International Conference on Management of Technology, Innovation, and Project (MOTIP) 2020
July 25th 2020, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia

Modeling Priority Maintenance Cost Based on Top-Down and Bottom-Up Approach with Reconciliation of Forum Group Discussion

Mohammad Fauzan and Bambang Syairudin
Department of Management Technology, Institut Teknologi Sepuluh Nopember, Surabaya
e-mail: mfauzan0803@gmail.com

***Abstract*—PT XYZ engaged in the electricity industry, which has a strategic issue that's reduction of BPP (Cost of Providing) electricity as one step in supporting the holding company policy. With the target of reduction BPP, where one component of the BPP is maintenance costs. This research shows the priority of maintenance costs of each Units that can be used in the drafting of the RKAP. In order to prioritize maintenance costs, it is necessary to compile an analysis of the cost, start from the proposed maintenance costs of each unit (using the bottom-up method) until evaluating cost from management (using the top-down method). This top-down method is strengthened by the analysis of priority maintenance costs from the expert's view using the Analytical Hierarchy Process (AHP) method with the Expert Choice V-11 Software tool. Then the results of prioritizing maintenance costs from the bottom-up and top-down methods are carried out reconciliation through Forum Group Discussion (FGD). Based on the results, that the highest weighting factor was Productivity (0.616), followed by Area (0.320), Specifications (0.064). Whereas the sub factor that is very dominant globally is having low production costs and the highest priority Unit for maintenance costs is Unit E.**

***Keywords*—BPP, Priority of Maintenance Cost, Bottom-Up, Top-Down, FGD.**

I. INTRODUCTION

PT XYZ is a company engaged in the electricity industry. PT XYZ has 7 existing Power Plant Units which are owned by PT XYZ's registered assets, where 6 of the 7 units are located on the Java Island which is spread on, Unit A (Jakarta), Unit B (West Java), Unit C (West Java) , Unit D (East Java), Unit E (East Java), and Unit F (East Java). While 1 other unit is the Unit G located in Pare-Pare, South Sulawesi. Total installed capacity power plants owned by PT XYZ is 7,055 MW.

PT XYZ is a sub holding company of a BUMN company, so that every drafting RKAP yearly needs the approval of shareholders who consider government policies, where one of the policies is no increase in the basic electricity tariff. That matter the holding company policy is optimize operational costs from all business lines and also ensure the allocation of costs incurred on target so the benefits obtained by the company will be greater. PT XYZ in this case is ready to support holding company policies and make it a corporate strategic issue that needs to be formulated together. Several plans have been prepared in order to be able to optimize operational costs, one of which is to optimize maintenance costs through prioritizing maintenance costs so that the allocation of maintenance costs can be on target.

Table 1.
Factors & sub-factors prioritize maintenance cost

Factors	Sub-Factors
Productivity	Having low production costs
	Good reliability
	Having high capacity factor
Specification	Large-scale generating capacity
	Power plant fuels
Area	Load center (VVIP area)
	High provincial minimum wage factor

In terms of prioritizing the maintenance cost for 7 existing Power Plant Units owned by PT XYZ, there are several Factors and sub-Factors that are considered for the allocation of the maintenance costs, including Table 1.

These factors in the discussion of drafting RKAP have often been taken into consideration, but have not yet been measured and weighted for each power plant units. Therefore, it is interesting to do research to study and analyze which power plant units have priority maintenance costs at PT XYZ, so that in making decisions on the allocation maintenance costs of each power plant unit are based on measurable and weighted factors. Determination of Factors and Sub-Factors is also the result of brainstorming to the team of RKAP PT XYZ for clarify the suitability of these Factors in considering the priority of maintenance costs of the generating units owned by PT XYZ.

In addition, the above factors & sub-factors are also contained in the focus of the company's strategy on the Company's Longterm Plan (RJPP) 2017 – 2021 as shown in the Figure 1 which is marked with a red circle. So that in determining the priority of maintenance costs is in accordance with the company's strategic plan to achieve the targets that have been determined.

