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Implementation of Life Cycle Costing on Airline Industry (Case Study of XYZ Airline in Indonesia)

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Abstract

The airline operating cost may vary along the operation time of the aircraft. This cost fluctuation should be taken as consideration for the decision-making process, for instance, the pricing calculation. A poor costing might distort pricing leading to a loss of business. A long-term oriented cost calculation to forecast the total cost of aircraft during the operation time is critical for the airline company. This research will study whether the life cycle cost analysis is fit for airline company with an emphasis on maintenance and disposal or aircraft redelivery cost and focus on aircraft operating lease context. It uses a case study framework on an airline in Indonesia with the interview and documentation analysis as the main research method. The life cycle cost is found to be fit for the airline company with activity-based life-cycle costing as the applicative model. The research presents an approach that provides a long-term oriented costing that is needed for management decision.

Keywords: life cycle costing, airline operating cost

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1. Introduction

The airline industry has well-known as a high cost, high risk, and low-profit business. The airline business was one that required a large amount of capital but had a few percentages of profit. Some of the risks in airline businesses are highly affected by oil prices, susceptible to economic downturns, and competition from low-cost carriers. Fuel cost is the major cost on the airline business, a small increase in fuel price could trigger a very significant increase in the cost of each trip. As the business is very sensitive to the economic situation, it vulnerable to economic downturns. The number of people who made business trips and holidays decreases during the economic crisis and this condition, of course, can provide a significant impact on the profitability of airline companies. The emerging of low-cost carriers has increased the competition to gain market share.

The airline cost may vary along the operation time, for example, aircraft maintenance cost. As the aircraft ages, the number of scheduled maintenance task becomes higher and the probability of unscheduled maintenance item also becomes higher. The aircraft maintenance costs represent on average of 14% of the variable costs incurred by airlines (Sriram, 2003). This number is important to be managed and calculated by the airline. The cost variation during the aircraft operation time should be monitored and considered for the decision-making, for instance, the pricing calculation. Therefore, accurate airline cost calculation is important in this situation, a poor calculation might distort pricing leading to a loss of business.

Several methodologies to calculate the cost is available such as traditional costing, activity-based costing, and life-cycle cost analysis. Activity-based costing is more complex and more accurate than traditional costing. However, this method doesn't include the cost activities take place in the future such a major overhaul of airframe, engine, APU, landing gear, and the redelivery cost of operating lease aircraft. Life cycle costing is described as the total costs that are incurred, or may be incurred, in all stages of the products life cycle (Emblemsvåg, 2003). It calculates all the acquisition cost, operational cost including maintenance cost, and disposal cost. This method should provide a more stable cost calculation on each period and less impact on the fluctuation of the product's price. Unlike the operational cost item that occurred similarly on each period, maintenance cost item is quite different. The maintenance task could be different on each period depend on the scheduled and unscheduled maintenance program. More attention is needed on operating lease scheme because there are several requirements on the lease agreement that has an implication on the total cost. Maintenance reserve contribution called as lessee contribution and aircraft redelivery condition are lessee's obligation according to the lease agreement that could impact the total cost of the aircraft significantly.

This research will study whether the life cycle cost analysis is fit for airline company with an emphasis on maintenance and disposal or aircraft redelivery cost and focus on aircraft operating lease context. It uses a case study framework with an airline company in Indonesia. In the practical world, the study should provide positive feedback to the company for providing cost information to the management and a reference for decision making. In the world of knowledge, this study provides concept development and application of costing methodology especially on airline industry with aircraft operating lease context.

2. Literature Review

There are limited papers that presenting about costing in the airline sector. One paper that describes the activity-based costing methodology in the airline sector is Tsai (2004). While there are several papers describing life cycle costing (LCC) methodology, but again it is very hard to find papers with case studies presenting LCC in use for aircraft and airline business. Adapting the model from other business is the way to develop the model for the airline business. This research provides additional study of costing implementation especially on airline business using the life cycle costing methodology.

