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Capacity Planning to Increase Mechanic Availability in After-Sales Service at PT. Elang

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ABSTRACT: After-sales service is critical in selling products such as heavy equipment, which require maintenance from mechanics who understand the product. PT. Elang is one of Indonesia's heavy equipment distributors and provides service support after purchase. The company currently struggles to manage the mechanics for repair requests from customers. Most of the time, the mechanics are already dispatched for regular maintenance, so repair requests are challenging to respond quickly to because of the unpredictable nature of the case. Complaints and bad reviews on after-sales service lead to lost customers and significant revenue loss. This study aims to identify the gap between current and ideal capacity, look for the root causes through the business process review to find where improvement is needed and provide a suitable solution for the company. The qualitative and quantitative methods were used in this study. The qualitative method was through interviews and discussions with the head of service support and the branch operation head to understand the situation and process. The business process related to the issue was then analysed with Business Process Modeling and Notation (BPMN) and the root cause was found using the Current Reality Tree (CRT) method. The quantitative method was through the sales and capacity data collected from the company. The best alternative solution was selected using the Analytic Hierarchy Process (AHP) using XLSTAT. This study showed that the problem happened because of two root causes: an inadequate number of mechanics and no sufficient integrated system to support the information flow through related divisions. Three alternative solutions were proposed based on the root causes. After the AHP calculation and analysis, the results were confirmed with the head of service support, and it was concluded that the solution that could be implemented in the company is providing service points with a priority result of 71.03%. The next alternative is to implement the cloud ERP system with a result of 15.04% and outsource mechanics with a result of 13.93%. With this solution, the company considered a long-term approach with more sustainability and scalability criteria than ease of implementation. The order of criteria priorities are cost, effectiveness, sustainability, scalability, and ease of implementation, with a consecutive result of 47.87%, 24.3%, 12.64%, 6.6%, and 8.59%.

KEYWORDS: After-sales service, Analytic hierarchy process, Current reality tree, Capacity planning, Heavy equipment.

I. INTRODUCTION

Indonesia has a large and diverse market, which offers a range of opportunities for heavy equipment distributors. Indonesia's heavy equipment distributor industry has seen significant shifts before and after the COVID-19 outbreak in 2020-2022. The pandemic brought uncertainty and volatility in the market because of the economic slowdown and reduced investment.

However, despite the initial decline, demand for heavy equipment shows signs of recovery after the pandemic. The Indonesian construction equipment rental market is estimated to reach $794.8 million by 2029, increasing at a CAGR of 8.99% [1]. Several reasons contribute to this growth, including increased infrastructure investment, government investment in national strategic projects, and the expansion of the mining industry. This recovery is a great advantage for companies that already prepared their resources to quickly bounce back to take these opportunities to expand their position in the changing market.

PT. Elang is one of the heavy equipment distributors in Indonesia. Most of their products are imported heavy equipment for construction and mining. PT. Elang has gone through the pandemic with some adjustments, such as tightening the budget by cost-cutting operations. The impact of this is to lay off the mechanics and lead to limited availability of mechanics when there is demand for repair maintenance from the customers.

The degree of competition in the Indonesian heavy equipment industry has increased due to rising demand for Chinese OEMs, which are offered at cheaper rates and with more accessible financing options. Chinese manufacturers provide low-cost equipment for 20% less than their Japanese competitors [2]. Each distributor will retain and expand market share through a price and product support plan. Furthermore, companies are focused on digital transformation to enhance after-sales services, which digital technology

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facilitates. After-sales product support is critical for customers in ensuring that the heavy equipment purchased is always ready for use and produces optimal output [3]. Heavy equipment, such as construction or mining equipment, needs frequent maintenance and repairs to ensure maximum performance and lifetime. As a result, trained mechanics enable the company to respond quickly to its customers' maintenance or repair demands, minimizing disruptions to the customers' operations.

Indonesia's heavy equipment distribution sector is also subject to several other rules and regulations. Foreign enterprises who want to market their products in Indonesia must hire a local agent or distributor under Ministry of Trade (MOT) Regulation No. 36/1977 and Government Regulation No. 15/1998. Other regulations, such as import taxes and VAT, impact Indonesia's heavy equipment distribution companies. According to the most recent data, Indonesia's average Most-Favored-Nation (MFN) imposed tariff rate was 8.1% in 2021, 8.7% for agricultural commodities, and 8% for non-agricultural commodities [4].

Based on the Tax Regulations Harmonization Law ("HPP Law"), which became Law No. 7/ 2021 on 29 October 2021, the general VAT rate will be increased to 11% and 12% by the starting date of 2025, up from the current 10% rate. The VAT rate might be reduced to 5% or increased to 15%. Rate modifications will be governed by a Government Regulation following consultation with Parliament [5].

On the environmental side, the Indonesian government planned for carbon neutrality by 2050. This drove the broad adoption of electric construction machines and hydrogen fuel technologies in 2022. To meet rising demand in the Indonesian construction equipment industry, major manufacturers such as Volvo Construction Equipment, SDLG, and XCMG introduced electric and compact mini excavators [6].

