STRATEGIC ANALYSIS OF ESTABLISHING AN AIRCRAFT ENGINE MRO: A FEASIBILITY STUDY IN THE INDONESIAN AVIATION MARKET

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Abstract

As a rapidly growing sector, the aviation market is highly open to development. Maintenance, particularly for major components like engines, is crucial and must comply with regulations. Establishing an Engine MRO facility shows a promising opportunity in the aviation sector. With over 640 commercial aircraft operating daily in Indonesia, the demand for engine maintenance and overhaul is increasing. However, limited local MRO capacity and capability force airlines or aircraft owners to outsource maintenance to foreign facilities, leading to higher costs, time, and logistical complexity. This study employs the I/O Model to analyze the feasibility of establishing a new local Engine MRO facility in Indonesia. The research utilizes industry, general environment, and competitor analyses, supported by market segmentation, to identify opportunities opening new engine MRO in Indonesia, resulting in a niche, growing market for the LEAP engine series capabilities. However, the study is highlighting the high initial investment required. Internal capabilities include skilled personnel, specialized tools, facilities, and strategic partnerships with suppliers or authorities. The implementation plan outlines five phases, from preliminary setup to long-term sustained growth. The study concludes that establishing a new Engine MRO in Indonesia can address demand gaps, reduce reliance on foreign facilities, and strengthen Indonesia's aviation industry. Recommendations focus on non-financial investments, including human resource development, lean operations, and adopting advanced technology.

Keywords: Feasibility Study, I/O Model, Engine MRO, Porter Five Forces, PESTEL, Market Segmentation

INTRODUCTION

Aircraft Maintenance is one of the most important activities for airline operators. Maintenance costs can cover almost 10-20% of the overall operation cost (Shaukat et al., 2020). The highest portion for maintenance comes from the major part overhaul, such as the Engine, Auxiliary Power Unit (APU), and Landing Gear. An aircraft's engine is crucial to its operation, and any malfunction could result in a catastrophic accident (Fu et al., 2013)

Therefore, airlines or engine's owner must ensure that their engines are well-maintained, particularly during major maintenance or overhaul procedures. Indonesia currently possesses a diverse range of aircraft with various types of aircraft engines (Cirium Data, 2024). However, the capacity for engine overhaul, which requires an engine shop or Maintenance, Repair, and Overhaul (MRO) facility in Indonesia, is quite limited. The famous available options for engine servicing are GMF AeroAsia in Jakarta and ST Engineering Aerospace Engine in Singapore. Each MRO facility also offers different capabilities such as engine overhaul and component repair.

The demand for engine shop facilities is wide open in the Indonesian market. With 640+ aircraft registered in Indonesia (Cirium Data, 2024) and limited engine shop capabilities domestically, the market for engine overhaul activities has shifted abroad to countries like Singapore and Malaysia.

In conclusion, a large amount of operating costs for airlines is incurred by aircraft maintenance, especially engine overhaul. Despite having a variety of aircraft, Indonesia does not have sufficient Engine shops or MROs with engine overhaul capability. The need for engine maintenance services is high given the nation's fleet of approximately 640 aircraft. Currently, facilities overseas—most notably in Singapore and Malaysia—meet this demand. Therefore, building up local capacity is imperative to meet this demand and take advantage of Indonesia's aviation sector's growth.

With the number of commercial aircraft engines exceeding 1,200 units, the demand for engine overhauls following regulations will surge. With an average Time Between Overhaul (TBO) of 3,000-6,000 flight hours (FH), each engine will require an overhaul approximately every 2-3 years, meaning around 400 engines will need overhauls annually. The demand for engine overhauls far exceeds the available MRO capabilities in Indonesia,

leading most airlines or aircraft engine owners to send their engines to MRO facilities abroad. Another challenge is that engine owners need to consider longer lead times due to the transport time for the engines and the need to arrange temporary customs clearance with customs authorities for sending engines overseas and bringing them back into the country.