The life cycle cost is often referred to as the sum of all costs incurred during an asset's useful life and allows for a more appropriate cost-benefit analysis. This method assists in the reduction of the total cost of a product, identification of high-cost components in a product's lifecycle, and comparison of competing products (Kara, 2017). LCC is a concept which aims to optimize the total costs of asset ownership, by identifying and quantifying all the significant net expenditures arising during the ownership of an asset (Woodward, 1997). The analysis shows that the instrument is particularly appropriate for firms that have an interest in the identification of cost drivers and other goals for which the impact of LCC is evaluated positively (Knauer, 2018).

Knauer (2018) demonstrate the practical relevance of LCC for long-term oriented, multi-period cost analyses. With respect to the impact of LCC on the achievement of cost-management goals, firms evaluate the instrument positively on average. Firms report that LCC is a beneficial instrument to support the achievement of certain cognition- and result-oriented cost management goals. Firms perceive that the greatest benefits of LCC are related to the identification of cost drivers, the improvement of decision-relevant information and the improvement of cost transparency.

Kaufman (1970) has provided one of the most original contributions ever to the body of LCC knowledge, whereby he developed a formulation based on the eight-step approaches: establish the operating profile; establish the utilization factors; identify all the cost elements; determine the critical cost parameters; calculate all costs at current prices; escalate current costs at assumed inflation rates; discount all costs to the base period; sum discounted costs to establish the net present value.

While most of the authors recognize the need for an LCC model, the models developed are, however, restricted to specific processes, simple operations or one phase of the life cycle. The costing models only focus on estimating product costs for a particular stage of a product life cycle, e.g. manufacturing cost. They cannot be applied to other stages of product life cycle to calculate the entire product life cycle cost (Xu et al. 2006).

There is no single life cycle cost model which has been accepted as a standard and being used widely. There could be several reasons for this such as the nature of the problem, existence of different cost collection systems, many different types of systems and the inclination of user (Dhillon 1989).

Life cycle modelling requires the easy collection of an immense amount of information on the different stages of the process life cycle, so that it is impossible to produce vast amounts of measurement data due to the restrictions of the resource reserved for the report. Thus, life cycle assessment also uses estimated, calculated and literature-based information (Soukka, 2007). Bengtsson (2016) on the research of life cycle cost or total cost of ownership analysis on machining equipment in a Swedish company, used the historic maintenance and operational data of same and similar machines to estimate (stochastic) costs. Cost history has been the foundation for estimation of the future costs. LCC is concerned with optimizing value for money in the ownership of physical assets, but its achievement depends upon the supply of accurate, relevant and speedy information (Woodward, 1997).

Adopting the model from previous research, for a typical aircraft, the LCC can be defined as (Kara, 2017):

$$\textit{Total LCC} = \textit{acquisition cost} + \sum_{i=1}^{n} (\textit{operating cost for a given year}_i + \textit{scheduled maintenance Cost}_i + \textit{unscheduled Maintenance cost}_i) + \textit{aircraft disposal cost or redelivery cost}$$

The initial capital costs or acquisition cost can be divided into three subcategories of cost, namely purchase costs; acquisition/finance costs; installation/ commissioning/training costs. The operating costs of an asset would include direct labor, direct materials, direct expenses, indirect labor, indirect materials and establishment costs. Maintenance costs include direct labor, materials, fuel power, equipment and purchased services. Maintenance costs can normally be broken down into smaller classifications such as regular planned maintenance; unplanned maintenance (responding to faults); intermittent maintenance for major life refurbishment (Woodward, 1997).

The maintenance and repair cost expected over the life of a repairable system depends on the time spent in restoring the system to fully working condition after failure, the number of failures likely to be observed over the life of the system and the costs incurred per failure instance. When the product fails in the field, the cost is not limited to the cost of repair or replacement, it may also need to include the money lost because the product is out of service being repaired or replaced (Waghmode, 2012).

