Analysis of Reverse Logistics Implementation in Improving Operational Efficiency

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Abstract— In the era of globalization and increasingly fierce competition, some industrial companies are required to focus not only on product and distribution efficiency but also on post-consumer product management. Supply chain issues need to be considered because they are related to the productivity of the company, if the supply chain management of a company runs well, the company's goals will be achieved, and vice versa. In addition to helping implement the principle of reducing, reusing, and recycling, reverse logistics also acts as feedback from customers on the product (finished or unfinished), including the sustainability aspect of the product. The frequent return of kWh (kilowatt-hour) meters in households that occur returns/defects and are returned from the reporting of consumers or customers that still exist and also the handling of companies that have not met the standards and strategies for the future. The results of the analysis of the maturity level of the implementation of reverse logistics in these three companies can be categorized at level 3 (Developed Level) with the results of measurements using MSI (Method of Successive Interval) successively are 2.549; 2.292; 2.459; 2.932; 2.677. With the calculation of scores on IFE and EFE in the IE matrix, it is in quadrant II (medium-high).

Keywords— Framework Reverse Logistics, IFE and EFE, Method of Succesive Interval, Reverse Logistics, SOAR Analysis,

I. INTRODUCTION

Supply chain issues need to be considered because they are related to the productivity of the company, if the supply chain management of a company goes well, the company's goals will be achieved, and vice versa, if the company's supply chain is hampered or problematic, it will have an impact on the company's productivity. Many companies use Reverse Logistics (Reverse Logistics) activities to generate value for their companies, including airplanes, ships, cars, iron and steel, electronics, chemicals, etc. [1].

The problem to be researched in this company's reverse logistics is the efficiency of collecting and returning kWh meters that have been used or damaged from customers or retailers back to their distribution centers. This process is often complex and requires good coordination between vendors and companies to ensure that returned kWh can be processed quickly and efficiently. The frequent return of kWh (kilowatt-hour) meters in households that are returned/defective and returned from the reporting of consumers or existing customers and also the company's handling that has not met the standards and strategies for the future. Reverse Logistics (Reverse Logistics) is one of the important topics to be discussed among academics in the field of environmental performance and sustainability through business. Reverse Logistics is found to be an effective strategy for business, environment, and sustainable development in many studies. Reverse Logistics is very important for many reasons such as reducing environmental issues, cost control, competitive advantage, and many more [2]

Based on previous research conducted by [3], discusses only SWOT analysis and does not compare it with current world developments. Meanwhile, research conducted by [4], only discusses previous research and does not focus on efforts to fill gaps and overcome future challenges. Therefore, in this research, an update will be made with the

design of the Reverse Logistics (RL) model in the electricity industry group specifically at UP3 Gresik. Some of the actors involved in this RL implementation are consumers, Collection Centers (CC) where these CCs are located in several Gresik areas or what is commonly called Rayon (ULP) such as Rayon Giri, Rayon Benjeng, Rayon Sedayu, and Rayon Bawean,; then to the Main Collection Center (CC Induk) or what can be called UP3 Gresik, Central Warehouse or CC Yosowilangun warehouse, and Vendors. By adding Collection Center as part of the kWh Meter supply chain before the unit is sent to the center. This update involves the presence of vendors as parties who assist and are tasked with installing, replacing kWh Meters in the field and also repairing kWh Meters that are sorted out before entering the central warehouse. These vendors have tasks that include quality checks, safe and proper installation, and quick repairs to maintain the continuity of electricity services to customers. In addition, the disassembling process is also carried out by vendors to ensure that kWh Meters that are damaged or require maintenance can be disassembled and repaired before being sent back to the center for further evaluation and data collection. Some of the vendors that are still working together can reach 8 vendors including divided into two parts, namely prepaid (Hexing, conlock, smart meters, cannet elektrik, citra sanxing, and melcoinda) and postpaid (Fujidarma elektrik and mecoindo).