This study will evaluate factors such as current market demand, target segments, and other considerations ensuring that the new engine MRO feasible. The research is collaborating with PT JKL, a consulting aviation firm specializing in aircraft and technical solutions, with detailed on expertise in qualitative resource data.

REVIEW OF LITERATURE

Industrial Organization Model

In general, in the process of choosing a strategy, a company or firm has to consider both the internal and external environment that might affect its decision. Although the Industrial Organization Model (I/O Model) theory claims that the organization's strategic actions are more strongly influenced by the external environment (Hanson, 2021). This external environment, more specifically, can be determined as the industry or segment that firms choose to compete in. Because of these statements, companies focus on the examination of external factors when they want to change or develop something in the company.

External Analysis

External analysis is used to understand that the competitive landscape—signified by the number of competitors, product differentiation, barriers to entry, and market size—influences how firms behave within an industry (e.g., pricing, advertising, research and development), which in turn determines overall market outcomes, such as profitability and efficiency. A crucial tool for analysis within the I/O Model is Michael Porter's Five Forces Framework (The Five Forces, 2023) which assesses competitive forces shaping industry attractiveness and potential profitability, including the power wielded by suppliers and buyers, the threat posed by new entrants and substitute products, and the intensity of competitive rivalry.

According to Gorjian Khanzad (2021), small businesses need to have flexibility in order to survive in an environment that is constantly changing. They can anticipate potential risks and challenges by analyzing important external factors utilizing the PESTEL framework.

Business Market

Every company that purchases goods and services to be utilized in the creation of additional goods or services that are rented, sold, or provided to third parties implies up the business market. The business market, also known as the business-to-business market, is occupied by any company that provides product components. The business market is composed of several major industries, including aerospace, computer, construction, energy, mining, public utilities, distribution, and services (Kotler, 2015).

Market Analysis

According to Kotler (2015), business marketers usually follow a two-stage process to identify and target segments, which are Macrosegmentation and Microsegmentation. The macrosegmentation phase entails classifying the market into broad categories and ranking the most desirable market segments according to important factors, including product applications and end-use markets. Then, the microsegmentation phase entails more precise divisions according to particular standards, such as purchasing standards (cost, quality, and service). This facilitates concentrating on particular markets that complement the company's competencies and strengths.

Internal Resource Analysis

After defining the demand and market, the next critical step for the company in establishing an Aircraft Engine MRO Service is to conduct a thorough assessment of the internal resources required. This involves identifying both tangible and intangible resources—categories typically divided by researchers (Jancenelle, 2021) when analyzing firm assets—and comparing them with the projected resource needs (resource forecasting) to ensure the company is adequately prepared.

RESEARCH METHOD

This research design process begins with an external analysis and parallels with engine overhaul maintenance demand. Then the process continues with strategic definition and internal analysis, with the last step to create an implementation plan for the new engine MRO.

The data collection method is derived from two main sources – Primary Data and Secondary Data. Primary data is obtained through interviews with experts in the aircraft business and aircraft engine domains. The interviewees are the CEO, COO, and Technical Expert from PT JKL, which has already been in the aviation industry for more than 10 years. Secondary Data includes detailed information about aircraft and aircraft engines owned by Indonesian operators, data on MROs with the capability to perform Aircraft Engine Shop Services, average ranges for Aircraft Engine Shop Visits (categorized by engine type), Indonesia's aviation growth, and other supporting data. The source of secondary data is from Cirium Data, IBA Aero Reports, and other aviation reports available.