Disposal cost is the cost incurred at the end of an asset's working life in disposing of the asset. The disposal cost would include the cost of demolition, scrapping or selling

the asset, adjusted for any tax allowance or charge upon resale. Such costs would be deducted from the residual value of the asset at the end of its useful life (Waghmode, 2012).

3. Methodology

The research uses a descriptive comparative method which describes the current company's costing model and compares it with life-cycle cost analysis. As discussed in the introduction that the research will use a case study framework on an airline company in Indonesia. The scope is limited to the aircraft operating lease scheme with emphasis on aircraft maintenance and disposal or redelivery cost.

In the research model, the steps taken within this research are shown in Figure 1. The steps are literature study, interview, and documentation analysis. The results from the literature study serve as input to conduct the interviews. While the documentation analysis provides an additional justification (method triangulation) of the interview outcomes.

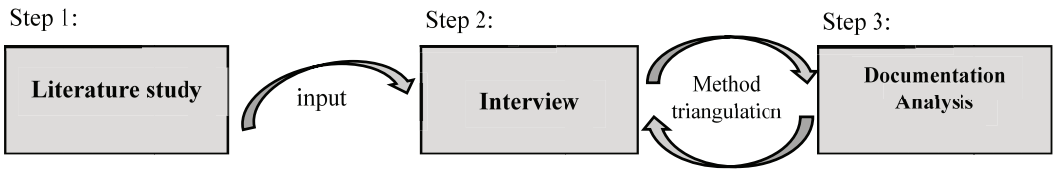

Figure 1: Research model.

A type of in-depth interview was conducted with the key respondents. Before the interviews, the important questions were established and listed in the questionnaires. The semi-structured and face-to-face interview technique was chosen by the researcher because this technique provides both guidance and flexibility over the interviews process. The documentation analysis is conducted to get the reliable result. The example of documents used is internal business procedure, lease agreement summary, planning of maintenance event, financial report, and another business document. Figure 2 shows the correlation between the information and data from each key respondent to answer each research objectives.

The company in this case study is airlines in Indonesia. The airline provides service to domestic and international passenger. The airline operates several types of aircraft within its fleet.

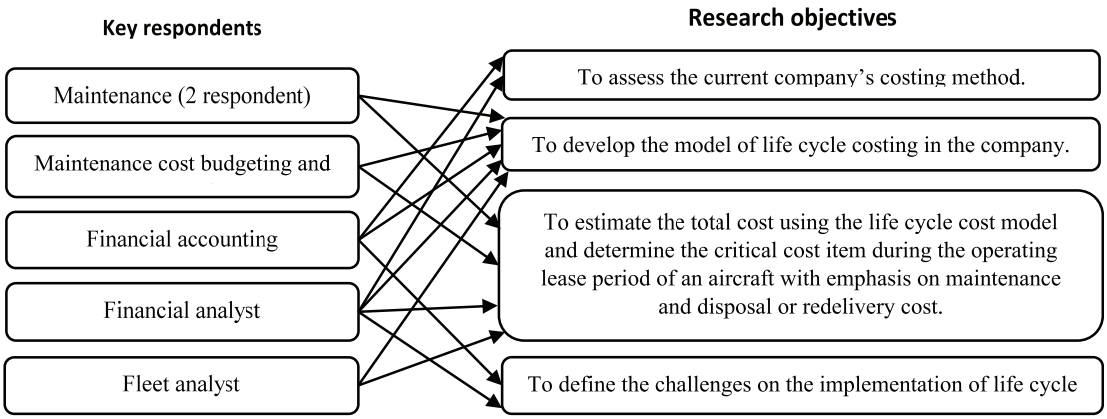

Figure 2: Key respondents and research objective correlation.

4. Analysis and Discussion

4.1. Assessment of Company's Costing Model

Based on the interview with the financial analyst respondent and the company's business process that was provided, currently, the company uses the activity-based costing on their costing model. The operating cost is classified into five categories, which are direct traffic cost, direct flight cost, fleet cost, indirect cost, and overhead cost. The cost objects are flight number and individual airplane.

