

DESIGN OF BUSINESS MODEL INNOVATION FOR POWER PLANT OPERATION AND MAINTENANCE SERVICES USING DESIGN THINKING METHOD

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Abstrak: Power generation business competition in Indonesia is increasingly competitive due to the growth of IPP's with better levels of reliability and efficiency. IPP growth with the TOP scheme in PJBTl has the potential to burden PLN and the state's finances in the long term. In order to guarantee the sustainability of the company, this needs to be a concern of PLN and its subsidiary, PLN Nusantara Power (PLN NP). PLN NP is expected to be able to provide more competitive O&M service fees. This study aims to formulate cost efficiency O&M services based on factors that affect the cost of supplying electricity, to provide efficient and competitive O&M service costs. The research began with the in-depth interviews with experts and reports of electricity supply, O&M service business processes, list of power plant units which were analyzed using the design thinking method, and supported by the cost leadership and blue ocean strategy. The results of the analysis obtained from this study have been validated by experts, in the form of proposed formulations that are studied comprehensively, and are able to solve O&M service cost problems by implementing a cost leadership strategy through changes to return on investment schemes, use of local workforce, appointment schemes directly, as well as the transfer of 3rd party contracts. This research proves that the proposed formulation is able to support O&M service cost efficiency of 9.5%.

Kata kunci: Design Thinking, Cost Leadership, Blue Ocean Strategy, Power Plant Operation & Maintenance Services

INTRODUCTION

Electricity consumption per capita (kWh / capita) is the number of kWh (electrical energy utilized either directly or indirectly from energy sources divided by the number of populations in an area in a period of one year. The aim is to determine the average electrical energy consumption of each resident, where the utilization of kWh of electricity per capita shows a significant increase. At the end of 2019, the electrical energy market in Java is dominated by large capacity plants, >1000 MW/unit with advantages in efficiency. On the contrary, for markets outside Java with small capacity plants currently its existence is still very much needed, considering the characteristics of the Indonesian archipelago and the mode of distribution of people outside Java.

The electricity generated by a plant will be distributed to customers using an electricity transmission and distribution network, where the process of distributing electrical energy in Indonesia is fully managed by PLN. Furthermore, the determination of which plant should be operated is carried out based on the nature of the available base load, load follower plants, plant starting costs, minimum operating duration and minimum outage duration of the plant. The

process of providing electricity in each plant can be one of the challenges of the electricity business. As a state-owned public agency tasked with providing electricity throughout Indonesia, PLN faces severe challenges. With a reduction in the Basic Electricity Tariff as of October 2020 to IDR 1,444.70/kWh. Although over time until

December 2022 there is a tariff adjustment, this does not have a major effect on the operational and maintenance costs of the generating unit. PLN NP is expected to be able to provide more competitive O&M service fees, where the current PLN NP O&M service fee is IDR 411.95/kWh compared to the national O&M service fee of 387.02/kWh.

In order to support business transformation, the use of strategic objectives of PLN and PLN NP through the implementation of the STARSHIP cost leadership strategy in the form of a proposal to design an innovative OM service business model at PLN NP shall be able to answer the challenges in the current electricity business mentioned.

LITERATURE REVIEW

O&M service business is a business engaged in maintenance services and operation of power plants that aim to maintain and improve the reliability of power plants. There are two parties in the O&M service business, namely as the first party who is the employer, in this case the owner of the asset plant, the owner and the second party as the provider of asset manager services or asset operator. There are two types of responsibilities in the O&M service business, where the second party as an asset manager is responsible for the implementation of investment work and routine O&M work or the second party as an asset operator is responsible for the implementation of routine preventive, predictive and corrective work.

Business competition is getting tighter day by day, so it requires companies to be able to continuously determine what strategy is most optimal to stay afloat, excel and win the competition. Volatile, uncertain, complex and ambiguous (VUCA) in the current Industry 4.0 era is very impactful and challenging in business implementation. The selection of business models to be used by the company can ideally combine internal factors, resources, management and see the structure of the industry externally, based on the results of external industry structure analysis. This is so that the company can optimize the use

of internal resources to create new advantages in achieving strategies to achieve goals.