Responding to the changing conditions in the macro-environment or industry, PT. Elang competes by lowering the price of heavy equipment units, and it is willing to have only a 3-8% profit margin, which is one-third relative to its rivals. It leads to a limited budget for hiring and training new mechanics. Cost-cutting measures during the pandemic and the need to allocate resources to critical business areas caused a reduction in investment for after-sales operations.

In terms of the value chain, after-sales service is the part that impacts the customer’s operation. The constant issue of unreliable service support to address the unit's failure is drawing customer complaints and bad reviews. Customers are dissatisfied because the long waiting time contributed to their operational disruptions. Customers could stop buying from the company and change to the competitor. Table 1 below is the historical data from the year 2022. Based on the interview, the customer-based churn rate due to delayed repairs is estimated at 25%, with an average unit price of $88,516. Based on the calculation from that data, the estimated total revenue loss from competitors capturing the market share is more than $2 million in one year.

Table I. Estimated Total Revenue Loss due to Delayed Repairs

Total Customers	***Total Units Sold***	***Average Revenue per Customer***	***Number of Lost Customers***	***Revenue Impact per Lost Customer***	***Total Revenue Loss***
85	401	$417,588	21	$104,397	$2,192,337

The data demonstrates that delayed repair service demand in PT. Elang is bringing significant revenue loss. Urgent action is required to address the underlying issues and reduce repair response time to improve customer satisfaction, trust, and retention. The stakeholders affected by this issue are the service support division, the sales division, customers, and shareholders. Understanding the root causes of this issue and proposing a suitable solution requires understanding the business process and resources.

II. LITERATURE REVIEW

A. Sales and Operations Planning (S&OP)

Sales and operations planning (S&OP) is a common multidisciplinary method used at the tactical planning level. Its primary goals are to balance supply and demand and create connections between the organisation's strategic and operational objectives. Improved forecast accuracy [7], service level [8], and capacity utilisation [7] are just a few of the operational performance benefits associated with S&OP approaches. By raising the gross margin and customer retention [8], as well as the profit margin and revenue [7], these operational changes result in improved financial and competitive performance.

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According to Pedroso et al. [9], information systems may be helpful with S&OP implementation on the one hand, but they may also be a barrier if they are not appropriately implemented. Most studies indicate that IT has a beneficial influence on S&OP despite differing opinions on its role in S&OP. Therefore, to improve the company's performance, the degree of technological integration needs to correspond with the maturity of the S&OP process [10].

Although coordination between a company's demand and supply sides is crucial for competitive performance [11], firms lack the necessary managerial tools to accomplish the essential results and integrate or reconcile demand and supply needs. According to Pedroso et al. [9], demand and supply planning, metrics and performance evaluation, information systems, forecast accuracy, cross-functional integration, information flow management, structured schedule, consideration of the external environment, integrated planning, top management support, training/process understanding, documentation, and process coordination are among the enablers of S&OP implementation. Barriers to S&OP implementation include silos culture, insufficient technology and information systems, a disconnect between S&OP and organizational strategy, a short-term focus, a lack of capacity to monitor and measure process progress, information reliability, and a lack of commitment.

B. Capacity Planning

Measuring capacity as 'the ability to supply' relates to the mix of products and services offered, their delivery duration, and the specification of what is supplied. The extent to which an operation may be performed is determined by what is required. Aggregated capacity measurements can help mitigate the fluctuation between product and service demands. Medium-term capacity management focuses on aggregated capacity levels rather than particular product or service characteristics. Medium-term capacity management sometimes involves some degree of approximation, particularly when the mix of products or services provided fluctuates drastically [12].

Planning involves identifying activities, tools, and resources required for interventions. Two primary techniques may be identified: one focused on determining criticalities (e.g., FMECA, ABC, and AHP) and one focused on optimization (e.g., genetic and optimization algorithms) [13]. However, most maintenance decisions are based on an individual's experience [14]. Therefore, the adoption of experience-based strategies and the low adoption rate of decision support tools [15] are due to a lack of organized data collection and analysis methods [16].

C. Enterprise Resource Planning

According to Haddara and Elragal [17], enterprise resource planning (ERP) systems are modular programs designed to support and integrate an organization's business operations using a single data repository. ERP is an excellent tool for controlling and planning, with additional benefits beyond system connection. Decision support facilities provide up-to-date corporate information to operational decision-makers. It integrates with typical software used by managers, like spreadsheets. ERP systems can also run on platforms like Windows NT, UNIX, and Linux [12].

Conventional ERP systems, or on-premise systems, are internally hosted and managed. On-premises systems can be expensive up front, complicated to update, and take a long time to execute. Organizations have been willing to shift their ERP system to the cloud to address these problems in the past few years [18]. According to Mell and Grance [19], cloud computing is "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction." Cloud ERP solutions may be accessible online without local installation and are entirely hosted by a third-party provider. According to [20], this cloud solution is also called software as a service (SaaS), offering more scalability, reduced prices, and simpler upgradeability.

D. Customer Retention and Satisfaction

Ginn et al. [21] describe customer retention as "the continuation of an affiliation between the customer and the company" and a chance for a corporation to repurchase current clients. The hypothesis states that lost customers are the result of flaws in customer relationship management that have a direct impact on retention. According to Sağlam [22], replacing lost customers is more expensive than retaining existing ones.