In accordance with the company's agenda every year, which carries out the discussion of RKAP with the n-1 cycle. Which means that the RKAP for next year has been prepared and discussed since the previous year. Based on company policy through director's decision letter regarding RKAP governance guidelines, that is explained the proposed RKAP from each power plant units will be submitted each year to Head Office PT XYZ, which will then be evaluated by the team RKAP PT XYZ in the Head Office which has a role as Cost Leadership. Reflecting on the discussion of RKAP at PT XYZ, where during the evaluation of the discussion, there was often needs a long duration and always happened tough debate in the discussion. It was because Factors and Sub-Factors that are considered for the allocation

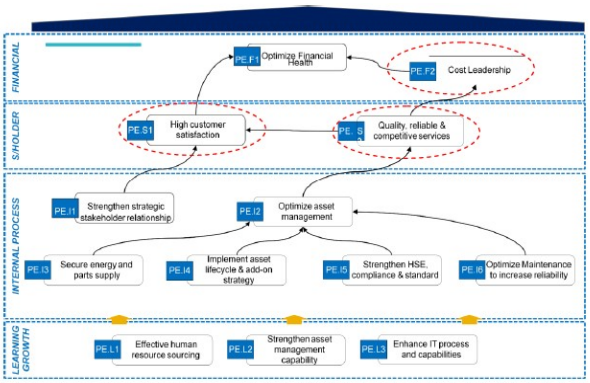

Figure 1. Company Strategy Map PT XYZ.

Table 2.
Population and criteria data

Data Criterion	Description
Company	PT XYZ
Number of expertise	5 People
Position	Head of Division (2 people) and Senior Manager in Head Office (3 people)
Working Period	All respondent, more than 15 years

of the maintenance costs have not yet been measured and weighted for each power plant units, so this research will be interesting because it will find out what is the most dominant factor & sub-factor in the drafting RKAP for maintenance costs, besides that it will also be known prioritization of maintenance costs of each unit owned by PT XYZ.

These factors in the discussion of drafting RKAP have often been taken into consideration, but have not yet been measured and weighted for each power plant units. Therefore, it is interesting to do research to study and analyze which power plant units have priority maintenance costs at PT XYZ, so that in making decisions on the allocation maintenance costs of each power plant unit are based on measurable and weighted factors. Determination of Factors and Sub-Factors is also the result of brainstorming to the team of RKAP PT XYZ for clarify the suitability of these Factors in considering the priority of maintenance costs of the generating units owned by PT XYZ.

In addition, the above factors & sub-factors are also contained in the focus of the company's strategy on the Company's Longterm Plan (RJPP) 2017 – 2021 as shown in the Figure 1 which is marked with a red circle. So that in determining the priority of maintenance costs is in accordance with the company's strategic plan to achieve the targets that have been determined.

In accordance with the company's agenda every year, which carries out the discussion of RKAP with the n-1 cycle. Which means that the RKAP for next year has been prepared and discussed since the previous year. Based on company policy through director's decision letter regarding RKAP governance guidelines, that is explained the proposed RKAP from each power plant units will be submitted each year to Head Office PT XYZ, which will then be evaluated by the team RKAP PT XYZ in the Head Office which has a role as Cost Leadership.

Reflecting on the discussion of RKAP at PT XYZ, where during the evaluation of the discussion, there was often

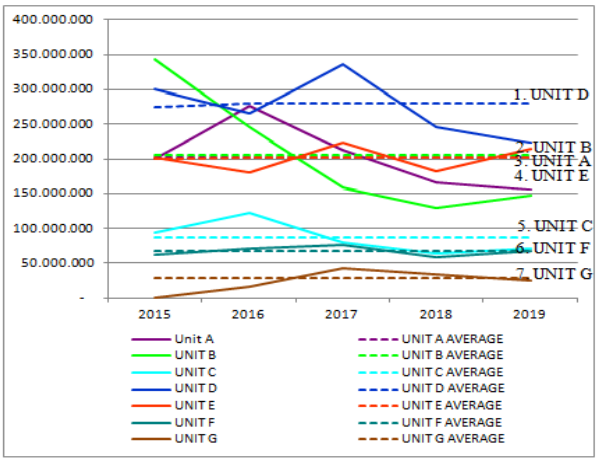

Figure 2. Trend realization maintenance cost over the past 5 years.

