

# Determining the Optimal Concession Period in Cancer Hospital Project using Public-Private Partnership (PPP) with Availability Payment Scheme

Nur Dzikri Huda and Ahmad Danu Prasetyo

**Abstract** — The construction of Cancer Hospital in city of X which require total Capital Expenditure of Rp 1,135,834,554,688 can answer the need of comprehensive cancer services in Indonesia. But due to limited local government budgets, forcing local government to find alternative funding through Public Private Partnership (PPP) scheme. One of the newest PPP scheme at the moment is the Availability Payment (AP) scheme.

Through this research, authors analyze the optimal concession period and the feasibility of this investment plan by calculating the required Capital Expenditures, Operating Cost, and other expense and Risk embedded to the project. The optimal concession period is analyzed by simulation of different concession period scheme ranging from 10-25 years and find the lowest required Availability Payment. The feasibility of the cancer hospital project is analyzed by using Discounted Cash Flow parameter which are Net Present Value, Internal Rate of Return and Payback Period. The risk embedded to the project is analyzed by using sensitivity, scenario and monte carlo analysis.

From the result of Availability Payment calculation, the optimal concession period for this project is 22 years, this period scenario generates AP payment of Rp 287,712,786,883. The result of this project is financially feasible with positive Net Present Value of Rp 95,490,595,725, the Internal Rate of Return (IRR) of 12,66% which greater than Weighted Average Cost of Capital (WACC) of 11.92% , and Payback Period of 11,17 years. This Cancer hospital Project is financially safe to build by business entity (BUP). From 10,000 trials of Monte Carlo simulation, the project NPV will lies between Rp 59,335,915,203 to Rp 121,260,967,584 with 95% certainties with worst case scenario NPV still positive Rp 40,041,126,128. Based on the sensitivity analysis the COGS expense is the variable that most affecting the overall NPV of this project, followed by the long-term debt interest rate.

**Index Terms** — Availability Payment, Public Private Partnership, Optimal Concession Period, Feasibility Study.

## I. INTRODUCTION

World Health Organization stated cancer is the second leading cause of death globally and is responsible for an estimated 9.6 million death in 2018 [1]. The Agency for Research on Cancer stated the cancer burden risen to 18.1 million new cases in 2018 [2]. One in 5 men and 1 in 6 women worldwide develops cancer during their lifetime, and one in 8 men and 1 in 11 women die from the disease in

2018. Global Cancer Observatory predict the number of cancer cases worldwide increase to 29.5 million in 2040 and number of death increase to 16.4 million in 2040 [3].

In Indonesia, cancer is one of the national health problems that need to get a common concern and commitment from governments, medical profession, and communities. Based on the result of basic health research, the prevalence of cancer in Indonesia is 179 per 100,000 inhabitants [4]. While burden cancer report in 2018, the cases of cancer in Indonesia amounted to 348,309 cases, with the prevalence of cancer at 137 per 100,000 which placed Indonesia in 7th highest Cancer Incident Cases in South East Asia. Global Cancer Observatory, predict the number of cancer cases in Indonesia increase to 575,814 in 2040 and number of death increase to 366,567 in 2040 [5].

The Cancer Hospital is located in City X. the construction plan is structured to improve the scope and quality of Cancer services, improving human resources and fulfilling the needs of specialist doctors/ oncologist specialists. The project will build 2 new building (Tower A and Tower B) that will serve as service building and hospice center (Tower A) as well as integrated cancer service building (Tower B). Tower A consist of 6 floors and tower B consist of 12 floors.

### A. Statement of Problem

The facilities and infrastructures of the Cancer Hospital in the city X still require considerable improvement, both in hospital facilities technology, as well as capacity of services that is felt less adequate as the comprehensive cancer center. This improvement requires significant fund to build, with limited budget of Directorate General of Health Services of Republic of Indonesia as government contracting agency (GCA), so that it is necessary to utilize the potential of funding outside the regional government budgets. Through the PPP scheme with Availability Payment mechanism allow the construction of hospital building is fully carried out by business entity without funding from local governments.

### B. Research Objective

The objective of this study are as follows:

- Determine how much the capital expenditures during construction, additional capital expenditures, operational cost and interest expense.
- Analyze the amount of annual payment for Availability Payment.
- Analyze the optimal concession period using scenario of different concession period ranging from 10 to 25 years.
- Analyze the financial feasibility of this cancer hospital project.

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- Analyze the risk embedded to the project.