Customer trust is strengthened when customers are satisfied with the offerings. This type of customer will probably buy the same products from the company again. Customer satisfaction positively and significantly impacts customer loyalty, as Khan et al. [23] have indicated. El-Adly and Eid [24] and Keshavarz and Jamshidi [25] both cite customer satisfaction as a precondition for loyalty

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based on the results of research around the service profit chain. If a customer has a positive experience with a product or service, they may get even more interested in it and decide to repurchase it [22].

Research findings by Balinado et al. [26] show a significant correlation between customer satisfaction and reliability, where most consumers were pleased with the service when it arrived on time. A similar study by Shokouhyar et al. [27] also finds that the provision of service as promised and the availability of technical service staff are the most crucial reliability factors in after-sales service to influence customer satisfaction. It suggests that customers know they can rely on the company's mechanics to promptly address their needs, leading to long-term customer relationships and a competitive advantage.

E. Business Process Modeling and Notation (BPMN)

BPMN is created and standardized by the Object Management Group (OMG). It was initially created by a consortium of process modeling vendors in 2003, and development continued for three years until it was published as an OMG standard in 2006 [28]. The BPMN charter clearly states that BMPN aims to assist businesses in understanding their internal processes. According to Aagesen and Krogstie [29], BPMN aims to serve a large business audience and the technical community. BPMN allows users to create a Business Process Diagram, which depicts the business process's activities and the flow controls that determine the order in which they are executed [30].

F. Current Reality Tree (CRT)

The Current Reality Tree (CRT) is a critical component of Eliyahu M. Goldratt's Theory of Constraints (TOC) management theory. The CRT visualizes the cause-and-effect links inside a complex system to identify the underlying causes of issues or unwanted outcomes. It helps determine the system's underlying dynamics, constraints, and challenges and illustrates the current state.

The CRT develops by identifying undesirable effects (UDEs) and examining their cause-and-effect connections. The method involves connecting UDEs via logical reasoning, commonly depicted visually using ellipses or circles to represent "and" connections. The CRT is constructed from the top down, beginning with the UDEs and progressing backwards to the underlying causes [31]. This structured approach helps discover the underlying causes of issues, making it a crucial phase in problem-solving. By concentrating on the fundamental causes rather than symptoms, the CRT allows businesses to address the main issues and produce long-term solutions.

G. Analytic Hierarchy Process (AHP)

When evaluating various choices while considering multiple criteria, the multiple-criteria decision-making (MCDM) method could be helpful [32]. For many years, the Analytic Hierarchy Process (AHP) has been the leading MCDM approach [33] and [34]. A vital component of the AHP is the pairwise comparison matrix A of a collection of n items, and w_i/w_j is represented by the components of $A = [a_{ij}]$, where w is the vector containing the weights of the compared items $i = 1, 2, 3,... n$ [35]. One method for generating w from A is shown in the following equation:

$$Aw = \lambda_{max} w$$

Pairwise comparisons using the Saaty Scale, a linear 1–9 scale, are typically conducted in the AHP. By using the Saaty Scale, A transforms into a positive reciprocal matrix, meeting the requirements of $a_{ij} > 0$ and $a_{ij} = 1/a_{ij}$, ∀i,j = 1, 2, 3,... n. $\lambda_{max} \geq n$ is a result of this positiveness and reciprocity. $\lambda_{max} = n$ is a consequence of consistency [36].

Table II. The Value of the Objective Function [37]

Relative Intensity	*Definition*	*Explanation*
1	Equal value	Two requirements are of equal value
3	Slightly more value	Experience slightly favors one requirement over another
5	Essential or strong value	Experience strongly favors one requirement over another
7	Very strong value	A requirement is strongly favored and its dominance is demonstrated in practice
9	Extreme value	The evidence following one another is of the highest possible order of affirmation

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2, 4, 6, 8	Intermediate values between two adjacent judgements	When compromise is needed
1/3, 1/5, 1/7, 1/9	Reciprocals	Reciprocals for inverse comparison

Saaty [36] proposed the consistency index, CI, as seen in the following equation:

$$CI = \frac{\lambda_{max} - n}{n-1}$$

If A is consistent, then $\lambda_{max} = n$ and CI = 0. The consistency ratio CR is a better indicator of a comparison matrix's consistency since it compares CI with a random index RI derived using the simulation of positive reciprocal matrices [38], as shown in Table III and the following equation:

$$CR = \frac{CI}{RI}$$

Table III. Saaty's Consistency Indices of Randomly Generated Reciprocal Matrices [39]

Order of the Matrix (n)	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***
RI Value	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

The 0.1 criterion was proposed [36] and assumes that normalized values for w_i range from 0 to 1; the needed order for RI was as low as 10% but no lower than 1% since inconsistency is crucial. According to Saaty [35], "Without it, new knowledge that changes preferences cannot be admitted." This study uses the normal CI, CR, and 0.1 criteria. This adoption is intended to accord with the original AHP theory and its standard practice.