Michael Porter, a Harvard University Professor, has defined three types of corporate strategies to achieve and maintain a better-than-average competitive advantage in an industry. The three approaches are based on two separate measurements, namely the scope and source of the strategy. The source is the measurement of supply and concentrates on the core competencies of the company. He established two of the most important key capabilities: low cost and differentiation (Porter, 1985). On the other hand, scope is a request size that concentrates on the target. Along with the development of today's increasingly competitive business environment, many companies strive to find the best way to gain a competitive advantage. Porter's generic strategy is currently considered appropriate and feasible to be used as a direction for business sustainability around the world in determining significant strategies in achieving goals and achieving optimal results (Enida Pulaj Brakaj, 2015).

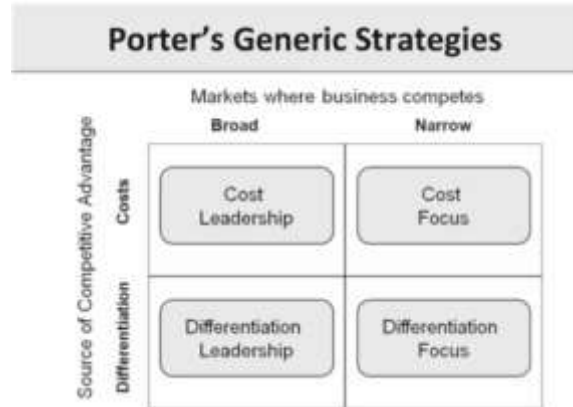


Figure 1. Porter's Generic Strategy

Comparative cost leadership with competitors is the subject that runs all general strategies on cost leadership and impartiality is business cost leadership in general (Salavou, 2015). Several studies suggest that access to minimal business assets has become the most talked about viewpoint of choice to support

corporate amenity procedures in developing countries.

Based on this method, the proposed implementation of cost leadership raises and distinguishes basic key issues that require administrative consideration. It is clear that many businesses seek to adopt the price or product cost provider with the greatest presumptive value. A company that effectively achieves a minimal business position will have the lowest costs compared to competitors. These factors in the cost leadership structure are not estimated independently because factors in one group can influence other group variables and inevitably affect the overall outcome of the procedure. Ultimately the primary techniques used involve a business effort to focus on a defined set of buyers, a share of goods or a geographic market. The key is that cost and cost is a free decision, where the system is cost-centered.

Economies that are free of scale can provide the strongest premise for cost initiative techniques. In addition, when a company strives to achieve a low-cost strategy position, a low-cost comparison with competitors is the subject of implementing the overall business strategy. Cost leadership strategies require quality with price aggressiveness, but it is sought by businesses to have a competitive advantage by implementing lower costs effectively compared to competitors. A company can take advantage of such a situation to lower its costs and gain a share of the market and accept bids from competitors or keep its costs at the current market rate to make a considerably more profit per unit sold.

Design thinking is one of the methodologies that has been widely used by practitioners and academics in solving problems by focusing on the expectations and / or needs of stakeholders or customers / people centers (Tomas Santa Maria, 2022). This method has succeeded in encouraging employees / people to think innovatively and has succeeded in initiating various innovations that have been proven to provide added value for stakeholders, customers and companies, and can further support the sustainability of the company (Wilkerson, 2021)

RESEARCH METHODOLOGY

The use of design thinking method in this study was carried out as a qualitative analysis to create a proposed O&M service business model through the STARSHIP approach. Through the

use of this method, researchers use many technical interviews and discussions with company experts. As for secondary data, this research was conducted based on data realization for 5 years (2018-2022). The scope of research is determined based on expert recommendations during in- depth interviews in terms of data adequacy, conditions and potential implementation in power generation units outside Java. The scope of research is carried out on fossil plants and EBT plants with a capacity of <100MW outside Java shown in Table 1.

Pembangkit Fossil	Pembangkit EBT
PLTU Anggrek (2x25 MW) PLTU Ampana (2x3 MW) PLTU Kendari (3x10 MW) PLTU Ketapang (2x10 MW) PLTU Amurang (2x25 MW)	PLTM Sampean Baru (1.85 MW)

This research uses data and information from annual reports, sustainability reports and corporate news during 2018 to 2022. This time period is considered to be able to describe the company's business and financial conditions in one of PLN NP's core businesses. The following are the stages of the design thinking method in this study :



Figure 2. Design Thinking Overview

RESULT

Identification of problems felt by customers towards PLN NP's O&M service business (empathizing) is carried out by photographing the wants and needs of stakeholders who have a level of strength and influence in the development of the STARSHIP idea and the design of this O&M service business model innovation. It is identified that the key player in wants and needs of B2B consumer stakeholders such as IPP plant owners, PLN, and others, then an in-depth interview process was carried out to representatives of a persona.