This study aims to analyze the impact of reverse logistics on a series of interrelated relationships with supply chain performance (Framework Reverse Logistic) and (SOAR) obstacles that are passed through focusing on the company's internal strengths and external opportunities by the product life cycle in the company. Framework design is needed to see the success of the implementation carried out and show clear parameters. These results can make the company further improve the level and strategy that has been previously owned. SOAR is a framework model that focuses on positive aspects in the company to encourage improvement and innovation. SOAR analysis (Strength, Opportunity, Aspiration, Result) is a development of a previously existing analysis method, namely SWOT analysis (Strength, Weakness, Opportunity, Threat). Basically, SOAR is used to analyze internal and external conditions to produce strategies for facing the future, especially in the business woReverse Logistics [5]

The process or flow carried out will be described by the Reverse Logistics Framework design and knowing the source of internal and external problems in the reverse logistics process with SOAR analysis. This Reverse Logistics model design will be a recommendation for the electricity industry group. Reverse Logistics research in Indonesia is still very rarely done. This is because the availability of the required data is very limited. Therefore, this research was conducted to optimize and implement the company's Reverse Logistics, in addition to improving the company's performance. The implementation of Reverse Logistics can also overcome waste problems, increase company profits and maintain consumer satisfaction and loyalty, and find out the sources of internal and external problems in the reverse logistics process in these problems so that later it will minimize waste and losses in terms of returning the kWh Meter.

II. METHOD

A. Reverse Logistics

Reverse Logistics (Reverse Logistics) is one of the important topics to be discussed among academics in the field of environmental performance and sustainability through business. Reverse Logistics has been found to be an effective strategy for business, environment, and sustainable development in many studies. Reverse Logistics is very important for various reasons such as reducing environmental problems, cost control, competitive advantage, and many more [5]. In conclusion, optimizing reverse logistics within the circular economy offers significant potential for improving material recovery,

enhancing resource circularity, and reducing the environmental impact of industries [6]. Logistics is the process of strategic management of the strategic movement and storage of goods, spare parts and goods from suppliers, between company facilities and to customers. Companies are progressively implementing reverse logistics techniques to conform to circular economy principles, including recycling, remanufacturing, and material reuse [7]. Reverse logistics is a new form of logistics where the flow of goods is reversed from customers or distributors to manufacturers and is in contrast to traditional logistics [8]. Reverse Logistics, in contrast to Forward logistics, involves a more reactive flow of information. Companies typically engage in reverse logistics operations as a reaction to events at lower levels, rather than as a result of forecasting and planning. Reverse logistics is described as activities to restore the economic value of a product or to carry out a proper disposal process [9][10]. Much of the research so far has focused on the economic and environmental benefits of RL. There is a lack of research investigating the relationship between RL and sustainability and evaluating how RL can improve sustainability performance by integrating the three pillars of sustainability performance [11].

B. Framework Reverse Logistics

The Reverse logistics framework is a series of interrelated relationships from Reverse logistics activities, namely from the point of collection or consumer to the end point or disposal. The Reverse logistics framework is created to provide a visual depiction of the Reverse logistics flow that occurs in a product or company. There are 5 dimensions in the Reverse logistics framework, namely 4W + 1H, namely Why Returning, Why Receiving, Who, What, and How [12].

Companies in implementing Reverse logistics are divided into types: level 1 or conventional if there is no application of the Reverse Logistics system [13]. Companies usually use traditional processes to produce products and use 100% natural resources. Level 2 or managed is a product with good quality and specifications. Companies begin to understand the benefits of implementing Reverse Logistics even though the implementation of Reverse Logistics is still not good. Level 3 or developed is a level of maturity that characterizes companies that have an understanding of the Reverse Logistics concept, although not too much. Level 4 or innovative, defines the level of maturity where companies find more innovation in any sector to minimize the total cost of Reverse Logistics, Products use 50% natural resources and 50% secondary materials. The highest level, level 5 or optimized, is the final maturity level, where the company focuses on optimizing continuous process improvement. It is a pioneer in environmental sustainability policy issues (zero defect and waste, advanced waste treatment, use > 75% secondary material) [14] and its products are Reverse Logisticsd-class products (nanotechnology products) with a sophisticated management information system [15].

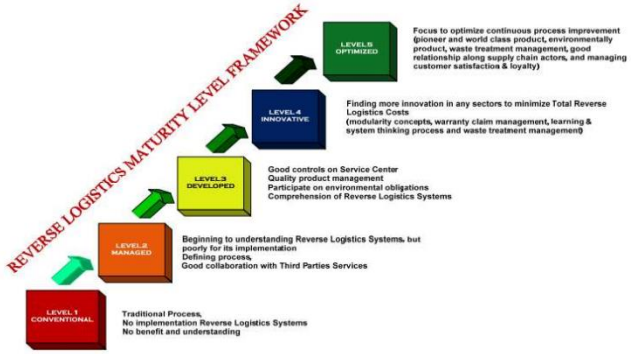

Figure 2. Level Maturity Frameork Reverse Logistics

MSI (Method of Successive Interval), also known as the successive interval method, can convert ordinal data into intervals [17]. This framework provides a structured

overview of how the research integrates various components to enhance reverse logistics flows and networks in the context of the circular economy [18].