III. METHODOLOGY

The research was conducted both qualitative and quantitative. Qualitative data was collected through semi-structured interviews and discussions with the head of the service support division. This data is used to understand the current situation and constraints, which helps determine the root causes. The business process related to the problem was analyzed using BPMN, and the root cause was found using CRT.

Quantitative data was also collected from the company. This data is used to identify the impact of the problem on the business, assess the gap between capacity and demand, and become a consideration in weighting the criteria on AHP. The AHP method selects the best alternative solution based on five confirmed criteria through discussion. AHP analysis uses both XLSTAT.

IV. RESULTS AND DISCUSSIONS

A. Current Capacity Analysis

Current capacity refers to working days available based on the number of mechanics. After-sales service demand refers to the days required for service. From the graph, it can be seen that some branches have insufficient capacity to fulfil the after-sales service demands. Sufficient mechanics is essential as a capacity cushion for unexpected demands like repair service. This is based on data from 2022, and after-sales service depends very much on the units sold in the same year. Therefore, solving the problem by adjusting the mechanics could not solve the real issue. Capacity improvement is needed to increase mechanic availability in responding to customer service demand while also providing an opportunity to scale the operation for future growth.

The capacity can be optimized by adding sufficient mechanics through hiring and training new mechanics or outsourcing for a more low-cost option. Integrating a supply and demand planning system such as ERP to track and plan the required capacity, accurate historical data for future planning and forecasting, and coordination through company divisions is also important. Another option is to provide more access from the customers to increase response time, such as providing service points in a broader area or with the highest demand pattern. Other analysis is needed to understand the cause of the problem and offer a suitable solution.

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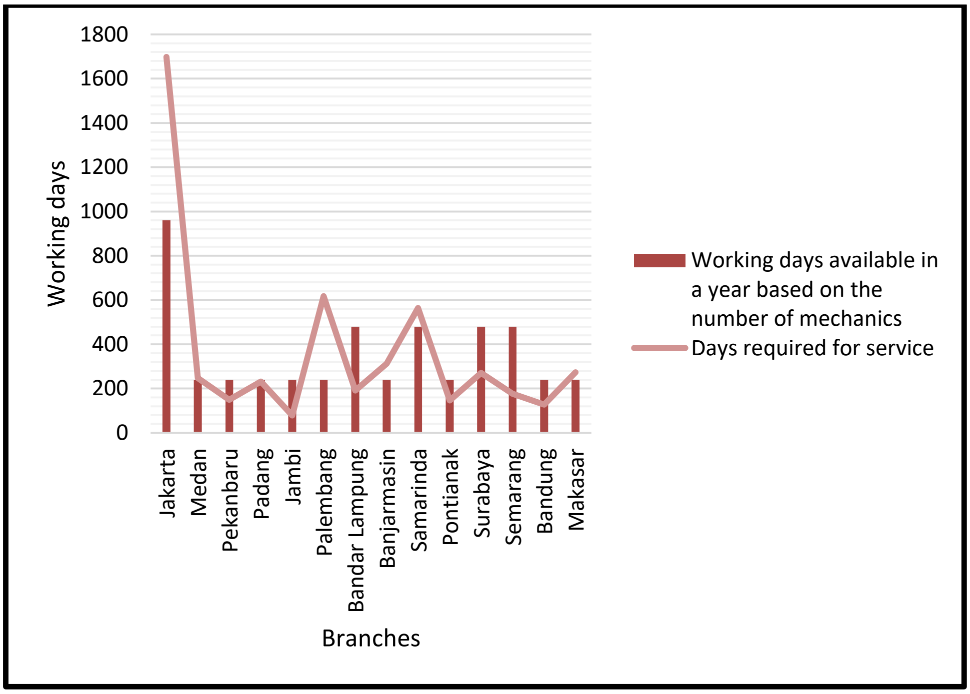