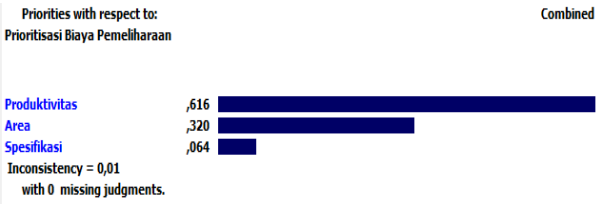

Figure 3. Result of data processing factor priority maintenance.

needs a long duration and always happened tough debate in the discussion. It was because Factors and Sub-Factors that are considered for the allocation of the maintenance costs have not yet been measured and weighted for each power plant units, so this research will be interesting because it will find out what is the most dominant factor & sub-factor in the drafting RKAP for maintenance costs, besides that it will also be known prioritization of maintenance costs of each unit owned by PT XYZ.

II. METHOD

This research shows the priority of maintenance costs of each Units that can be used in the drafting of the RKAP, so that the RKAP compiled in a Corporate receives maintenance costs as needed, and is able to meet the desires of the Stakeholders. In order to prioritize maintenance costs, it is necessary to compile an analysis of the cost, start from the proposed maintenance costs of each unit (using the bottom-up method) until evaluating cost from management (using the top-down method).

This top-down method is strengthened by the analysis of priority maintenance costs from the expert's view using the Analytical Hierarchy Process (AHP) method with the Expert Choice V-11 Software tool. Then the results of prioritizing maintenance costs from the bottom-up and top-down methods are carried out reconciliation through Forum Group Discussion (FGD) to explore input on the research results of the most dominant factors and the most priority units

According to (Larson & Gray, 2011) Bottom-Up Method is a cost estimation method that consists of several work packages that are collected into a work package or commonly called Work Breakdown Structure (WBS) [6]. So that the detail of the work needed can be identified the costs needed to know the total cost of a project or company

Table 3.
Tabulation of maintenance cost over the past 5 years

Ranking	Power Plant Units	Years					Average
		2015	2016	2017	2018	2019	
1	Unit D	300.428.073	266.031.805	335.717.481	245.440.492	223.525.183	274.228.607
2	Unit B	343.627.129	246.778.717	159.569.257	128.821.186	147.460.171	205.251.292
3	Unit A	199.289.407	275.932.950	211.836.119	165.740.461	155.775.196	201.714.827
4	Unit E	201.270.915	180.881.519	223.853.072	182.663.910	214.430.513	200.601.986
5	Unit C	94.292.055	122.561.378	80.438.837	63.331.419	70.941.636	86.313.065
6	Unit F	62.831.602	71.170.278	76.319.176	59.130.256	67.998.879	67.490.038
7	Unit G	-	16.551.930	42.310.052	33.508.147	24.672.217	29.260.587

Table 4.
Tabulation of proposed maintenance costs for RKAP 2020

Ranking	Power Plant Units	Proposed Maintenance Cost 2020
1	Unit D	244.336.123
2	Unit E	220.344.380
3	Unit A	148.585.776
4	Unit B	145.891.730
5	Unit C	78.739.378
6	Unit F	71.476.840
7	Unit G	21.502.263

Table 5.
Tabulation calculation of factor & sub-factor values

Factors	Value	Ranking	Sub-Factors	Value (Global)	Ranking (Local)	Ranking (Global)
Productivity	0,616	1	Having low production costs	0,384	1	1
			Good reliability	0,048	3	4
			Having high capacity factor	0,185	2	3
Specification	0,064	3	Large-scale generating capacity	0,027	2	7
			Power plant fuels	0,036	1	6
			Load center (VVIP area)	0,281	1	2
Area	0,320	2	High provincial minimum wage factor	0,039	2	5

Table 6.
Comparison of bottom-up and top-down prioritization

Trending Bottom-Up (5Years Ago)		2020		To	
Ranking	Unit	Ranking	Unit	Ranking	Unit
1	Unit D	1	Unit D	1	Unit E
2	Unit B	2	Unit E	2	Unit A
3	Unit A	3	Unit A	3	Unit C
4	Unit E	4	Unit B	4	Unit F
5	Unit C	5	Unit C	5	Unit D
6	Unit F	6	Unit F	6	Unit B
7	Unit G	7	Unit G	7	Unit G

operations. In this research for the bottom-up method, primary data collection is obtained from the recapitulation of the maintenance costs of each unit for the RKAP 2020. Whereas secondary data collection uses maintenance cost data for the last five years sourced from the Company's Financial Statements, to see the trend of realization in that period.