C. SOAR Analysis

SOAR (Strength, Opportunity, Aspiration, Result) analysis is the development of an existing method of analysis, namely SWOT (Strength, Weaknes, Opportunity, Threat) analysis [15]. Basically, SOAR is used to analyze internal and external conditions to produce strategies for the future, especially in the business Reverse Logistics, SOAR model transforms SWOT analysis [19]. SOAR analysis is one of the strategic planning tools with an approach that focuses on strengths and seeks to understand the whole system [20]. SOAR's focus is on internal strengths. The implication is that no matter how many external obstacles and turmoil there are, this analysis still seeks to find internal strengths to deal with hostile external conditions, of course, while remaining measurable. SOAR also contains the element of Aspiration which opens up opportunities for many individuals to participate in strategic decision-making [21]. This is a good tradition considering that strategic decisions in many large companies are only made by individuals who are top managers[22], [23].

The SOAR model changes the SWOT analysis approach which generally focuses on internal weaknesses and external threats faced by the organization. Instead, SOAR emphasizes the aspirational aspects of the company as well as the measurable outcomes it seeks to achieve. This approach argues that weakness and threat factors can create negative feelings in organizational members, which can reduce their motivation to give their best [24], [25]. The SOAR matrix serves to organize the company's strategic factors that illustrate how the external strengths and opportunities faced by the company can be adjusted to its aspirations and measurable results. The SOAR analysis matrix is divided into four conditions as follows [26]

Internal / **Eksternal**	***Strenght*** Faktor kekuatan internal	***Opportunities*** Faktor peluang eksternal
	Strategi SA	**Strategi OA**
Aspirations Faktor harapan dari internal	Ciptakan strategi yang menggunakan kekuatan untuk mencapai aspirasi	Strategi yang berorientasi pada aspirasi yang selanjutnya di harapkan untuk memanfaatkan peluang
Result	**Strategi SR**	**Strategi OR**
Hasil yang terukur untuk di wujudkan	Ciptakan strategi yang berdasarkan kekuatan untuk mencapai hasil yang terukur mencapai hasil yang sudah terukur	Strategi yang berorientasi kepada kesempatan untuk berorientasi kepada kesempatan untuk mencapai hasil yang sudah terukur

Figure 3. Framework SOAR

The factor measurement technique used in general is Unstructured interviews are free interviews where researchers do not use interview guidelines that have been arranged systematically and completely [28] for data collection with the Likert scale answer form consisting of strongly agree, agree, disagree, and strongly disagree [29].

III. RESULT AND DISCUSSION

A. Data Collection

In this structure design process, a questionnaire is needed to assess the implementation of Reverse Logistics. Direct observation of the business environment is also useful because it can prevent differences of opinion between researchers and companies. Statistical tests, including validity, reliability, and data sufficiency tests, are conducted after the questionnaires are collected. SOAR (Strength, Opportunity, Aspiration, Result) is used to analyze internal and external conditions to produce strategies for facing the future, especially in the business Reverse Logisticsd. The data collected consists of

questionnaire data on the implementation of reverse logistics in the company. The questionnaire data is categorized into 5 aspects consisting of 21 assessment categories. Consumer questionnaire data concerns consumer perceptions and expectations of kWh Meter products.

Table 1. Open Coding

Coding	Description
A1	Interviews with stakeholders or actors involved in Reverse Logistics
A2	Reverse Logistics implementation success *level* categories (conventional *level*, managed *level*, developed *level*, innovative *level*, optimized level)
A3	Category *Reverse Logistics Aspect* (The success rate of Reverse Logistics can be seen from several aspects including *Information management, production and operation management, distribution, business process and environment*)
A4	Categories of indicators of successful Reverse Logistics implementation (The indicators used in this study are 21 indicators divided into 5 aspects. In addition to the specific aspects used as assessment materials, more indicators are needed to make the assessment of Reverse Logistics implementation more thorough).

Table 2. Axial Coding

Coding	Description
B1	*Causal condition*: Causal factor (Reverse Logistics implementation has been utilized by many businesses that have already done so.)
B2	*Central phenomenon*: The central or main phenomenon that is the focus of the research. The central phenomenon in this study is the maturity level of the Reverse Logistics implementation.
B3	*Consequences*: The consequence that occurs is that the existence of this *framework* will be able to change the pattern of thinking and evaluation in the future.
B4	*Context*: The situation that influences the occurrence of an action. Many methods exist that can minimize costs
B5	*Intervening Condition*: Factors that inhibit or facilitate the occurrence of an event or behavior (action).

