0.10)$$

$$OMAX\ GA = (10\ x\ 0.2) + (10\ x\ 0.2) + (10\ x\ 0.2) + (10\ x\ 0.15) + (0\ x\ 0.15) + (0\ x\ 0.10)$$

$$OMAX\ GA = 2 + 2 + 2 + 1.5 + 0 + 0$$

$$OMAX\ GA = 7.5$$

Based on the calculation results above, the OMAX value for the Guna Arta enterprise is 7.5, indicating that the productivity of reverse logistics implementation at Guna Arta can be classified as good.

The following are the OMAX values obtained for each enterprise:

Table 4.
OMAX Values for Each Local Craft Enterprise

Enterprise Name	OMAX Value	Description
Manaya	4.02	Moderate
Guna Arta	7.50	Good
Caloe Angel	4.26	Moderate
Red Rock	4.75	Moderate
Dewata	7.12	Good
Daijobu	5.15	Moderate

It can be observed that the local craft enterprise Guna Arta achieved the highest OMAX value of 7.5, which falls into the good category, while the lowest OMAX value was recorded by

Manaya at 4.02. Both Guna Arta and Dewata are classified as having good performance in the implementation of reverse logistics based on their OMAX values, whereas the remaining four enterprises are categorized as having moderate performance.

Productivity of Reverse Logistics Implementation in Local Craft Products

This section comprehensively discusses the research findings related to the productivity of reverse logistics implementation using the Objective Matrix (OMAX) method across six local craft enterprises in Bali. The analysis is structured around two main dimensions—effectiveness and efficiency (Sembiring, M.H.B., et.al., 2025)—each comprising three criteria: (1) number of finished products, (2) number of products sold, (3) number of defective products, (4) average production time, (5) raw material usage efficiency, and (6) number of workers. These six criteria were selected because they represent the most relevant productivity indicators within the reverse logistics framework, consistent with Sharma and Singh (2013), who argue that productivity is influenced by both output effectiveness and resource efficiency.

1. Effectiveness Analysis

Effectiveness in the context of reverse logistics refers to the extent to which MSMEs achieve targeted output levels, maintain product quality, and minimize production defects.

a. Number of Finished Products

   Guna Arta recorded the highest production volume (1,200 units), achieving a perfect score of 10, while Caloe Angel showed the lowest output (200 units). This finding reflects substantial disparities in production capacity among MSMEs and aligns with Mochammad et al. (2020), who note that small-scale enterprises exhibit significant variations in capacity due to differences in equipment, labor availability, and access to raw materials.

b. Number of Products Sold

   This criterion reflects market performance. Guna Arta again outperformed other enterprises with 1,100 units sold, whereas Caloe Angel sold only 180 units. The large disparity indicates differences in market penetration, product design quality, and promotional capability. According to Jing, Whiteside, and Pellathy (2020), the success of recycling initiatives depends not only on technical waste-processing capabilities but also on the ability to convert recycled outputs into marketable products.

c. Number of Defective Products

   Defective products are a direct indicator of quality control. Manaya and Dewata recorded the lowest defect levels (20 units), earning the highest score of 10, while Guna Arta recorded the highest number of defective products (80 units). Although Guna Arta achieved high production volume, this did not automatically translate into superior quality. This phenomenon is consistent with the volume–quality trade-off described by Tangen (2005), where increased output often raises defect risk if processes are not adequately standardized. Overall, these effectiveness indicators suggest that most MSMEs still face challenges in maintaining consistent quality while achieving stable output levels.

2. Efficiency Analysis

   Efficiency is a core principle of reverse logistics, as it relates to optimal resource utilization, waste minimization, and high productivity (Govindan & Soleimani, 2017)

a. Production Time

   Significant variation was observed in production time across MSMEs. Guna Arta and Red Rock required only 60 minutes per unit (score 10), while Manaya required 120 minutes (score 0). Longer production times directly reduce productivity, as slower processes limit daily output. Production time efficiency is particularly critical in small-scale industries, consistent with Kazancoglu et al. (2021), who emphasize cycle time reduction as a key strategy for productivity improvement in recycling systems.

b. Raw Material Usage Efficiency
This criterion reflects how effectively MSMEs utilize waste materials and raw inputs. Guna Arta achieved the highest efficiency (90%) with a score of 10, whereas Manaya recorded only 60% efficiency (score 0). Material efficiency directly indicates the enterprise's ability to implement circular economy principles by converting waste into valuable inputs (Sbihi & Eglese, 2010).

c. Number of Workers
This criterion was evaluated using a "lower is better" logic. Manaya employed four workers (score 10), while Guna Arta employed 40 workers (score 0). However, this indicator must be interpreted cautiously. A higher number of workers does not necessarily imply inefficiency, as larger enterprises naturally require more labor. A more accurate indicator would be output per worker rather than the absolute number of workers. This limitation should be acknowledged as a methodological constraint.