According to (Larson & Gray, 2011) Top-down Estimate methods usually come from someone who uses his experience and / or information to determine the total costs required. This estimation method is usually made by the top management level (managers) who have more knowledge of the costs required to complete the project or the operational needs of the company [6]. It is good to estimate costs with the Top-Down method involving people who know the details for the preparation of the RKAP, by involving people who are experienced with the work, it will increase the accuracy of the estimated cost needed [12]. In this research for the top-down method, primary data collection is obtained from interviews and filling out questionnaires by experts in the power plants who are familiar with the drafting of the RKAP to determine the most important factors and alternatives in prioritizing maintenance costs [13].

Furthermore, for the classification of experts are personnel who already have a working period of > 15 years and are always involved in the drafting RKAP every year. So that it is expected to have good sensitivity to the factors & sub-factors that are most important in the drafting of the RKAP, as well as knowing the characteristics of each power plant units. Population and research data criteria shown in Table 2.

By using software Expert Choice v.11 as a supporting tool for analysis in multi-factor decision making by simplifying the existing complexity. From the results of data processing using expert choice, the weighting of the most important factors is obtained, and then the priority unit ranking can be obtained. According to (Saaty, 2004) Analytical Hierarchy

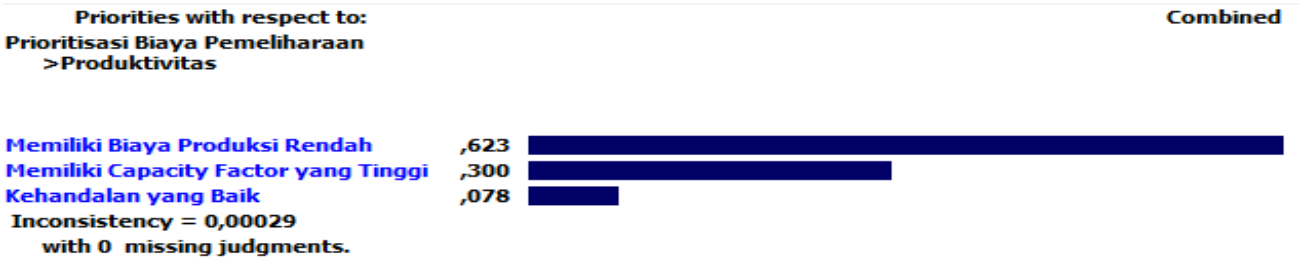

Figure 4. Result of data processing sub-factor productivity.

Figure 5. Result of data processing sub-factor specification.

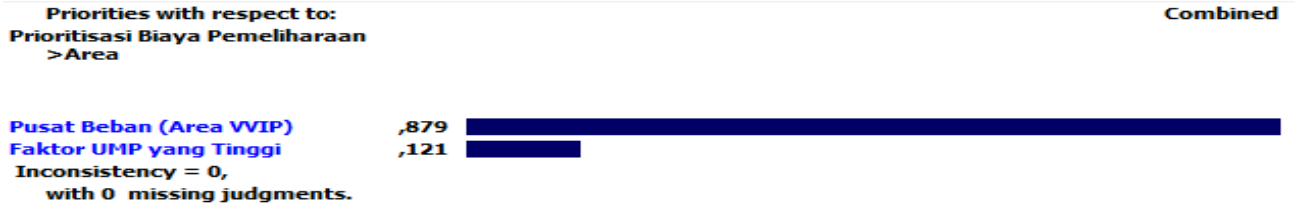

Figure 6. Result of data processing sub-factor area.

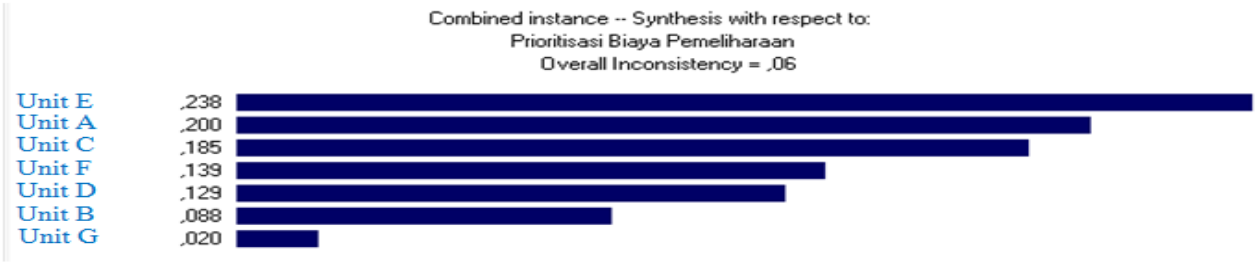

Figure 7. Result of data processing alternative/unit priority.