According to the interview with the financial analyst respondent and the company's business process that was provided, currently the management accounting report uses financial accounting information and data as references. This has some implication, as we understand that financial accounting focuses on external reporting that is directed by authoritative guidelines and prescribed accounting principles. According to the interview with financial accounting respondent and document analysis (company's business procedure and PSAK), an example of the weakness is described on the following. Accounting policy for maintenance and repair cost item is divided into two categories, maintenance expense, and maintenance asset. The cost of major airframe inspection (major overhaul airframe) and major engine inspection (major overhaul engine) that occur at regular intervals over the useful life of the airframe and engine are meet the recognition criteria of an asset. Under an operating lease, the lessee does not recognize an asset at delivery, the major overhaul cost will only be capitalized and amortized after the major overhaul occurs. As we can see on Figure 3 below, there is no cost calculated from delivery date until the first overhaul event (first period), called maintenance holiday period. The depreciation cost is calculated from the OVH 1 until the OVH 2 (second period) and from the OVH 2 until the redelivery date (third period). The depreciation

cost per year in the third period become higher than the second period due to it has shorter depreciation period.

From the interview and document analysis as described above, the researcher can sum up that the current costing is not a long-term oriented, it is more focus on the short-term period. It doesn't consider the cost item that occur in the future of the aircraft operation. The condition described above become a limitation to fulfill the management accounting purposes, such as formulating overall strategies and long-range plans.

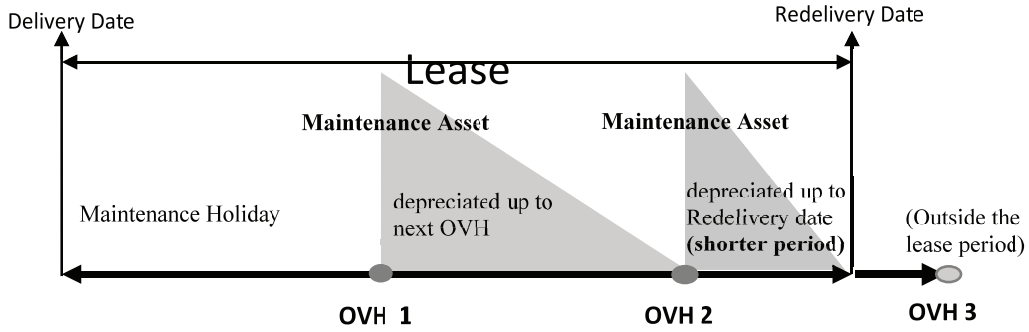

Figure 3: Maintenance asset and depreciation.

4.2. Life Cycle Costing

After assessment of the current costing model and the need for a long-term oriented model, now we will discuss the result of the life cycle cost analysis. Based on the literature review by adopting from previous research, for a typical aircraft the life cycle cost is the sum of the acquisition cost, operating cost, maintenance cost, aircraft disposal cost or redelivery cost. This concept becomes guidance for the interview of key respondents.

A financial analyst respondent provide the general information about cost item during the whole lease period, two respondent from maintenance expert provide the detail information about maintenance cost, a fleet analyst respondent provide the detail information about the redelivery cost, the financial accounting respondent provide the detail information about the accounting policies during the lease period, the maintenance cost budgeting and control expert provide the triangulation of source. The following are the detailed result of cost item during the lease period.

4.2.1. Acquisition cost

Acquisition cost for purchase aircraft is the sum of purchase cost, delivery cost, bridging cost, and initial training cost. The purchase cost is the price of the aircraft, brand new

aircraft or used aircraft. The delivery cost is all cost relate to delivery flight from the manufacturer or seller location to the buyer location such as fuel cost, crew cost, handling cost, and landing fee. Bridging cost includes all activities to make the aircraft comply with operator requirement or local regulation. Operator requirement such as aircraft livery painting, replacement of seat cover and carpet as operator's standard, etc. A regulatory requirement such as cost for application certificate of registration and certificate of airworthiness, radio permit, and other requirements as per regulation. Initial training cost includes training for the cockpit, maintenance, cabin, and dispatcher.