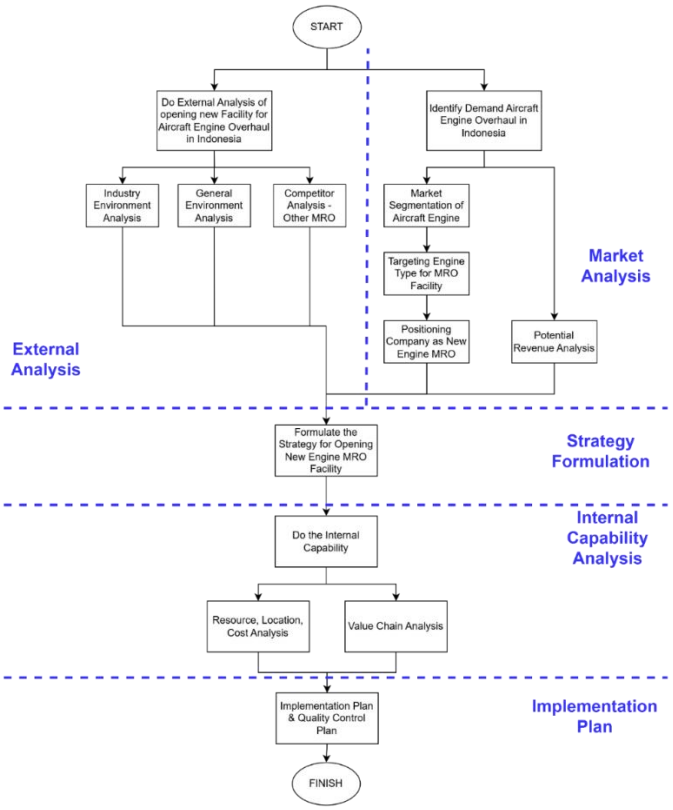

Figure 1.
Research Design

The analysis will be conducted by qualitative and quantitative data analysis methods. These two methods are used to provide a comprehensive strategy. With these methods, the quantitative information obtained from market statistics and other sources is combined with the qualitative insights obtained from expert interviews sourced from PT JKL's CEO, COO, and their Technical Expert. By combining various data sources, a thorough foundation for strategic analysis is created, with the plan is informed by facts and takes into account industry knowledge. At the end of the research, an implementation plan is created using the analysis results as a basis. The actions required to match the company's resources with the strategic goals are outlined in this plan, which guarantees that the business is ready to successfully execute the engine overhaul MRO service.

RESULTS AND DISCUSSION

External Analysis

The external analysis is held by using Porter's five forces as the industry environment analysis, PESTEL as the general environment analysis, and competitor analysis. The five forces analysis found that the competitive advantage is slightly higher than the drawbacks. The threat of new entrants is low due to the complexity of compliance with regulations, such as CASR 145 certification, the need for DGCA-approved manuals, and significant initial capital investments. For instance, recruiting experts with prior Engine MRO experience incurs high costs but helps build trust (COO PT JKL Interview, 2024). The bargaining power of suppliers is moderate because parts and materials are controlled by a few OEMs like Rolls-Royce and GE Aviation, though bulk purchasing can reduce costs (CEO PT JLK Interview, 2024). However, the limited availability of licensed personnel increases competition, with MROs offering higher salaries to attract talent. The bargaining power of buyers is moderate to high as airlines and leasing firms choose MROs based on cost, quality, expertise, and fast lead time (Technical Expert PT JKL Interview, 2024). Dissatisfied customers may switch providers but often agree to terms if availability and quality are met. The threat of substitute services is low since there are no alternatives to engine overhaul services, which are essential for compliance and safety. Competitive rivalry is high, with established local players like

GMF AeroAsia and NTP, alongside regional competitors like ST Aerospace in Singapore, increasing competition for local providers (Technical Expert PT JKL Interview, 2024).