Figure 1. Current capacity and after-sales service demands in one year

B. Business Process Analysi

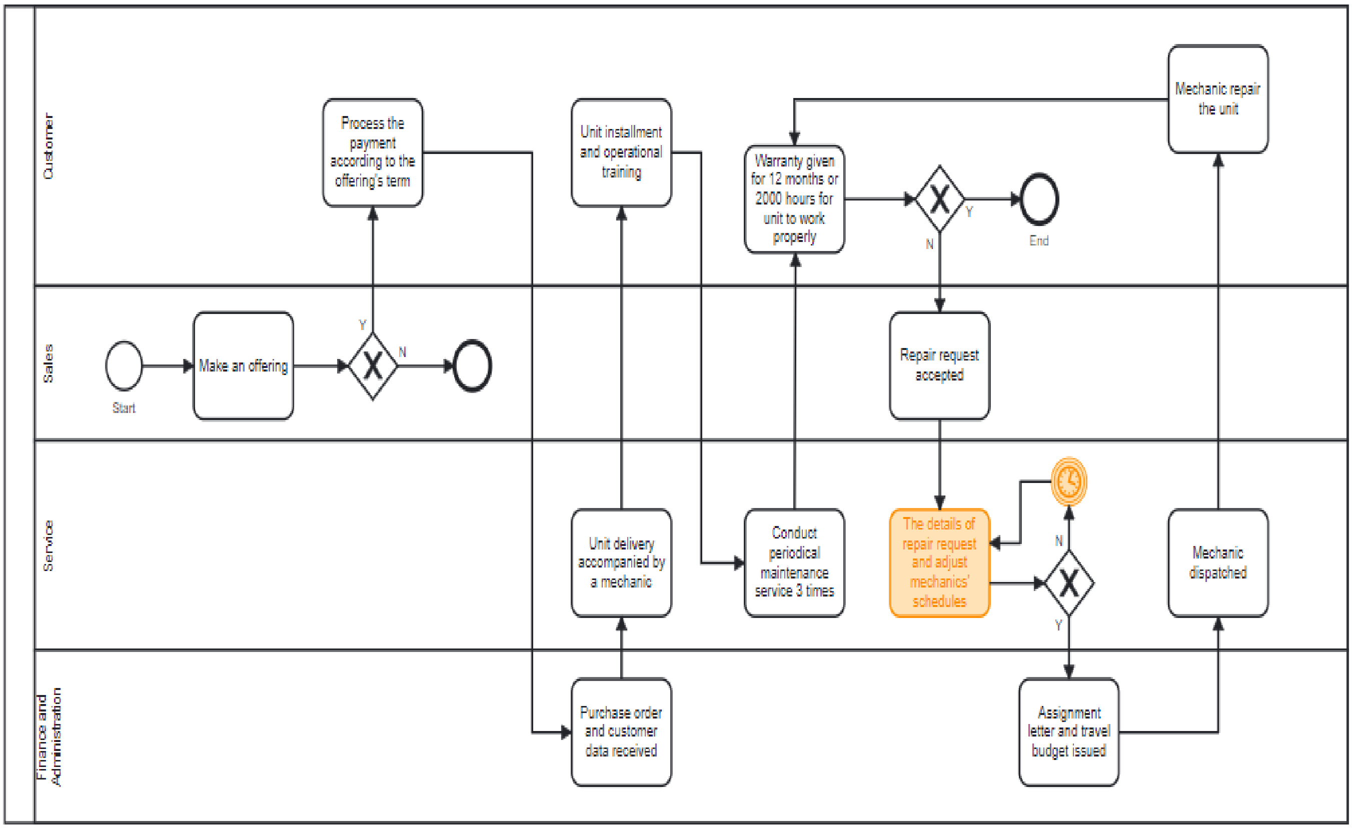

Figure 2. BPMN related to the operational problem at the service support division in PT. Elang

The first process is offering the unit to the customer by sales. The offering includes the unit specification, price, warranty, and after-sales service (periodic maintenance), with technical delivery and payment. The customer asked for a 20% down payment to make an order, and the delivery only started after the customer had finished all the payments or the purchase order had been released through leasing. A mechanic will be dispatched with the unit for delivery and installation. The unit instalment usually needs 3 days of downtime, with the mechanic providing operational training and field guidance. After that, service support is responsible for periodic maintenance and repair service in a warranty period. Periodic maintenance includes overhaul and oil replacement three times every 250 working hours. The process ends if the unit works properly during the warranty period.

In case the unit needs repair, the process is started by the customer calling the company through sales, which then confirms the details of the repair requests with the service support manager or the head of the branch. This is where the problem happened: adjusting mechanics' schedules to respond to the repair demand requests. Even though the company has already applied a periodical forecast for service based on the working hours of unit equipment, the demand for repair services is difficult to predict and ultimately disrupts scheduling plans for that month. The company has difficulty allocating mechanics with a schedule for periodic maintenance, resulting in service delays. The division handled it by delaying the periodic maintenance and negotiating to prolong it to the following schedule. But it still took some time for the customer to wait, at least 1 week. This problem also impacted branches from the outside island of Java, which needed mechanics from Jakarta as a backup. This certainly prolonged the response and waiting time for customers. After the mechanic is available, the service support manager or the head of the branch will inform the finance and administration department to issue the assignment letter and the travel budget.

In Figure 2, we can review the process and suggest improvements to reduce the response time. The company could improve the flow of information from the customer to be directly continued to the service support. This can be achieved if the company has a good information system that can be accessed through all of the divisions. Another improvement is capacity planning, which aligns the capacity needed to perform the after-sales service demands of periodic maintenance and repair. This requires more analysis to understand clearly what needs to be done about this part of the company's business process. To understand that, the current tree analysis is conducted to look for the causes.

C. Root Cause Analysis

Root cause analysis uses the current reality tree approach. The undesirable effects (UDEs) are explored with their cause-effect connection to look for the core causes. Based on the current reality tree in Figure 3, two root causes lead to this problem. The lack of an integrated system to monitor demand and supply capacity and insufficient mechanics are causing difficulty in responding immediately and scheduling outside periodical maintenance. This leads to customers' complaints and bad reviews on after-sales service support.