Open coding: the process of detailing, testing, comparing, conceptualizing, and categorizing the data. In addition, there is labeling of phenomena and naming of the categories so that the process of grouping events can be cleaReverse Logisticsy clustered as shown in the table above.. Axial coding: identifies key phenomena, examines causal conditions, specifies strategies, identifies influencing contexts and conditions, and explains the consequences of the phenomena. The table above explains how a problem is identified, its sources, solutions, and consequences. Axial coding helps dig deeper into how and why certain processes occur, by connecting the factors that influence the Reverse Logistics flow.

B. Reverse Logistics Implementation Indicators

In this framework, the research is categorized into 5 aspects consisting of 21 assessment indicators. These 22 assessment indicators were obtained from the pre-sampling distribution. From the pre-sampling distribution, it was found that one assessment indicator was invalid, namely the distribution aspect for category C4, namely Network, so the total assessment categories were 21. Table 3 shows the indicators used to measure the implementation of the Reverse Logistics system. This table is divided into five important sections: Reverse System Thinking and Information Management, Reverse Production and Operations Management, Reverse Distribution, Business Process and Reverse Sustainable Environmental.

Tabel 3. Indicators of Reverse Logistics System Implementation

No	*Reverse Logistics Category*	*Assessment Categories*	*Code*
1	*Reverse Sistem Thinking and Information Management*	*1. The Comprehension of Reverse Logistics Concepts*	A1
		2. Benefit of Reverse Logistics Implementation	A2
		3. The Reclaiming Product Management	A3
2	*Reverse Production and Operations Management*	*1. End of life Product Recovery and Inventory Management*	B1
		2. ICT/ Digital Sistems Technology	B2
		3. Quality Product	B3
		4. Services Mechanism	B4
3	*Reverse Distribution*	*1. The Comprehensive of Relationship and Communication along Reverse Logistics Actors*	C1
		2. Collecting of Used Product Mechanism	C2
		3. Locating Collection Center for Returned Used Product	C3
4	*Business Process*	*1.Leadership*	D1
		2.Strategic Planning	D2
		3.Customer & Market Focused	D3
		4.Measurement, Analysis & Knowledge Management	D4
		5.Human Resources Focus	D5
		6.Process Management	D6
		7.Business Result	D7
5	*Reverse Sustainable Environmental*	*1. Waste Treatment Management*	E1
		2. Green Technology Application	E2
		3.Participate on Environmental Legislation	E3
		4. The Utilizing of Secondary Material	E4

C. Framework Reverse Logistics

The primary data collected by the researcher consisted of questionnaires filled out by the company management, direct interviews, and direct observations in the field. Secondary data came from internet access, recorded data from several houses, rayon data (ULP), and the company's own data.

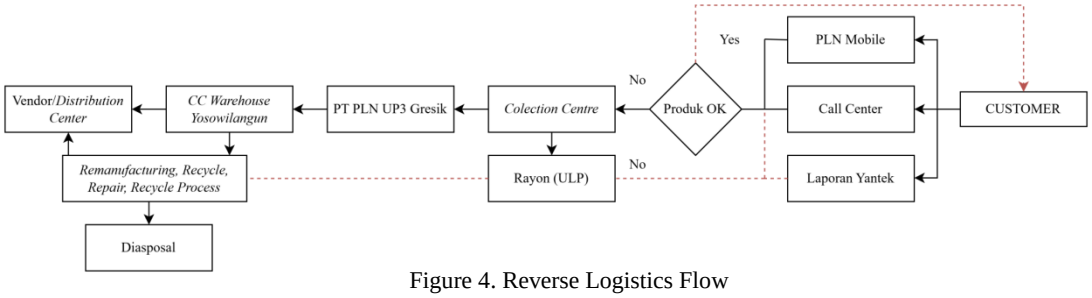

Figure 4. Reverse Logistics Flow

D. SOAR Application

At this stage, a rating calculation will be carried out which will later be used in input to the IFE and EFE analysis to produce further scores for the SOAR matrix.