## II. LITERATURE REVIEW

### A. Public Private Partnership

PPP can be defined as a partnership between the governments and the Private sector (BUP) for the purpose of providing a project or services for public interest that traditionally provided by the government only [6].

The limitation of government budgets to fulfil Indonesia infrastructure development targets, have led to financial gap that should be met. To solve this problem, government need to find the alternative project funding scheme, one of them through Public Private Partnership (PPP).

### B. Availability Payment

The Availability Payment (AP) scheme is a scheme in PPP project where the return of investment on business entity (BUP) is paid by the government periodically (usually on annuities basis) based on services of the business entity provided. According to PPP implementation guidelines with availability payment mechanism from Ministry of Public Works and Public Housing the Availability Payment formula in Indonesia can be calculated from [7]:

$$\text{Availability Payment} = \frac{\text{Capex} + \text{Opex} + \text{ROI}}{\text{AP Concession Period}}$$

## III. METHODOLOGY

The research methodology for this Cancer Hospital Project consist of 8 steps. First by defining the main issues of this project. The second step is determined and projected the cost related to the project such as Capital Expenditures, Operational, Interest and Depreciation expense. The third step is to determine the amount of the Availability Payment needed to be paid by the Government so the hospital project NPV equates the business entity return on investment. The fourth step is to create simulation of availability payment calculation using different concession period scenario ranging 10-25 years. The fifth step is to determine the optimal concession period based on the lowest value of AP payment. The sixth step is to calculate financial feasibility analysis based on the optimum concession period scenario. The final step is to conduct analysis of financial risk that may occur during concession period using sensitivity analysis, scenario analysis and Monte Carlo Simulation.

## IV. FINDINGS AND ARGUMENT

### A. Capital Expenditures

Capital expenditures is the fund used by the firm to buy, develop fixed asset in order to improve the efficiency or maintain business operating activity. The cancer hospital project capital expenditure consists of initial investment in building A & B also additional capital expenditures for medical & non-medical instruments.

#### Building Capital Expenditures

Initial capital expenditures for cancer hospital building construction consist of physical construction, construction planning, construction management, and activity management with total building capital expenditure of Rp 317,582,539,355.

TABLE 1: INITIAL CAPITAL EXPENDITURES FOR BUILDING CONSTRUCTION (RP MILLION)

Type	Physical Construction	Construction Planning	Construction Management	Activity management
Building A	52,511.3	1.690,0	1.380,0	4.232,0
Building B	239.969,4	7.340,0	5.900,0	4.560,0

#### Building A Initial Capital Expenditures for Medical & Non Medical Instrument

Table 2 show the details of the initial capital expenditures of building A for this cancer hospital project:

TABLE 2: BUILDING A INITIAL CAPEX FOR MEDICAL & NON-MEDICAL INSTRUMENT

No.	Description	Value (Rp)
1	Hospice Bed	2.381.140.000
2	Furniture	720.000.000
3	Double Door Washing Machine	1.704.170.000
4	AHU Clean Room	1.646.700.000
5	AHU Non Clean Room	1.919.980.000
6	Capacitor	133.690.000
7	Chiller	3.663.500.000
8	Power Unit	5.874.000.000
9	Transformer Unit	888.570.000
Total		18.931.750.000

#### Building B Initial Capital Expenditures for Medical & Non-Medical Instrument

Table 3 show the details of the initial capital expenditures of building B for this cancer hospital project.

TABLE 3: BUILDING B INITIAL CAPEX FOR MEDICAL & NON-MEDICAL INSTRUMENT

No.	Description	Value (Rp)
1 <sup>st</sup> floor	Sidewing Hall and Business Center	
	Furniture	100.000.000
2 <sup>nd</sup> floor	Specialist Polyclinic	
	Furniture	50.000.000
	Medical Instrument in Examination Room	1.200.000.000
	Medical Instrument in Anatomic Pathology Lab	10.293.840.000
	Medical Instrument in Clinical Pathology Lab	6.343.950.000
4-7 <sup>th</sup> floor	Medical Ward	
	Hospital Bed	4.530.780.000
	Furniture	1.370.000.000
	Inpatient Medical Instrument	418.710.000
8 <sup>th</sup> floor	Chemotherapy	
	ODC chemotherapy	727.570.000
	Cytotoxic Handling Facility	5.000.000.000
9 <sup>th</sup> floor	Clinical Trial Ward	
	Inpatient Clinical Trial Room	400.000.000
	ICU Clinical Trial Room	500.000.000
10 <sup>th</sup> floor	Minimal Invasive Procedure	
	Furniture	100.000.000
	Minimal Invasive Medical Instrument	16.110.350.000
11 <sup>th</sup> floor	ICU/PICU/HCU	
	Hospital Bed & Supporting Medical Instrument	25.252.200.000
12 <sup>th</sup> floor	Central Surgery Installation	
	Surgical Instrument	33.960.070.000
	Anesthesia Instrument	16.732.680.000
	Recovery Room	2.653.040.000
Total		127.743.190.000