Process (AHP) is a multi-factor decision making method that involves a number of factors and alternatives chosen based on consideration of all factors related to different degrees of importance [14]. There are 3 main main principles in making decisions using the AHP methodology: 1. Compilation of the hierarchy; 2. Determination of priorities; and 3. Logical consistency [2]. The compilation of the hierarchical structure must include at least general objectives, criteria / factors, sub-criteria / sub-factors, and the last is an alternative. Determination of priorities by doing analyze the priority of elements by the method of pairwise comparisons between two elements so that all existing elements are covered [15]. Logical consistency it means Respondents must have consistency in comparing elements based on numerical values provided by Saaty's scale, with consistency value still below 10% (0,1) with formulate CI (Consistency Index) = Analytic Hierarchy Process (AHP) was chosen as a tool to make decisions from several qualitative factors and the freedom of the relationship between one factor and another [1]. After that the Forum Group Discussion (FGD) was conducted to receive input and views from the results of research on the actual conditions in the field, so that if prioritization is applied to suit the actual conditions, especially for the executor in the power plant units [5]. According to (Koentjoro, 2005) The purpose of the FGD is as a tool to convince data collectors (researchers) as well as a re-check tool for various statement / information obtained through various research methods used or information obtained previously, both similar and conflicting information [4].

III. RESULT AND DISCUSSION

Bottom-Up data collection in this research done in two ways namely, look at the trending realization of maintenance costs over the last five years (2015 - 2019) and recapitulation based on the proposed unit of maintenance costs for RKAP 2020. Data collection for the realization of maintenance costs over the past five (5) years is obtained from the Annual Financial Report of PT XYZ which has been Audited in each year starting from 2015 – 2019 as shown in Table 3 (value stated in Thousand Rupiah).

Same as the data in Table 3, if made in a graphical display (trend) for the last five years (2015 - 2019) can be seen in

Figure 2 below 3 (value stated in Thousand Rupiah). In accordance with the data shown, it can be seen that the ranking order or priority over the past 5 years in PT XYZ is as follows: Unit D (PLTGU), Unit B (PLTGU), Unit A (PLTGU), Unit E (PLTU), Unit C (PLTA), Unit F (PLTA), and Unit G (PLTD). This is considering that indeed in history 5 years ago, the issue in the supply of electricity in the Java-Bali System was system reliability, in this case power plants having many engine & large capacities likes PLTGU were prioritized in maintaining the reliability of electricity supply in the Java-Bali System. Another insight that can be seen from this trend is that changes in maintenance cost priorities have begun from 2018 - 2019, especially for PLTGU unit which have begun to decline in maintenance costs. Whereas on the other hand, PLTU (Unit E) experienced a trend of rising maintenance costs.

The other bottom-up data recapitulation is the value of the proposed maintenance costs for RKAP 2020 submitted by each power plant units as shown in Table 4 (value stated in Thousand Rupiah). As seen in the proposed maintenance costs for 2020, the priority ranking almost reflects the realization of the maintenance costs in 2019. This shows that the corporate concentration in priority maintenance costs is almost the same in 2019 & 2020.

Furthermore, for the results of research from the top-down method which is strengthened by the calculation of expert's analysis through a questionnaire, the expert is a person who had often been involved in the drafting RKAP PT XYZ and which were currently attached according to their respective positions. Based on the results of the questionnaires that collected from 5 respondent (expertise), then the results of the questionnaire were carried out data recapitulation and data processing using the Analytical Hierarchy Process (AHP) method with software Expert Choice v.11. As for data processing in accordance with the hierarchical structure consisting of Factors, Sub-factors, and Alternatives.

Based on the hierarchical structure as can be seen in Table 1, there are 3 factors (Productivity, Specifications, and Area) which are measured importance of each factor by pairwise comparisons. The measurement results of the most dominant factor in prioritizing maintenance costs as shown in Figure 3. From the data shown that the most important factor in prioritizing maintenance costs is the Productivity Factor which has 0,616 then followed by an Area Factor with a value of 0,320, and the last is a Specification Factor with a value of 0,064. It can also be seen in Figure 3 that the consistency value for the prioritization factor of maintenance costs shows a value of $0.01 \leq 0.1$ so that the result is consistent and acceptable.