The highest OMAX values were achieved by Guna Arta (7.50) and Dewata (7.12), indicating consistently strong performance, particularly in efficiency-related indicators such as production time and material utilization. In contrast, MSMEs with lower OMAX values, such as Manaya (4.02) and Caloe Angel (4.26), experienced key weaknesses in slow production time and low material efficiency, despite having relatively low defect rates. These variations demonstrate that reverse logistics implementation in Bali's craft sector remains uneven across enterprises, both in terms of input utilization (materials, labor, time) and output performance (finished products, sales, defect rates). Overall, the findings indicate that reverse logistics has been implemented reasonably well among local craft MSMEs; however, productivity is primarily driven by raw material efficiency and production speed rather than labor quantity or production volume alone. The OMAX results confirm that enterprises with higher efficiency levels consistently achieve superior productivity outcomes.

CONCLUSION

Based on the research findings, the productivity of reverse logistics implementation in local craft products currently ranges from moderate to good, as indicated by OMAX values varying between 4.02 and 7.50. This variation suggests that productivity performance is not yet evenly distributed among all local craft enterprises. Nevertheless, the overall results reflect that reverse logistics has been implemented effectively across the sector to a meaningful extent. Enterprises that achieved higher productivity levels consistently demonstrated superior operational efficiency, particularly in terms of raw material utilization and shorter production times, both of which contributed significantly to higher OMAX scores.

In contrast, enterprises with lower productivity levels generally faced challenges related to inefficient material usage and longer production cycles. Interestingly, several of these enterprises were still able to maintain relatively low defect rates, indicating that product quality alone does not guarantee high productivity. This finding highlights the importance of operational efficiency as a critical determinant of productivity within reverse logistics systems, especially in small-scale craft industries where resources are limited.

Overall, the study concludes that productivity in reverse logistics implementation within the local craft industry is strongly influenced by efficiency-oriented operational practices rather than merely by high production volumes. Enterprises that successfully minimized waste, optimized raw material usage, and accelerated production processes achieved consistently higher productivity performance. These practices reflect the core principles of reverse logistics and circular economy, where value recovery, waste reduction, and process optimization are central objectives.

Furthermore, the results confirm that reverse logistics can serve as an effective strategy for enhancing productivity in the local craft sector, particularly when integrated with systematic material efficiency management and effective time management practices. For local craft MSMEs, strengthening capabilities in waste processing, material recovery, and production planning is essential to maximizing the benefits of reverse logistics. From a managerial perspective, these findings emphasize the need for continuous performance evaluation and process improvement to ensure that reverse logistics contributes not only to environmental sustainability but also to long-term economic competitiveness.

REFERENCES

Abdulrahman, M., Gunasekaran, A., & Subramanian, N. (2014). Critical barriers in implementing reverse logistics in the chinese manufacturing sectors. International Journal of Production Economics, 147, 460-471. https://doi.org/10.1016/j.ijpe.2012.08.003

Badenhorst, A. (2016). Prioritising the implementation of practices to overcome operational barriers in reverse logistics. Journal of Transport and Supply Chain Management, 10(1).

https://doi.org/10.4102/jtscm.v7i1.113.

Canonico, L., Comitini, F., & Ciani, M. (2014). Dominance and influence of selected saccharomyces cerevisiae strains on the analytical profile of craft beer refermentation. Journal of the Institute of Brewing, 120(3), 262–267.

https://doi.org/10.1002/jib.133.

Deni, I. (2022). Analisis produktivitas industri kecil menggunakan pendekatan OMAX. Jurnal Teknologi & Bisnis, 14(2), 77–89.