On the general environment analysis, Indonesia's political landscape, with elections every five years and shifting government policies, creates uncertainty for long-term Engine MRO planning (COO PT JKL Interview, 2024). Monopolistic practices by OEMs like Pratt & Whitney further restrict opportunities for new entrants, compelling MROs to explore alternative markets. From an economic perspective, Engine MROs contribute to Indonesia's GDP and employment but face challenges such as fluctuating currency exchange rates that impact imports and transactions (Trading Economics, 2024). However, growing aircraft numbers and increasing demand for Engine MRO services provide a strong foundation for industry growth. On the social side, public trust in aviation safety and maintenance standards is essential, and local Engine MROs enhance efficiency by reducing downtime and enabling faster aircraft servicing, leading to better customer satisfaction (COO PT JKL Interview, 2024). From a technological standpoint, advanced tools like predictive maintenance, NDT equipment, and 3D printing for the production of engine components (Bassett, K., 2015) significantly improve MRO efficiency but require considerable investment, which is vital for maintaining competitiveness. Regarding environmental factors, regulations like AMDAL and carbon pricing policies enforce sustainable practices, ensuring compliance with both local laws, UU no. 32 of 2009, Permen LHK No. 4 of 2021, and PP No. 98 of 2021, and international standards. Lastly, the legal requirements for Engine MROs include meeting licensing standards from DGCA, FAA, and EASA to attract international clients. High corporate taxes and VAT rates (PWC, 2024) challenge competitiveness, making service quality and efficient customs management critical to minimizing delays and operational costs.

For the competitor analysis, a sizable percentage—63.7%—of the engines owned/operated by Indonesian airlines or operators are not currently covered by contracts for engine overhauls. This indicates that most operators are maintaining their engines in other MROs without a formal agreement. Contracts, which most likely entail long-term agreements with Maintenance, Repair, and Overhaul (MRO) service providers, cover only 36.3% of the engines.

The engine overhaul capability is primarily dominated by engines manufactured by CFM International. This dominance highlights the importance of considering the engine population in this study. Although the capability for servicing CFM engines is extensive, there are instances where MROs face capacity constraints and become overloaded, preventing them from accepting additional engines for overhaul (Technical Expert Interview, 2024).

Market Segmentation

The commercial aircraft engine population in Indonesia is segmented into three categories based on engine quantity: high population engines (200+ engines), such as CFM56-7B and PW127, dominate due to their use in frequent domestic and regional flights. Moderate population engines (40-200 engines), like the V2527 and Trent 772, serve long-haul and high-capacity flights. Low population engines (<40 engines), including Trent 7000 and LEAP Series, cater to specialized or newer aircraft.

Engine types include turboprop engines for short routes, turbofan engines for high-speed and altitude efficiency, turboshaft engines for helicopters, and piston engines for simpler applications.

Aircraft engine generations are divided into current generation engines, like CFM56 and V2500, and new generation engines, like LEAP Series and Trent 7000, offering advanced designs and fuel efficiency.

Market Targeting

Despite growing demand for LEAP engines, Indonesia lacks domestic facilities for LEAP engine overhauls, leading to reliance on foreign services that increase costs and turnaround times. Establishing a local MRO facility specializing in LEAP engines would meet rising demand, reduce dependency on international services, and align with the nation's aviation sector needs.

Market Positioning

Positioning for LEAP engine MRO services should focus on cost-effectiveness, high-quality maintenance, and fast turnaround times to attract low-cost carriers and regional airlines. Providing comprehensive solutions from inspections to overhauls positions the MRO provider as a reliable choice for Indonesia's aviation market.

Potential Revenue Analysis

Projected revenue growth is substantial, rising from $8M in year one to $34.4M by year 16, with further potential as more engines are serviced. This consistent growth demonstrates strong market demand and investment attractiveness.

Financial Feasibility Study

The Engine MRO industry promises long-term profitability, with positive cash flow and NPV from year 13, supported by a payback period of 11.03 years and a discounted payback period of 13.58 years. These indicators highlight significant financial feasibility and investor appeal in the growing aviation sector.

Internal Analysis

In establishing an Engine MRO, the company faces challenges with both tangible and intangible resources. Financially, the company cannot handle the high initial investment alone and must seek investors, pursue a joint venture, or secure a bank loan. Positive net cash flow is anticipated by the ninth year. Regarding physical assets, the current facilities are inadequate for Engine MRO requirements, necessitating the purchase or rental of appropriate facilities and equipment. A location near Soekarno-Hatta International Airport, close to the company's South Tangerang office, would be advantageous for logistics and transportation. On the intangible side, the company has limited technical expertise in aircraft engines and will need to hire skilled engineers and mechanics. Existing support personnel for marketing, operations, and finance are adequate, though additional hires may be needed to manage workload effectively. The company has a strong reputation in technical support and engineering planning, with a reliable client base for Borescope Inspection. However, stronger relationships with engine OEMs are required to secure licenses, manuals, and specific spare parts essential for comprehensive engine maintenance.