Director of Operations in Makmur Sejahtera Wisesa, subsidiary of Adaro Energy, expects that companies engaged in electricity can provide knowledge sharing or release products in the form of formulating new formulas in the implementation of plant operations and maintenance as well as innovative designs for new business models for O&M service business lines (Jannah, 2023). This is what makes the user persona of the IPP Director of Operations in accordance with the purpose of this study to represent the target consumer segment for the commercialization of formulation products new calculation of operation and maintenance costs of generating units (STARSHIP) and innovative design of O&M service business model.

The current business model will be reviewed. Parenting Style is used to describe problems experienced by customers due to the length of business processes that cause long bureaucracy process.



Figure 3. Existing Business Model in PLN NP

Based on the business process that has been running so far for O&M Services outside Java shown in Figure 3, it can be seen that the type of parenting style that has been running so far is a stand-alone type. PLN NP's O&M service business only has a single customer, namely PLN, where the O&M service business is provided to PLN NP through an assignment scheme mechanism. In this business model, it can be seen that the cause of PLN NP's O&M

service business process becomes long because the assignment of O&M services received by customers in this case is that PLN is forwarded back to PLN NP's subsidiary, PJBS, and some supporting work that is not the core competence of PLN NP Group in subcon returns to outside parties. This is one of the obstacles that makes the process long and the work time long. It also leads to high tax costs and regular maintenance.

Furthermore, an analysis was carried out to identify the best and most appropriate formula preparation factors as a solution to the problem. This define stage will help determine the biggest cause of the problem, using pareto analysis. The cost structure of O&M services is divided into nine cost components as follows.

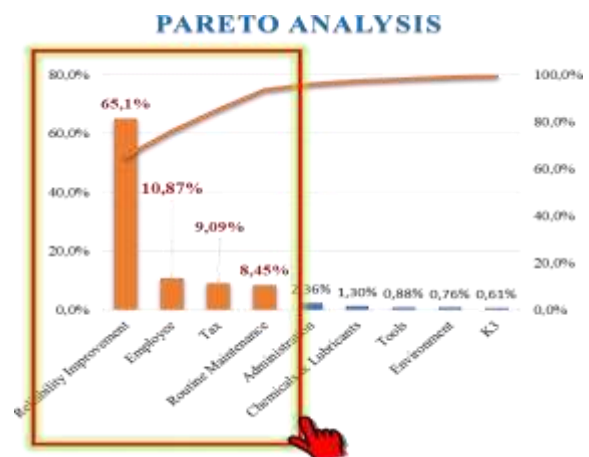


Figure 4. Pareto Analysis of O&M Service Cost Structure

Based on Figure 4, the four largest components in PLN NP's O&M service costs were obtained, including: the cost of increasing reliability or investment costs (65.1%) caused by an even return scheme each year during the term of the agreement, staffing costs (10.87%) caused by the employment at all levels of positions from Java, tax costs (9.09%) and routine maintenance costs (8.45%) caused by the existing O&M service business model with stand-alone parenting style and non-core work subcon. These

four components have an impact of 93.5% of the total cost of PLN NP O&M Services.

Then the design process is carried out at the ideate stage using two interrelated concepts in strategic management, namely using the blue ocean strategy method as an approach to create new markets with the tools used are the four actions framework for designing innovative strategies. The four actions framework on PLN NP is used to consider factors such as price, quality, delivery time and customer service. Based on the consideration of these factors, PLN NP can identify opportunities to create added value for customers.