Based on those two root causes, three alternative solutions are proposed. The first solution is strategically establishing service points to reduce travel time and improve response efficiency. It also facilitates the future demands on the area. The second solution is to outsource mechanics for periodic maintenance service only, while in-house mechanics are prioritized to install the unit and respond to repair requests since this activity requires a mechanic who knows the details of the unit sold. This solution is focused on increasing mechanic availability. The third solution is to upgrade communication and coordination processes within the service support division by transitioning from manual methods to a cloud-based ERP system. This solution also focuses on response and waiting time like solution 2, but more on long-term investment. By implementing this system, the company could make data-based decisions for better strategy execution and customer-focused options.

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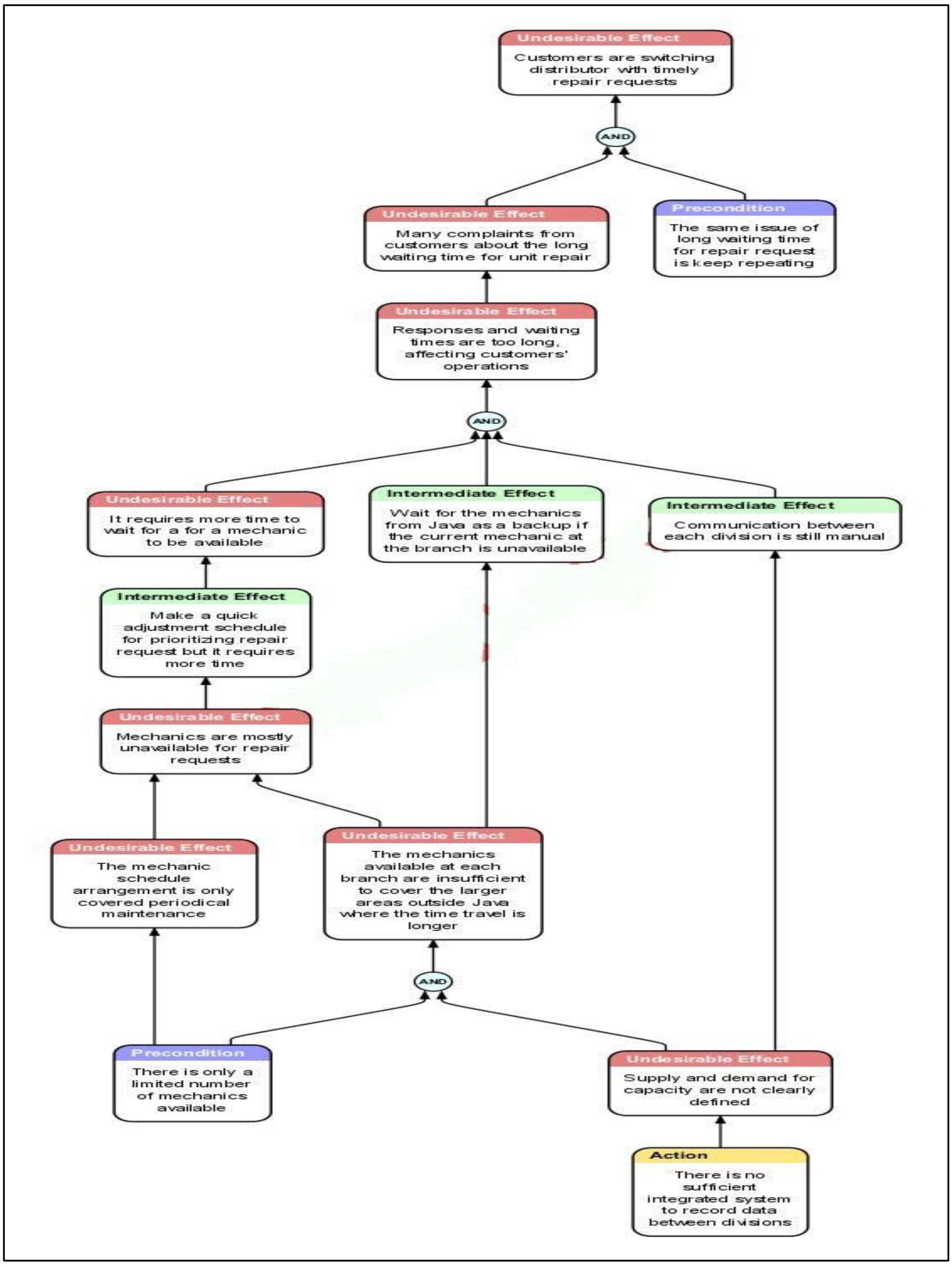

Figure 3. Current reality tree of the problem

Those solutions also need to be considered carefully. The company should be careful when making short-term decisions based solely on expense reductions and/or operational cost savings without considering the long-term strategic and operational implications of outsourcing. Outsourcing solution is only for the essential but not value-adding resources because outsourcing the incorrect operations might lead to a corporation losing its core capability [12]. Contract-based outsourcing also might be problematic since third parties lack incentives to make investments tailored to the company's demands. Monitoring and controlling outside parties' activity through contracts and arms-length transactions can be challenging. Unexpected issues may develop, causing delays

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or cost overruns and making it difficult to reach an amicable resolution [40]. The company must promote cross-functional engagement among all relevant managers and functions. All of this planning is necessary to establish proactive sourcing procedures that will evaluate and drive continuous performance improvement by the subcontractor.