Business Solution: Strategic Formulation

Financial Planning Strategic

Establishing a New Engine MRO is not an easy task. The huge investment at the beginning of building it is something to focus on first. There are some options for preparing this huge investment.

1) Debt to Bank (can be collaborated with other strategies)

2) Joint Venture (JV) with the OEM
3) Joint Venture (JV) with Big Operator
4) Joint Venture (JV) with Indonesia's Government
5) Acquisition Small Engine MRO (can collaborate with other strategies)

Operational Efficiency

To enhance operational efficiency, focus should be placed on process streamlining, advanced technology integration, and facility location optimisation. Implementing ERP and other systems will synchronise supply chain management, inventory monitoring, and resource distribution, providing a smooth operational flow. Implementing lean principles can reduce waste, especially in maintenance processes, resulting in cost reductions and enhanced turnaround times.

Human Resource Development

Developing a skilled and capable team is essential for the success of an Engine MRO business. Recruitment initiatives must focus on certified engineers and mechanics experienced in servicing particular engine models, such as the CFM56 or LEAP series. Collaborations with OEMs for training initiatives will enhance technical expertise and guarantee compliance with international standards, including FAA and EASA certifications.

Focused Marketing Strategy

As a reliable and effective service provider in the competitive aircraft industry, Engine MRO will become known for its focused marketing plan. Attention should be directed towards the LEAP Series engines, which are now witnessing sustained growth in Indonesia. Marketing campaigns should highlight economic advantages, quicker turnaround times, and superior quality services offered by a local MRO facility relative to overseas options.

Implementation Plan & Justification

Over 20 years, the implementation plan for a new Engine MRO plant is built using a focus on guaranteeing steady development and market competitiveness. The plan starts with basic operations, including facility building, equipment purchase, and first regulatory certifications, along with moves to market entrance, where targeted marketing and relationship building lay the groundwork for acquiring consumers. With a greater variety of activities, the objective shifts to increasing operational efficiency and thus expanding service

capacities and capabilities utilizing improvement. While looking at global market possibilities, the main focus of the mature period is on increasing profitability and client loyalty. In the end, innovation, technology integration, and service diversification promote constant development, therefore supporting the MRO's leadership in engine maintenance and repair in the aviation sector.

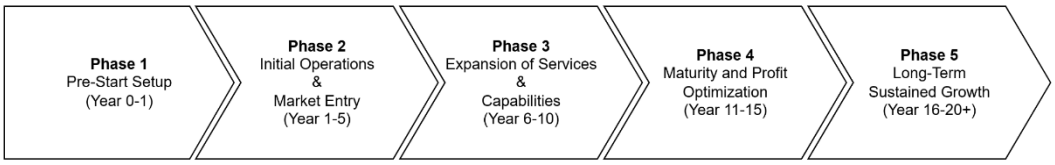

Figure 2.
Implementation Plan Phases

A. Phase 1: Preliminary Setup (Year 0-1)

Establishing the foundation for the MRO facility comes first in this phase. A strategically desirable site near a big airport will be selected. Facility design and construction will offer careful consideration to effective engine maintenance procedures. An engine test cell, non-destructive testing tools, and borescope devices are some of the important things that will be bought. Starting to guarantee compliance with aviation standards is the certification process with the FAA, EASA, and DGCA. To meet operational and legal criteria, qualified people—that is, engineers and mechanics—will be hired and trained.