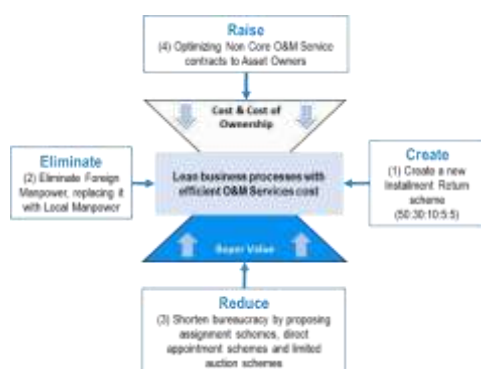


Figure 5. Ideation Process using Four Action Framework

In order to achieve lean business processes, the right solution is needed by paying attention to 4 factors shown in Figure 5, including: Create (1), for investment costs through the creation of a new scheme of return on investment with a proportion of installment return of 50:30:10:5:5. Eliminate (2), related to staffing costs through the replacement of part of Javanese employments for staff level with local employments in certain areas. Reduce (3), related to value-added tax costs, through shortening bureaucracy by proposing assignment schemes for Strategic O&M work, direct appointment schemes for Routine O&M work and limited auction schemes for O&M Support work. Raise (4), used to solve problems related to routine maintenance costs through optimizing non-core O&M service agreements to asset owners.

Based on this, a proposal was obtained to design an O&M service business model with a linkage influence type that can be used in PLN

NP's O&M service business so that lean and efficient business processes are obtained at competitive costs. Based on the supporting aspects of the asset management system, digital transformation is created in the O&M service business model that can be implemented in general. So that through the supporting aspects in the digital transformation of the O&M service business model, Figure 6 is displayed a proposed O&M service business model.

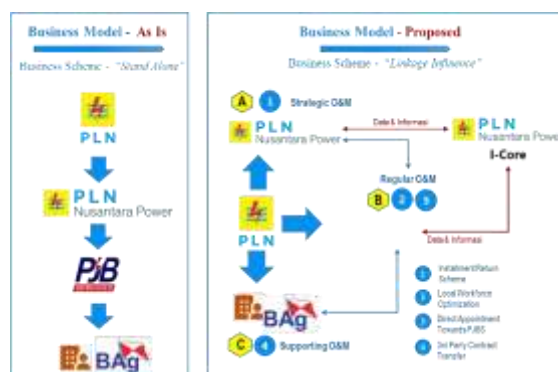


Figure 6. Existing vs Proposed O&M Service Business Model

In the Strategic section (1), an assignment scheme can be carried out by PLN to PLN NP for work that is of an increased nature of reliability such as overhaul, rehabilitation, relocation and expertise services. Where in the Strategic O&M the return on investment scheme used is 50:30:10:5:5. In the Regular section (2), a direct appointment scheme can be carried out by PLN to PJBs for routine maintenance work such as preventive, predictive and corrective maintenance. In routine maintenance work, PJBs will use local labours for staff posts. While in the Supporting section (3), a limited auction scheme can be carried out by PLN to vendors or other parties for supporting or noncore O&M services such as jetty management work. Where in this case PLN can enter into jetty management agreements for several generating units at once managed in its area or commonly referred to as the transfer of 3rd party contracts, so that procurement costs can be reduced.

Based on the prototype proposed above, Cost Adjustment will be implemented. Following the results of the analysis using the four action framework, at this testing stage, four strategies were obtained to achieve lean O&M service business processes. Where then a comparative calculation of the cost formulation of the existing business model against the proposed new business model is carried out. The design of the proposed innovation of the O&M service business model using the linkage influence type is able to produce cost standardization that can be used in calculating the cost of PLN NP O&M services in the future

to support cost efficiency efforts and make the business more competitive as shown in Table 2.

There are four Cost Adjustment strategies, also known as STARSHIP in direct sales schemes, third party contract transfers, optimization of local labor and investment installment schemes to improve the reliability of generation units. Using a new, more concise calculation formula is expected to provide cost efficiency in O&M service work and be able to make businesses more competitive to be able to compete in the current market or new markets later.

Table 2. O&M Cost Adjustment

Cost Adjustment Strategies	<i>Existing Business Model "Stand Alone"</i>	<i>Proposed Business Model "Linkage Influence"</i>	Ideation Process
Direct Appointment	(HPS PJBS + PPN PJBS) + PPN PLN NP	HPS PJBS + PPN PJBS	<i>Reduce</i>
3rd Party Contract Transfer	((HPS P3 + PPN P3) + Margin PJBS) + PPN PJBS) + PPN PLN NP	(HPS PJBS + PPN P3) + <i>Management Fee</i> PLN NP 5%	<i>Raise</i>
Local Workforce Optimization	P1 + P2 + P3 + GPA + Bonus + Annual Leave + Big Leave + Annual Bonus + BPJS + Uniform + Pension Contribution + Extravoeding + Overtime Pay + Meal Allowance + Communication Fee + Gathering	UMK + Competency Development Assistance + Annual Bonus + Severance + BPJS + Uniform	<i>Eliminate</i>
Reliability Improvement Installment Scheme	20:20:20:20:20 (IRR 7%)	50:30:10:5:5 (IRR 7%)	<i>Create</i>