Providing service points requires significant costs and investments. This must be considered by calculating the additional operational costs compared to the added value that the company can get from this solution. Considering the best location while considering the growth of demands is also critical.

The last solution to be considered is implementing a cloud ERP system. One of the primary strategic risk considerations for cloud-based ERP systems is an excessive reliance on the service provider [41]. Research by Haddara et al. [42] shows that scalability and more convenient collaboration (accessibility) are two benefits that have relatively significant predictive qualities toward attitude, while vendor dependency is a negative trait with a similar impact. ERP problems might also result from inadequate training [43]. Selecting consultants and suppliers is nearly as crucial as deciding which ERP systems to use because every company has different needs and capabilities [44].

Other obstacles include the possibility of data loss and security issues. Organizations using cloud ERP systems may be exposed to security threats or information leakage because they lack awareness of cloud providers' security platforms, processes, and procedures. From a security perspective, there are several things to be aware of while deploying cloud ERP, such as encryption, accountability, security breaches that compromise sensitive data, and maintenance problems. Therefore, the acceptance and effective implementation of Cloud ERP depends heavily on security-related strategies, policies, tools, and methods [45].

D. Analytic Hierarchy Process Analysis

The analytical hierarchy process is conducted to select the best alternative solution from the proposed solutions based on the root causes analysis. The following analysis uses XLSTAT. The criteria to evaluate the decision are:

1) ***Cost:*** Cost related to the implementation of the solution.
2) ***Effectiveness:*** Addressing root causes and impact on customer satisfaction and response time.
3) ***Sustainability:*** Impact on the company's ability to sustain long-term and face the potentially changing future demands, trends, workforce dynamics, and technological advancement.
4) ***Ease of Implementation:*** Alignment with the company's resources and values.
5) ***Scalability:*** Accommodate the company's growth.

Criteria	Cost	Effectiveness	Sustainability	Ease of implementation	Scalability
Cost	1,00	5,00	3,00	5,00	5,00
Effectiveness	0,20	1,00	3,00	5,00	3,00
Sustainability	0,33	0,33	1,00	3,00	1,00
Ease of implementation	0,20	0,20	0,33	1,00	1,00
Scalability	0,20	0,33	1,00	1,00	1,00

Alternatives for criterion Cost:

Alternatives	Service Points	Outsource	Cloud ERP
Service Points	1,00	7,00	5,00
Outsource	0,14	1,00	1,00
Cloud ERP	0,20	1,00	1,00

Alternatives for criterion Effectiveness:

Alternatives	Service Points	Outsource	Cloud ERP
Service Points	1,00	7,00	3,00
Outsource	0,14	1,00	1,00
Cloud ERP	0,33	1,00	1,00

Alternatives for criterion Sustainability:

Alternatives	Service Points	Outsource	Cloud ERP
Service Points	1,00	5,00	3,00
Outsource	0,20	1,00	1,00
Cloud ERP	0,33	1,00	1,00

Alternatives for criterion Ease of implementation:

Alternatives	Service Points	Outsource	Cloud ERP
Service Points	1,00	5,00	7,00
Outsource	0,20	1,00	3,00
Cloud ERP	0,14	0,33	1,00

Alternatives for criterion Scalability:

Alternatives	Service Points	Outsource	Cloud ERP
Service Points	1,00	3,00	5,00
Outsource	0,33	1,00	1,00
Cloud ERP	0,20	1,00	1,00

Figure 4. Pairwise Comparative Matrices for Criteria and Alternatives

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Criteria	%
Cost	47,87
Effectiveness	24,30
Sustainability	12,64
Ease of implementation	6,60
Scalability	8,59

IC = 0,093 ; RC = 8,32%

Crit./Alt.	Service Points	Outsource	Cloud ERP	IC	RC
Cost	35,69	5,75	6,43	0,01	1,09
Effectiveness	16,65	3,30	4,35	0,04	7,03
Sustainability	8,28	1,99	2,36	0,01	2,52
Ease of implementation	4,78	1,28	0,55	0,03	5,67
Scalability	5,63	1,60	1,36	0,01	2,52
	71,03	13,93	15,04		