B. Phase 2: Initial Operations & Market Penetration (Year 1-5)

This stage is focused on starting activities and building a market presence. Starting basic engine inspection, repair, and maintenance services for particular models, including LEAP 1-A and LEAP 1-B. Under industry events, contacts, and digital platforms, marketing campaigns will concentrate on airlines, engine lessors, and regional operators. To procure components and technical assistance, partnerships with OEMs and vendors will be established. Post-sale support and warranty services will be used to inspire customer loyalty and improve the MRO's reputation.

C. Phase 3: Expansion of Services & Capabilities (Year 6-10)

The MRO will increase its technical competencies and service offers in this phase. Along with innovative approaches like predictive maintenance and IoT-based monitoring, maintenance services will extend to encompass other engine maintenance, including

component repair. Expansions of facilities will allow for higher demand through ways that involve costs in comprehensive testing and storage enhancements. New certifications will be acquired to guarantee compliance with evolving industry criteria. Efforts will focus on keeping present customers utilizing relationship management and attracting new business via tailored maintenance packages.

D. Phase 4: Maturity and Profit Optimization (Year 11-15)

This stage seeks to increase operational effectiveness and profitability. Lean concepts will be applied to streamline processes, and stronger supplier agreements will help to reach cost reductions. Using discounts and priority services, customer loyalty programs will help to build ongoing confidence. Data analytics will improve services quality and maintenance plans. Expansion of the international market will be explored for by means of alliances or other facilities in areas with notable demand.

E. Phase 5: Long-Term Sustained Growth (Year 16-20+)

The last phase highlights ongoing development and creativity. To keep competitive, emerging technologies such as 3D printing and artificial intelligence diagnosis will be applied. Energy-efficient tools and ecologically friendly behaviour constitute part of sustainability initiatives. Expanding partnerships with OEMs and airlines can help to get special resources and projects. Diversification into companies like component maintenance, part manufacturing, and consulting services will create fresh income sources. Constant evaluation of market prospects and possible development into the larger APAC region will ensure a steady increase.

CONCLUSION

Current Demand for Engine Overhaul Services in Indonesia

The demand for engine overhauls in Indonesia is shown by the total number of aircraft engines currently operating in the country. The large number of around 640 commercial aircraft in Indonesia indicates an increasing demand for engine overhaul services, as these are standard maintenance procedures. This demand can be seen by the fact that the average number of engines per aircraft is generally twice the number of aircraft.

However, Indonesia's current Engine MRO facilities are limited and are lacking in the capacity to fulfill the total demand for engine services. This shortage forces engine owners, including airlines and engine lessors, to utilize overseas MRO facilities. Depending on overseas facilities raises costs and requires additional administrative obligations, such as temporary customs, compared with utilizing domestic Engine MRO capabilities. The increasing demand for aviation engine overhauls, in combination with limited local capacity, highlights an urgent demand for growing Engine MRO services in Indonesia.

Target Segments and Strategies for Market Share Growth

Since this younger engine type is likely to expand in the next years, the LEAP engine family is the key target area for engine overhaul services in Indonesia. The most frequently utilised narrowbody aircraft in Indonesia run on LEAP 1A and 1B engines found in Boeing 737 Max and the newest A320 variants. Airlines often like newer technology aircraft, and given engine MRO planning is expected to last several decades, demand for services tailored to the LEAP engine family fits very nicely with market needs.

The business should give competitive prices, excellent service as its top priority to properly capture and serve these segments, as well as develop close ties with possible customers. Customised services addressing certain operational requirements will raise client satisfaction. The company can raise client satisfaction and grow its market share by concentrating on present clients and others with like needs and offering tailored solutions.

Operational and Financial Considerations

Starting a new Engine MRO with a specific engine overhaul capacity will demand a large initial cost. The first outlay includes building and preparing the facility, tool and equipment purchases, licence fees, and—above all—the costs of hiring skilled employees to maximise service performance. Entering this sector depends on effective cost control and finding trustworthy finance sources—loans, joint ventures with OEMs, or government agency partnerships, among other things. The financial projections show a good cash flow starting in the thirteenth year, therefore stressing the long-term profitability of the MRO and the importance of smart financial planning in the first phase.

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