The next measurement is to find out which sub-factors are the most dominant towards the prioritization of maintenance costs both locally and globally. In this case, it will be discussed from each of the factors which are then viewed globally.

A. Productivity

The productivity factor itself has 3 sub-factors including Having low production cost, Having high capacity factor, and Good reliability. That based on the results of the calculation as shown in Figure 4, where the sub-factor has a low production cost is the most dominant with a value of 0,623 then followed by the sub-factor has a high capacity factor with a value of 0,300, and the last is a sub-factor good reliability with a value of 0,078. The inconsistency value for the Productivity sub-factor ≤ 0.1 so that the result is consistent and acceptable.

B. Specification

The specification factor itself has 2 sub-factors including Large-scale generating capacity and Power plant fuels. That based on the results of the calculation as shown in Figure 5, where the sub-factor power plant fuels are more dominant with a value of 0,567 when compared to the sub-factor large-scale generating capacity which has a value of 0,433. Following are the inconsistency values for the Specifications sub-factor ≤ 0.1 (Figure 5).

C. Area

The area factor itself has 2 sub-factors including Load center (VVIP area) and High provincial minimum wage factor. That based on the results of the calculation as shown in Figure 6, where the sub-factor load center (VVIP area) is more dominant with a value of 0,879 when compared to the sub-factor high provincial minimum wage factor which has a value of 0,121. The inconsistency value for the sub-factor Area ≤ 0.1 so that the meaning is consistent and acceptable (Figure 6).

Furthermore, in the Table 5, to recapitulate the results of calculations between factors and each sub-factor to facilitate the reading and can determine the weight of sub-factors locally and globally. As shown in Table 5 above, that indeed the highest global value is the sub-factor having low production cost, this shows that in terms of prioritizing maintenance cost in PT XYZ currently is highly considered that the unit has a low or high production cost, as an accordance with the strategic issues that currently exist in the holding company. Whereas the sub-factor that has the lowest value is Large-scale generating capacity, which indicates that the size of the capacity of the power plant does not indicate that the unit must have a large or small maintenance cost. Indeed, there is a change in direction from the holding company from conditions a few years ago, that the issue of the reliability of the Java-Bali electrical system became a major issue because of the occurrence of byar pet in some areas due to the lack of electricity supply (generation). The current condition with the occurrence of surplus power generation available and the beginning operation of new power plants that have more efficient technology than existing plants. This makes changes the stigma in the holding company that the provision of electricity at low cost is a priority, considered government policies to keep the price of basic electricity tariff, thus requiring the holding company to continue doing innovation to be able to produce electricity at a low cost for consumers (Public).

After obtaining and knowing the factors or sub-factors that have the highest value or influence, then the results for priority maintenance costs of each power plant units as shown in Figure 7. Where the results for the synthesis of

priority maintenance cost obtained prioritization results along with the weighting value of each unit in the following order: Unit E (0,238), Unit A (0,200), Unit C (0,185), Unit F (0,139), Unit D (0,129), Unit B (0,088), and Unit G (0,020).

The synthesis result in Figure 7 decides that Unit E is the most priority unit in maintenance costs, of course, because Unit E has a low production cost because the plant is a Coal Fired Power Plant, where the average production cost of Component C for a Coal Fired Power Plant is 400 Rp / kWh, very far from the production cost of Component C for gas-fired power plants which can reach ± 1,000 Rp / kWh depending on the price of gas supplied to the plant [15]. While the results of the prioritization ranked 2nd is Unit A, because the location of the Unit A is located in DKI Jakarta Province which is the load center of the Java-Bali System electricity. Unit A also supplying electricity to VVIP areas such as the State Palace, the DPR / MPR Building, and around the Ring-1 Area, even though Unit A type is gas-fired power plants which has quite high production costs, but because it is located in a strategic area makes this plant continue to be operated by Dispatcher. Ranked 3rd and 4th priorities are Unit C & Unit F which are hydropower units, of course have low production costs because they only utilize available water reservoirs to turn turbines and generators. However, this hydropower unit has constraints on the availability of water supply which is very dependent on natural or seasonal conditions. In addition, other functions of the hydropower unit especially Unit C, have a function Fast Response Load, which means that it can increase loads in a short time to maintain the reliability of the Java-Bali electricity system, especially in anticipating blackout events. And the last priority is Unit G which is the Diesel Power Plant unit which certainly has a very high production cost and has a low efficiency. Beside that, the location of Unit G outside the Java-Bali System also influences the prioritization In accordance with the initial purpose of the research, which is that we want to see the results of prioritization maintenance costs from the bottom-up method and the top-down method, with priority order as can be seen in Table 6. Analysis of the results of prioritizing each method (stage) is grouped according to each stage as follows:

1) Trending Bottom-Up (5 Years Ago)

Realization maintenance cost from the last five (5) years are still dominated by gas-fired power plants including Unit D, Unit B, and Unit A. This is in accordance with the condition of the Java-Bali electricity system at that time the issue was system reliability, power plants with large capacities and large numbers of units such as gas-fired power plants were still a priority.

But when seen in its trend the realization of the maintenance cost gas-fired power plants has begun to decline, because the issues in the holding company began to change towards the efficiency of electricity supply for consumen, where the efficiency of Unit E (Coal Fired Power Plant) has better efficiency than the gas-fired power plants.

2) Bottom-UP RKAP 2020

The bottom-up priority order for the needs of RKAP 2020 does not change too much with the realization of maintenance costs over the last 2 years (2018 - 2019), which means the issue of efficiency in drafting RKAP has been captured, so that Unit E is prioritized number 2nd after Unit D. Regarding Unit D is still the first priority because Unit D has a large capacity & type of power plant, but in terms of trending maintenance cost have decreased, while maintenance cost for Unit E have increased.

3) Top-Down

The results of prioritizing maintenance cost from the top-down method produce a priority order in Unit E, this is in accordance with the results of determining the critical factor in the prioritize maintenance costs where productivity factors with low cost factors are the most dominant factors in the drafting RKAP for maintenance costs.

Furthermore, the results of unit prioritization as in Table 6 will be used as discussion material in the Forum Group Discussion (FGD). The purpose of this FGD is to be able to obtain information or input from the results of research that has been done to strengthen the justification of factors and sub-factors that play a very dominant role [3], as well as getting input on the results of unit prioritization both from the bottom-up method and the top-down method [7]. The FGD participants consisted of several divisions at the head office that were closely related to drafting the RKAP and also representatives of each unit represented by at least the manager of maintenance or engineering and accompanied by the SPV maintenance planning who has tasked with drafting the RKAU annually [8]. As for some important input or information from FGD participants, as written in the points below: (1) “The issue of cost efficiency has become an issue in the holding company, PT XYZ as a subsidiary must support the policy, in this case PT XYZ must be able to produce electricity at a low cost” -Budget Planning Manager. (2) “We all agree that currently issue of low cost is very dominant, but do not be careless with the issue of reliability (customer satisfaction), so that at least even though the majority of Unit D are gas-fired power plants but still need equipment preservation costs even though the condition of the unit is not operated” -Manager Unit D. (3) “The presence of hydropower in priority positioning is seen to be quite good, but as information that the equipment contained in a hydropower plant is not as complex as the equipment in a Coal Fired Power Plant or gas-fired power plants, so the allocation of maintenance costs such as realization in 2018 & 2019 should be sufficient for the operation of the power plant without requiring additional allocation of costs again” -SPV Maintenance Planning Unit F. (4) “If we looked at the composition of the current maintenance cost allocation from 2018 it is quite good and proportional to the needs of the unit, it is given that the maintenance cost of gas-fired power plants has been optimized and indeed prioritizes Coal Fired Power Plant as the ‘backbone’ of PT XYZ to be able to operate optimally” -Manager of Planning & Evaluation Maintenance Head Office [9-10].

IV. CONCLUSION

Based on the approach of the top-down method of the respondents (expertise) conducted data processing using the