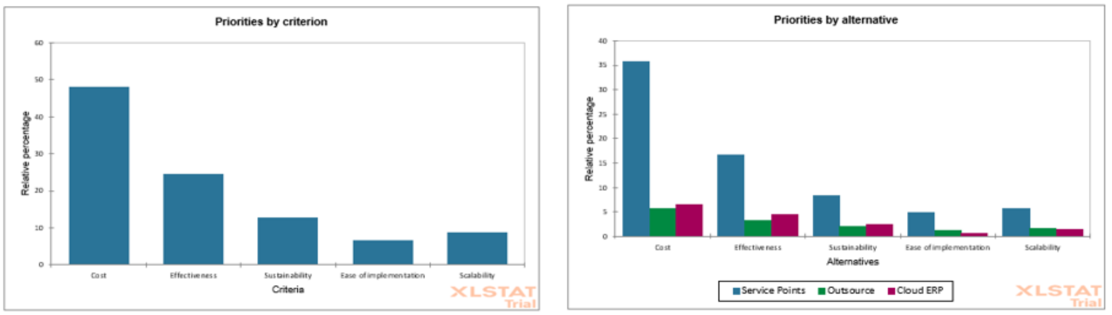

Figure 5. Consistency Check Result

The criteria to shorten the response and waiting time for repair requests are chosen from the previously stated probable criteria, and the Head of the Service Support is given the option of selecting from the provided list or adding additional criteria that he considers are required for choosing the best solution according to the situation and resources available. To compare choice elements in the AHP technique, the evaluator uses the preference intensity evaluation or relative relevance scale mentioned in Table II. After installing the XLSTAT software, the weight of each criterion and alternative is inputted into the table on the AHP design worksheet. Figure 4 on the previous page is a pairwise comparative matrix collected from a discussion with the Head of Service Support.

The next step is to click run analysis to get the final and consistency check result. The result of previous comparative matrices can be seen in Figure 5 above. IC in that software stands for consistency index, and RC stands for consistency ratio. For criteria, the value of RC is 8.32% or 0.0832, which means that this is acceptable because it is below 0.1 or 10%. This RC result value is also applied to the alternatives relative to the criteria.

From the result, we can order the priority criteria from the highest value: cost, effectiveness, sustainability, scalability, and ease of implementation. The best alternative solution based on this result is to provide service points with a result of 71.03%. The second priority solution is implementing a cloud ERP system, with a value of 15.04%, and outsourcing is the last choice, with a value of 13.93%. The criteria priorities are cost, effectiveness, sustainability, scalability, and ease of implementation, with consecutive values of 47.87%, 24.3%, 12.64%, 6.6%, and 8.59%. Apart from the cost and effectiveness of the solution, the evaluator weighted the sustainability and potential scalability more than ease of implementation. It can be concluded that the Head of Service Support is considering a more long-term solution to this issue even though providing service points requires more costs, more mechanics, and an integrated planning system. The Head of Service Support has confirmed that it is willing to implement this solution based on the provided criteria.

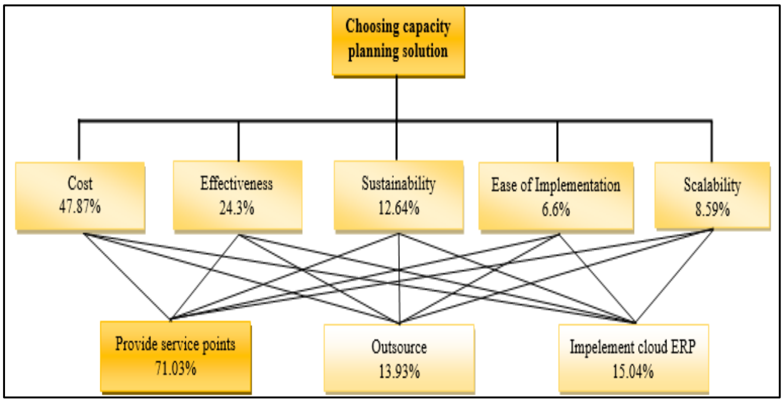

Figure 6. AHP Final Result

V. CONCLUSION AND RECOMMENDATION

PT. Elang's current capacity is insufficient to fulfil the demand for after-sales service. Companies could profit from better-aligned operational and strategic objectives and a more balanced supply and demand [7]. Based on the data from 2022, the current capacity utilization is identified. The branches that have insufficient mechanics and utilize more than their capacity are Jakarta, Medan, Palembang, Banjarmasin, Samarinda, and Makasar. This can be a consideration in future demand and supply planning or other capacity decisions, significantly increasing service reliability to maintain customer trust and potential customer retention. The capacity can be optimized by adding sufficient mechanics, integrating a supply and demand planning system to track and plan the required capacity, and providing more access to increase response time. Mincsovics et al. [46] demonstrate that the value of flexibility declines as lead time increases, concluding that managers should invest in larger levels of permanent capacity when capacity acquisition lead time and demand unpredictability are high.

The causes that drive mechanic unavailability at repair service demand based on CRT analysis are an inadequate number of mechanics and insufficiently integrated systems to support the information flow through cross-functional divisions. Three alternative solutions are proposed to address these causes. The proposed first solution is to provide more service points to cover vast regions, decrease travel time, and increase responsiveness. The proposed second solution is to provide a capacity cushion with outsourced mechanics for handling periodic service, while the in-house mechanic could prioritize handling unit instalments and repair requests. The proposed third solution is investing in an ERP system aligning demand and capacity. Those solutions are then evaluated using AHP with five criteria: cost, effectiveness, sustainability, ease of implementation, and scalability.

The solution to solve the delayed response and waiting time based on the AHP result and the consideration of the head of service support is to provide service points with a result of 71.03%. Providing service points requires sufficient mechanics and an integrated supply and demand planning system. This also requires long-term investment and commitment from all stakeholders. But on the other hand, this is necessary to stay relevant in the changing heavy equipment market and industry. Future research suggestions include designing an ERP framework suitable to the company's needs while also being cost-effective, conducting market research to map the service points, determining the financial projection of this implementation project, and monitoring the performance of this initiative.

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