4.2.2. Operational cost

The operational cost of the aircraft would include direct labor, direct materials, direct expenses, indirect labor, and indirect materials. Four groups of cost on the operational cost are traffic cost, flight cost, salary & training cost, fleet cost, and overhead cost.

4.2.3. Maintenance cost

Five groups of cost on the maintenance cost are airframe maintenance cost, engine maintenance cost, auxiliary power unit (APU) maintenance cost, landing gear maintenance cost, and component maintenance cost.

4.2.4. Redelivery cost

Redelivery cost has a similarity with the maintenance cost. It doesn't occur on each period like the operational cost item, it only occurs on the final phase of the lease period. Return compensation and redelivery condition are the main factors on redelivery cost. Return compensation by means of maintenance reserves is a key tool for the lessor to protect asset value (aircraft). The other lessor's way to mitigate the risk of decreasing aircraft value is by contractually agreed delivery and redelivery conditions.

As we can see on Figure 4, the lessee must pay maintenance reserve start on the delivery date until OVH 1. Then lessee could claim the amount of maintenance reserve on after accomplishment of OVH 1. The lessee must pay again the maintenance reserve until OVH 2 and make a claim after the accomplishment of OVH 2. The issue arises when the OVH 3 due outside the lease period. The lessee must pay the maintenance reserve until redelivery date and the amount of maintenance reserve belong to aircraft (lessor). This is called a return compensation cost or lessee contribution.

There are many specific redelivery conditions mentioned on the lease agreement to provide security on the financer/owner/lessor side. For instance, specific work scope should be done by the lessee in order to comply with the redelivery requirement, the remaining engine hours and cycle at specific value as stated in the contractual agreement, etc. To comply with all the redelivery requirement, the lessee should perform redelivery maintenance check with higher cost compare to regular maintenance check.

Another cost during the redelivery process that needs to be calculated is lease rent. According to historical data, the average time to accomplish the redelivery process was about 2 months. It is mean that the aircraft is grounded for 2 months without flying (no revenue) but still paying the lease rent. The lease cost during the redelivery process should be calculated on the life cycle costing.

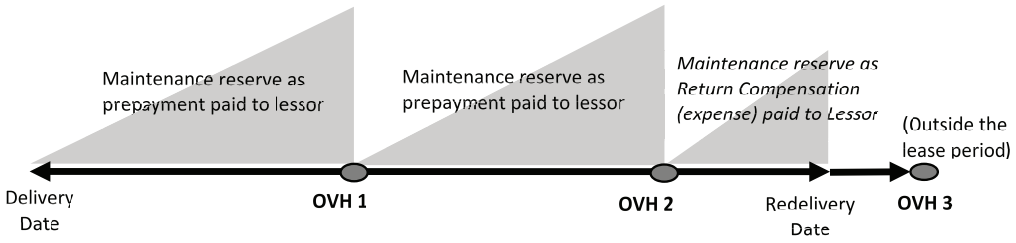

Figure 4: Maintenance reserve scheme.

4.2.5. Life cycle cost model

According to the interview result and document analysis, as described above, the life cycle cost model of operating lease aircraft can be seen in table 1 below.

4.3. Case Product Calculation

The case product calculation is accomplished using the data collected from the company. As explained before that the research will emphasis on maintenance and redelivery cost, only both cost items will be calculated. The researcher will calculate the life cycle cost of an aircraft start from the delivery date until redelivery date (twelve years of lease period). The number shown below is only for illustration, it has been adjusted from the original number due to confidential reason. Again, the main purposes are to provide a better perspective of the differences of the current costing model and life cycle model.