Tabel 4. Questionnaire Rating Results

No	Factor	Rating	SOAR	Description
1	products using recycled materials are of good quality.	3.28	Strength (S1)	Very good
2	Management information system is very good and easy to access	3.27	Strength (S2)	Very good
3	Product return reporting is quickly responded to	2.85	Strength (S3)	Good
4	Product return procedure is easy to follow	2.66	Strength (S4)	Good
5	The integration of production and remanufacturing	2.4	Opportunities	Good

	processes improves the company's operational efficiency and supports its sustainability goals.	0	(O1)	
6	Arriving personnel have systematic and safe and environmentally friendly product unloading procedures	3.16	Opportunities (O2)	Very good
7	Using a third party for *reverse* logistics/product return improves the efficiency of the return process	2.94	Opportunities (O3)	Good
8	The company has a good and effective approach in handling different types of used product components.	3.20	Opportunities (O4)	Very good
No	**Factor**	**Rating**	**SOAR**	**Description**
9	The company has a good scheduling strategy for new parts and storage.	2.65	Aspiration (A1)	Good
10	The company offers satisfactory repair services.	3.26	Aspiration (A2)	Very good
11	The company through the officers who come to provide clear information	2.86	Aspiration (A3)	Good
12	The Company strives to improve service quality on an ongoing basis	3.41	Aspiration (A4)	Very good
13	The company pays good attention to customer satisfaction and trust	3.42	Result (R1)	Very good
14	The company's policy in safeguarding the personal data of consumers who report can be trusted.	3.23	Result (R2)	Very good
15	The company has a good system for installing new products	2.77	Result (R3)	Good
16	It is important for consumers that the company's product return policy is clear and easy to understand.	3.24	Result (R4)	Very good

E. Data Processing

- MSI (Method of Successive Interval)

The interview results collected in table before are ordinal data, therefore an ordinal to interval data transformation will be carried out.

Tabel 5. Transformation Data

Ordinal Scale Value	Frequency	Proportion	Cumulative Proportion	Z Scale	Density	Scala V	Value of scalling
1	6	0.286	0,286	-0.565	0.340	-1.189	1.000
2	1	0.048	0.333	-0.431	0.364	-0.497	1.692
3	10	0.476	0.810	0.876	0.272	0.193	2.382
4	3	0.143	0.952	1.668	0.099	1.208	3.397
5	1	0.048	1.000	0.000	0.000	2.084	4.273
Total	21					**MEAN**	**2.549**

Based on the Method of Successive Interval (MSI) table above, the ordinal scale 1 to 5 obtained frequencies of 6, 1, 10, 3, and 1 with proportions of 0.286, 0.048, 0.476, 0.143, and 0.048, respectively. The cumulative proportion shows a gradual increase, starting from 0.286 at scale 1 until it reaches 1,000 at scale 5. The Z-Scale values obtained based on the cumulative normal distribution of the cumulative proportion are -0.565, -0.431, 0.876, 1.668, and undefined for scale 5 because the density is 0. The difference between Z-Scales is used to calculate the density, which is 0.340, 0.364, 0.272, and 0.099, respectively. Based on these densities, the V-Scale is calculated, which indicates the psychological distance between scale categories, which are -1.189, -0.497, 0.193, 1.208, and 2.084. From these calculations, the Value of Scaling for each scale is 1.000, 1.692, 2.382, 3.397, and 4.273, respectively. The average (Mean) of the Value of Scaling is 2.549 which shows the tendency of respondents to be between scales 2 and 3. This indicates that respondents' perceptions tend to be neutral to slightly positive, with most choosing the middle category. etc

- IFE

At this stage, the IFE matrix is used to determine the weight and rating of each internal factor which then results in a final score. Furthermore, after obtaining the final score, it will be used for analysis in the IE matrix. TS is obtained from the results of researcher assumptions that have been adjusted to the field conditions with scores between 1-3. The weight is derived from the result of the division between TS and the number of TS. The total weight must be 1.00 or 100%. The rating is obtained from the average questionnaire and the final score is the product of the weight and rating.