AHP (Analytical Hierarchy Process) method, the results of research on critical factors and sub-factors that have the most dominant influence on the prioritization of maintenance costs with global weighting values are as follows. Factors Productivity (0,616), Area (0,320), and Specification (0,064). It can be seen that what really influences the prioritization of maintenance costs for power plant units is to look at the productivity factors of these units, especially power plant units that have low production costs. From the results of weighting of the factors and sub-factors become a reference in the prioritization unit of maintenance costs carried out synthesis of research with the results of the order of priorities as follows : Unit E (0,238), Unit A (0,200), Unit C (0,185), Unit F (0,139), Unit D (0,129), Unit B (0,088), and Unit G (0,020). From the results of the order priorities based on the bottom-up approach there are several different from the top- down approach, especially when looking at the realization trends of the past 5 years. From the analysis, there has indeed been a change in the focus of prioritization maintenance costs 5 years ago to the present, where the current issue of cost efficiency is a priority, whereas in the past the issue of reliability of the Java-Bali electricity system was a priority. Through the Forum Group Discussion (FGD) agenda, there were some inputs from participants that were closely related to the results of weighting factors and sub-factors, all participants agreed on the weight of sub-factors having a low cost as one step in efforts to support corporate policies for cost efficiency while pay attention to the reliability of power plant units. In addition, there are also suggestions that the current prioritization is indeed appropriate, but that can also change depending on the issue that is the focus in the next few years at the holding company or PT XYZ.

ACKNOWLEDGMENT

This study was supported by Institut Teknologi Sepuluh Nopember (ITS) Surabaya, through Junior Researcher scheme. This result was presented in the International Conference on Management of Technology, Innovation, and Project (MOTIP) 2020, 25th July, Surabaya, East Java that supported by by Institut Teknologi Sepuluh Nopember (ITS). We would like to show our gratitude to PT XYZ stakeholders, especially the respondents (expertise) who have to spare the time and shared their knowledge for this study.

REFERENCES

[1] Chen, M. K., & Wang, S. C. (2010). The critical factors of success for information service industry in developing international market: Using analytic hierarchy process (AHP) approach. Expert Systems with Applications, 37(1), 694–704. https://doi.org/10.1016/j.eswa.2009.06.012.

[2] Chin, K. S., Xu, D. L., Yang, J. B., & Lam, J. P. K. (2008). Group Based ER-AHP System for Product Project Screening. Expert System with Application, 35(4), 1909-1929.

[3] Irwanto. (2006). Focus Group Discussion: A Simple Manual, Jakarta: Yayasan Obor.

[4] Koentjoro, N. (2005). Metode-Metode Penelitian Masyarakat. Jakarta: PT Gramedia Pustaka Utama

[5] Krueger, R.A., & Casey, M.A. (2000). Focus Groups: A Practical Guide for Applied Research. 3rd ed. Thousand Oaks, CA: Sage.

[6] Larson, E. W., & Gray, C. F. (2011). Cross Reference of Project Management Body of Knowledge (PMBOK) Concepts to Text Topics. Retrieved from http://www.engr.sjsu.edu/fayad/current.courses/cmpe203-fall2014/docs/ERM/Project Management 5th Edition.pdf.

[7] Masadeh, M. a. (2012). Focus Group: Reviews and Practices. International Journal of Applied Science and Technology, 2(10), 63–68. Retrieved from http://www.ijastnet.com/journals/Vol_2_No_10_December_2012/9.pdf.

[8] Mulyana, S. T., Pembimbing, D., Teknologi, D. M., Keahlian, B., Industri, M., Bisnis, F., & Manajemen, D. A. N. (2017). Treatment Plant Di Area Kerja Onshore Processing Facility.

[9] Mulyadi (2001). Sistem Akuntansi. Edisi Tiga, Jakarta: Salemba Empat.

[10] M. Munandar (2007). Budgeting, Perencanaan Kerja, Pengawasan Kerja. Edisi Kedua. BPFE UGM. Yogyakarta [11] Nafarin (2007. Penganggaran Perusahaan. Edisi Ketiga, Jakarta: Salemba Empat.

[11] Ngai. E. W. T., & Chan, E. W. C. (2005). Evaluation of Knowledge Management Tools using AHP. Using Expert System Application, 29(4), 889-899.

[12] Parvaneh, F., & El-Sayegh, S. M. (2016). Project selection using the combined approach of AHP and LP. Journal of Financial Management of Property and Construction, 21(1), 39–53. https://doi.org/10.1108/JFMPC-09-2015-0034.

[13] Saaty, T. L. (2004). Decision making — the Analytic Hierarchy and Network Processes (AHP/ANP). Journal of Systems Science and Systems Engineering, 13(1), 1–35. https://doi.org/10.1007/s11518-006-0151-5.

[14] Tugiman (2017). (CSF) untuk Menunjang Kinerja Pejabat Pembuat Komitmen (PPK) dalam Pembangunan Jembatan Ketapang.

[15] UDIKLAT. (2008). Materi Ajar Pelatihan Pembangkitan. Surabaya.