Figure 5 shows the maintenance & redelivery cost per year as a percentage of the total maintenance & redelivery cost for 12 years lease period. The current costing method

Table 1: Life cycle cost model

Hierarchy 1	Hierarchy 2	Hierarchy 3
Acquisition cost	Delivery cost	
	Bridging cost	
	Initial training cost	
Operating Cost	Traffic cost	Commission Onboard service Reservation Catering
	Flight cost	Fuel Landing Handling Air traffic control Travel & variable crew
	Salary & training cost	Cockpit crew Cabin crew Maintenance crew
	Fleet cost	Lease rent Insurance
	Overhead cost	Station Marketing Sales Administration Flight interruption
Maintenance cost	Airframe	Line maintenance Base maintenance
	Engine	Performance restoration LLP replacement
	APU	Performance restoration
	Landing Gear	Overhaul
	Component	Component shop visit
Redelivery cost	Return compensation cost	
	Redelivery maintenance check cost	
	Lease rent cost	

provides lower cost from year one until year seven compare to life-cycle cost method. However, the cost will increase starting on year eight until the end of the lease period on year 12 and the cost is higher compared to life-cycle cost method. Major engine overhaul depreciation cost and airframe structure inspection are the main contributors to the cost starting on year eight. Redelivery activity then contributes to the additional cost on year 12. As shown in Figure 6, the major cost items during the lease period are engine, line maintenance, component, and return compensation.

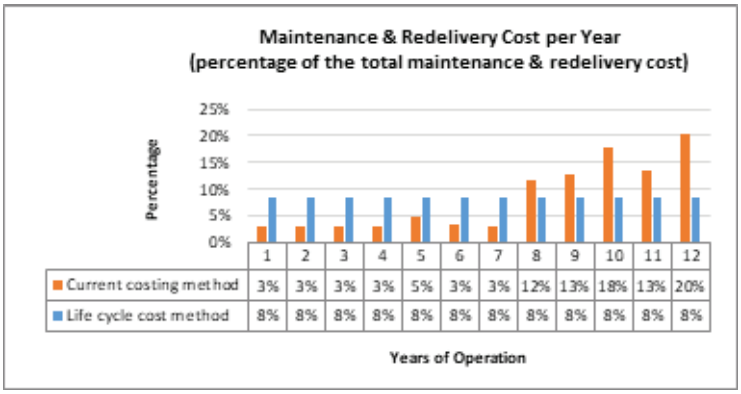

Figure 5: Maintenance & redelivery cost per year.

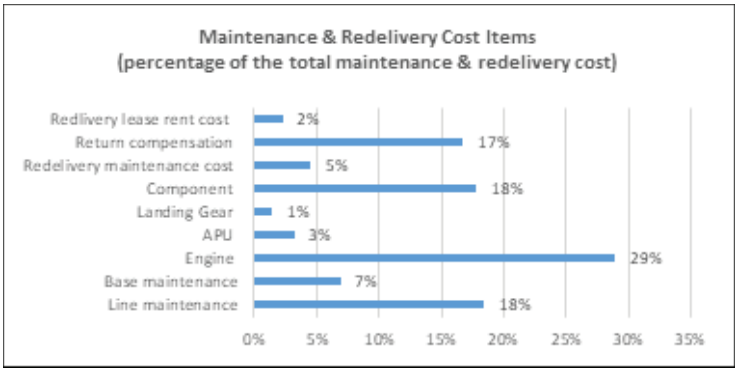

Figure 6: Maintenance & redelivery cost contribution of single aircraft.

Figure 7 shows the maintenance & redelivery cost per aircraft flight hour, the cost per aircraft flight hour using the life cycle model as a reference. We can see that the cost per flight hour using the current costing method is lower from year one until year seven compare to life-cycle cost method. However, the cost per flight hour increases significantly start from year eight until end of lease period. If the current costing method is used as a reference for pricing, then the product price is low at the beginning and increase significantly after year seven when the major overhaul of the engine, structural inspection, and redelivery occurs.