Govindan, K., & Soleimani, H. (2017). A review of reverse logistics and closed-loop supply chains: A global perspective. European Journal of Operational Research, 240(2), 603–626.

https://doi.org/10.1016/j.ejor.2015.06.016.

Kabir, S. (2017). An overview of fault tree analysis and its application in model based dependability analysis. Expert Systems With Applications, 77, 114–135.

https://doi.org/10.1016/j.eswa.2017.01.058.

Kamila, N. (2023). Analisis produktivitas proses produksi gondorukem menggunakan metode objective matrix (OMAX) di PT XYZ. Performa Media Ilmiah Teknik Industri, 22(1), 1–11.

https://doi.org/10.20961/performa.22.1.67653.

Khansalar, E., Bayaz, M., & Safari, R. (2015). Maximizing profit in reverse supply chain. International Business Research, 8(11), 111.

https://doi.org/10.5539/ibr.v8n11p111.

Khoirunni'am, A., & Suseno, S. (2022). Analisis produktivitas untuk meningkatkan hasil produksi dengan objective matrix (OMAX) dan root cause analysis (RCA). Jurnal Trinistik: Teknik Industri, Bisnis Digital dan Teknik Logistik, 1(2), 72–79.

https://doi.org/10.20895/trinistik.v1i2.633.

Maulidah, A. (2023). Penerapan metode objective matrix (OMAX) dalam mengukur produktivitas (Studi kasus: Departemen Servis PT Tri Mitra Lestari). Jurnal Teknik Industri, 9(2), 371.

https://doi.org/10.24014/jti.v9i2.22560.

Ni Komang Deviana. (2024). Utility of the Intaran Market in the continuity of micro and small businesses typical of Buleleng District products. RIDE: Journal of Cultural Tourism and Religious Studies, 2(1), 64–69.

https://doi.org/10.25078/ride.v2i1.3607.

OECD. (2023). Securing reverse supply chains for a resource-efficient and circular economy. OECD Publishing.

https://www.oecd.org/en/publications/securing-reverse-supply-chains-for-a-resource-efficient-and-circular-economy_6ab6bb39-en.html.

Polewangi, Y. (2023). Penggunaan metode American Productivity Center (APC) untuk pengukuran produktivitas pada UMKM XYZ. Journal of Industrial and Manufacture Engineering, 7(1), 1–11.

https://doi.org/10.31289/jime.v7i1.8252.

Ramadhani, S., Prihandoko, A., & Adiwijaya, N. (2018). Sistem informasi pengukuran produktivitas hotel menggunakan metode OMAX dan AHP (Studi kasus: Hotel Istana). Berkala Sainstek, 6(1), 10.

https://doi.org/10.19184/bst.v6i1.7555.

Rubio, S., & Jiménez-Parra, B. (2014). Reverse logistics: Overview and challenges for supply chain management. International Journal of Engineering Business Management.

https://doi.org/10.5772/58826.

Sharma, S., & Singh, G. (2013). Reverse logistics: Design implications on the basis of product types sharing identical supply chain motivations. Uncertain Supply Chain Management, 1(1), 33–44.

https://doi.org/10.5267/j.uscm.2013.05.001.

Sembiring, M. H. B., Wirda, N. A., & Hernawati, T. (2025). Analisis pengukuran produktivitas menggunakan metode pendekatan Objective Matrix (OMAX) pada proses produksi air minum di PT Tirta Investama Langkat. Blend Sains Jurnal Teknik, 3(3), 268–285. https://doi.org/10.56211/blendsains.v3i3.810

Sijoatmodjo, R., & Hadi, Y. (2022). Analisis produktivitas unit produksi di perusahaan abon UD Sumber Hasil Malang menggunakan metode OMAX. SAKTI: Jurnal Sains dan Aplikasi Keilmuan Teknik Industri, 1(1), 59–65.

https://doi.org/10.33479/jtiumc.v1i1.6.

Starostka-Patyk, M., Zawada, M., Pabian, A., & Abed, M. (2013). Barriers to reverse logistics implementation in enterprises. In Proceedings of ICADLT 2013 (pp. 506–511).

https://doi.org/10.1109/icadlt.2013.6568510.

Zalukhu, W. (2024). Analisis produktivitas produk tempe menggunakan metode objective matrix (OMAX). Jurnal Teknologi dan Manajemen Industri Terapan, 3(1), 78–89