Tabel 6. Matrix IFE

	FACTOR	TS (1-3)	WEIGHT	RATING	SCORE
STRENGTH	products using recycled materials are of good quality.	**2**	**0.12**	3.28	**0.39**
	Management information system is very good and easy to access	**3**	**0.18**	3.27	**0.58**
	Product return reporting is quickly responded to	**3**	**0.18**	2.85	**0.50**
	Product return procedure is easy to follow	**3**	**0.18**	2.66	**0.47**
ASPIRATION	The integration of production and remanufacturing processes improves the company's operational efficiency and supports its sustainability goals.	**2**	**0.12**	2.40	**0.28**
	Arriving personnel have systematic and safe and environmentally friendly product unloading procedures	**2**	**0.12**	3.16	**0.37**
	Using a third party for *reverse* logistics/product return improves the efficiency of the return process	**1**	**0.06**	2.94	**0.17**
	The company has a good and effective approach in handling different types of used product components.	**1**	**0.06**	3.20	**0.19**
TOTAL		**17**			**2.95**

From the table above, it can be seen that there are 8 factors from the Strength and Aspiration elements that produce a total IFE score of 2.95. It is known that this score indicates that the IFE matrix score is at a moderate level which is then combined with the results of the EFE matrix score to be included in the IE matrix analysis.

- EFE

In the EFE matrix, the weight and rating of external factors, namely opportunity and result, will be calculated. The results of the calculation of weights and ratings will get a total score which will then be used for analysis in the IE matrix.

Tabel 7. Matrix EFE

	FACTOR	TS (1-3)	WEIGHT	RATING	SCORE
OPPORTUNITIES	The company has a good scheduling strategy for new parts and storage.	**1**	**0.06**	2.65	**0.17**
	The company offers satisfactory repair services.	**2**	**0.13**	3.26	**0.41**
	The company through the officers who come to provide clear information	**1**	**0.06**	2.86	**0.18**
	The Company strives to improve service quality on an ongoing basis	**2**	**0.13**	3.41	**0.43**
	FACTOR	**TS (1-3)**	**WEIGHT**	**RATING**	**SCORE**
RESULT	The company pays good attention to customer satisfaction and trust		**0.19**	3.42	**0.64**
	The company's policy in safeguarding the personal data of consumers who report can be trusted.		**0.19**	3.23	**0.61**
	The company has a good system for installing new products		**0.19**	2.77	**0.52**
	It is important for consumers that the company's product return policy is clear and easy to understand.		**0.06**	3.24	**0.20**
TOTAL		**6**			**3.15**

Tabel 8. Matrix Internal External

		IFE score (2.99)		
		Strong (3-4)	Medium (2-2.99)	Weak (1-1.99)
EFE Score (2.90)	High (3-4)	I	II	III
	Medium (2-2.99)	IV	V	VI
	Low (1-1.99)	VII	VIII	IX

From the table above, it can be seen that the IFE score and EFE score in the IE matrix are in quadrant II (medium-high) with grow and build conditions (intensive strategy, integrative strategy, product/system development). From both IFE and EFE scores, the difference is quite small, meaning that both have a balanced point that is not too strong and not too weak. This proves that in the eyes of the buyer as the customer side of the kWh Meter return there are still some things that need to be improved.

IV. CONCLUSION

The results of the analysis of the maturity level of reverse logistics implementation in these three companies can be categorized at level 3 (Level Developed) where this level is a level that has felt significant benefits from the implementation of RL. The advantage of companies with this level is that the company already has cooperation with third parties for product repair problems and claims originating from the company. The company does not need to set up too many service centers / stations because there are already 3rd parties who help of course with the SOP (Standard Operational Procedure) provided by the company to maintain the quality of the product itself. with the results of measurements using MSI (Method of Successive Interval) successively for UP3 Gresik, Rayon Giri,

Rayon Benjeng, Rayon Sedayu and Rayon Bawean are 2.549; 2.292; 2.459; 2.932; 2.677. The results of the calculation of scores on IFE and EFE in the IE matrix are in quadrant II (medium-high) with grow and build conditions (intensive strategy, integrative strategy, product / system development) meaning that the company has moderate internal strengths and faces high external opportunities. This condition shows that the company is in a fairly competitive position in the market and has a great opportunity to grow, although its internal strengths are not yet maximized. From both IFE and EFE scores, the difference is quite small with IFE 2.95 and EFE 3.15, meaning that both have a balanced point that is not too strong and not too weak. This proves that in the eyes of the buyer as the customer side of the kWh Meter return there are still some things that need to be improved.

In this study, there are still shortcomings in the methodological limitations in preparing maturity levels. It is recommended to develop more comprehensive indicators in the MSI method, especially those related to sustainability and operational efficiency in reverse logistics. For future research, it is also expected to use methods that can be used in other company sectors by using clearer updates as well as the possibility of a high return value experienced. It should be noted again in determining the filling of maturity level forms and questionnaires for customers, make sure that the person concerned understands and knows the overall concepts and processes for the implementation of Reverse Logistics.

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