The life cycle cost method provides the life-cycle perspective and focuses on total costs during the life cycle of the aircraft. This method accommodates the long-term oriented cost calculation rather than the current costing method. The life cycle cost method provides a more stable cost per flight hour and less impact on the fluctuation of product pricing during the lease period. For the high competition of business, of course, the more stable cost and pricing are preferable than the fluctuated cost and pricing.

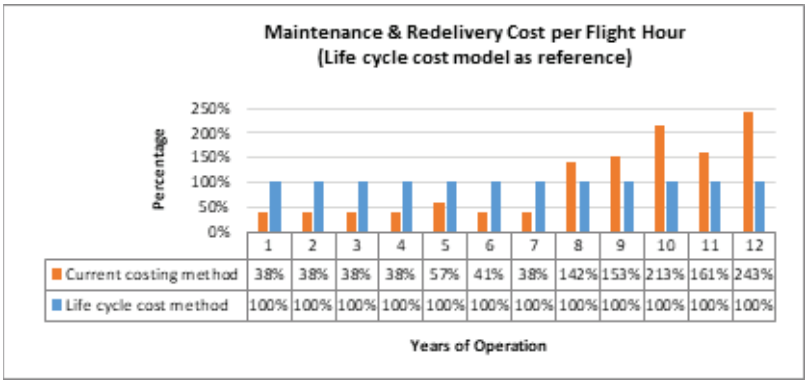

Figure 7: Maintenance & redelivery cost per flight hour.

4.4. Challenge for Implementation

Based on the interview with the respondent, there are several aspects that considered as challenges for the implementation of the life cycle costing in the company.

1. Firstly, about the model of life cycle costing. There was no available model that can be implemented by the company. This research provides and proposes the life cycle cost model to the company for the implementation of life cycle costing analysis.

2. Secondly about the data collection. In fact, that there is no single part of the company that is responsible for collecting and aggregating the data related to the aircraft until the end of the lease period. The company needs to appoint a certain part of the company that has responsibility for collecting and aggregating the data related to the aircraft until the end of the lease period.

3. The third about the IT system used by the company on day to day basis. There should be no significant issue on this aspect due to the company currently use an IT system that commonly used by other company. Some adjustment on the system is possible to be done without significant additional cost.

4. The fourth is about the implication of cost calculation. The review of the life cycle costing implication should be done thoroughly. The cost calculation per flight number could be different compare to current costing method and this will affect the cost of goods sold and finally pricing. Moreover, it also affects the budget. In the airline business especially for operating lease aircraft, life-cycle budgeted costs indicate the costs to be incurred over the lease period of the aircraft and can provide important information for pricing decisions. To be profitable, the company must generate revenues to cover costs in all operation times. A product life-cycle

budget highlights the importance of setting prices and budgeting revenues to recover costs in all the lease period rather than costs in only some of a specific time period.

5. Conclusion

The current costing is more focus on the short-term period and doesn't consider the cost item that occur in the future of the aircraft operation. This provides a limitation to fulfill the management accounting purposes, such as formulating overall strategies, long-range plans, and pricing. A long-term oriented costing that includes historical, current information, and expected future performance and activities is needed. The model of life cycle costing has been developed according to the interview result and documentation analysis. All cost item that included on the acquisition cost, operational cost, maintenance cost, and redelivery cost is constructed the life cycle cost model. With the emphasis on aircraft maintenance and disposal or redelivery cost, the case product calculation shows that the life cycle cost method provides the more stable cost per flight hour during the lease period. This is preferable for the business compared to the fluctuated cost and pricing resulted from current costing method. Several aspects that considered as challenges for the implementation of the life cycle costing, consist of the model of life cycle costing, the data collection, the IT system, the implication of cost calculation.

According to the result described above, the life cycle cost analysis is fit for the company. It could fulfill the need for long-term oriented cost analysis for the company and could be implemented by the company. Further research is needed to confirm the benefit of other life cycle cost item that is not discussed in this research such us fuel cost and other cost item on operational cost. Further research with a focus on uncertainty with Monte Carlo simulation methods or sensitivity analysis also needed to enrich the life cycle cost benefit in the airline business.

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