Based on the results of the analysis process and data interpretation that can be used as a reference in making managerial decisions at PLN NP after the implementation of STARSHIP with a proposed innovation of O&M service business models consisting of financial and non-financial benefits. In terms of financial benefit, there is an efficiency in O&M service costs of 9.54% from the initial price of IDR 412/kWh which has decreased to IDR 372/kWh, while it is known that the national O&M service tariff is IDR 387/kWh.



Figure 7. Estimated Decrease in O&M Service Costs

In a more detailed calculation, the cost savings received by PLN are IDR 24,005,651,808 / year as Table 3 for calculations that have been carried out on six generating units in the scope of this study using the implementation of STARSHIP.

Tabel 3. Cost Savings using STARSHIP Implementation

No	Strategies	Comp	% Reduction	% Reduction per Component	Reduction (IDR/year)
1	Local Workforce Optimization	ABOP			
1a	PLTU Anggrek		5.68%	7.64%	3,068,709,594
1b	PLTU Ampaña		14.47%	20.56%	5,621,382,118
2	3rd Party Contract Transfer	ABOP			
2a	Jetty Management PLTU Ketapang		1.90%	24.77%	1,796,991,751
3	Installment Return Scheme	AI			
3a	PLTU Amurang		3.73%		4,649,730,081
3b	PLTU Kendari 1-3		3.90%		4,106,119,090
3c	PLTU Ketapang		5.07%		4,489,355,459
4	Direct Appointment	ABOP			
4a	PLTM Sampean Baru		10.00%		273,363,717
TOTAL			9.54%		24,005,651,808

Furthermore, the potential savings that PLN will receive if applied to all PLN NP O&M service units, where for the calculation in this study carried out on 6 selected power plant units, then if applied to 15 other O&M service units managed by PLN NP, it will obtain savings of about IDR 434 billion / year.

In terms of non-financial benefit, the Company can implement STARSHIP and innovate O&M service business models in all O&M service generation units at PLN NP and at PLN Group. PLN NP is also expected to meet KPIs in terms of maintenance cost efficiency and synergy between other subsidiaries of three and three points respectively with a total of six points out of a total weight of 100 points. In addition, the results of this study are expected to support PLN's transformation, namely LEAN in achieving efficient and fast business processes.

The proposed innovation of PLN NP's O&M service business model affects all stakeholders. The government as one of the key stakeholders that greatly determines the sustainability of energy management companies and guarantees energy sovereignty and security in Indonesia, should be able to support companies by participating in easing the financial burden of PLN and its subsidiaries engaged in power plants. The government can conduct studies and change regulations that form the basis for TOP's cooperation with IPPs in Indonesia which have proven burdensome for

company and state finances in the future. In addition, efforts to encourage adjustments to the basic electricity tariff that can help PLN and its subsidiaries, while not burdening state and community finances, can be implemented.

CONCLUSIONS

A number of factors that affect the high cost of providing electricity were obtained from this study based on the results of analysis using the design thinking method with the approach used through value stream mapping. There is an over process that has no value added. This makes costs high because there is a value of risk, overhead, profits and the imposition of a multilevel

value added tax. In addition, there is a waiting time that makes the business process long and long until it takes up to 100 days.

The proposed O&M service business model is to create leaner business processes and can provide opportunities to increase PLN NP's market share, which is a business model with a parenting style - linkage influence type. The proposed linkage influence service business model is estimated to provide potential cost efficiency of IDR 434 billion / year upon implementing it on all PLN NP O&M service units.

In order to support the company's growth and sustainability in the future, efforts need to be made by the company to strengthen the plant O&M service business line by implementing the STARSHIP strategy. Direct appointment scheme from PLN to PLN NP, for routine work, transfer of third party contracts, for work on O&M Supporting, optimization of local employment, and return on investment scheme for units that have AMC status.

Of course, PLN NP needs support from PLN to be able to carry out direct appointment schemes and limited auctions for routine O&M and O&M Support work. As a special concern that there needs to be rules related to the classification of O&M service work so that business processes run smoothly. In addition, this STARSHIP strategy can also be applied in all PLN Group O&M service units and in general

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