**Total Initial Capital Expenditures**

The total initial capex for this project Rp 568.351.488.548. This project has interest during construction (IDC) because the cancer hospital needs 2 years construction period, in the year 2 the firm need to pay interest for construction in year 1. The financial fees are cost of a service to the bank because the loan is approved by the bank, in this calculation using 1% provision fees using Bank BNI provision fees as benchmark. Table 3 Show the detail of total capital expenditures.

TABLE 4: TOTAL INITIAL CAPITAL EXPENDITURES

Description	Value (Rp)
Total Initial Investment Before Provision fees, contingencies, IDC & VAT	464.257.479.355
Contingencies	34.819.310.952
Value Added Tax	49.907.679.031
Interest During Construction (IDC)	15.524.127.925
Financial Fees	3.842.891.285
Total Initial Capex	568.351.488.548

**Capital Expenditures Schedule**

As the Medical & Non-medical instrument fully depreciated and need to be replaced in year 7 and year 15, there are 2 additional capex for medical & non-medical instrument. Table 5 show the detail of additional capital expenditures.

TABLE 5: CAPITAL EXPENDITURES SCHEDULE (RP MILLION)

Year	Building	Non-Medical Instrument	Medical Instrument	Total
1	155.515,9	8.087,9	63.736,9	277.340,6
2	233.273,8	12.131,8	95.605,3	341.010,9
7		26.830,6	211.439,7	238.270,3
15		37.071,2	292.141,5	329.212,7

**B. Operating Expenditures**

The operating expense in this cancer hospital project divided into 2 categories, first the fixed operating cost consist of salaries, electricity, building management and medical & non-medical management expense that calculated manual in year 1 then increase with assumed inflation rate 4,12% except salaries expense that use 8,38% salaries expense growth.

**Salaries Expense**

As the design, build, finance, maintenance, transfer (DBFMT) contract design, business entity is responsible just for the maintenance of the building and equipment, the daily operation of cancer hospital is part of public service agency responsibility chosen by Indonesian Ministry of Health. Therefore, the salaries expense is calculated manually by the job function and salaries benchmark. The business entity assumed consist of 20 employees and salaries expense increase by 8,38% per year based on historical data of city X salary increase.

TABLE 6: SALARIES EXPENSE

Job Description	Salary Per Month	Number of Employee	Total Salary Per Month
CEO	260.000.000	1	260.000.000
CFO	137.000.000	1	137.000.000
COO	145.000.000	1	145.000.000
Finance & Accounting Manager	36.000.000	2	72.000.000
General & Project Manager	37.000.000	2	74.000.000
Finance & Accounting Supervisor	8.200.000	4	32.800.000
General & Project Supervisor	8.000.000	4	32.000.000
Staff	5.500.000	5	27.500.000
Total Salary Expense Per Year			9.363.600.000

**Electricity Expense**

Electricity cost in this project consist of medical and non-medical instrument such as pump, electrical power area, air conditioning, etc. Electricity expense assumption use Rp 1.036/ Kwh as this is government building and assumed to operate 24 hrs/day. In year 1 the total electricity cost of this project Rp 25,816,676,592 and increase with assumed inflation rate.

TABLE 7: ELECTRICITY EXPENSE

No	Description	Building A+B (Kilo Watt)	Electricity Expense Per Year (Rp)
1	Electrical Power Area	937	8.503.612.320
2	UPS	240	2.178.086.400
3	Chiller	37	335.788.320
4	Air Conditioning & Pressurization	989	8.975.531.040
5	Medical instrument	11	99.828.960
6	Clean Water Transfer Pump	22	199.657.920
7	Packed Booster Pump	7.4	67.157.664
8	Hot Water Pump	166	1.506.509.760
9	Waste Processing Installation Pump	44	399.315.840
10	Kitchen Waste Water Pump	4,4	39.931.584
11	Rainwater Pump	4,4	39.931.584
12	Fire Hydrant Pump	150	1.361.304.000
13	Motorized Fire Extinguisher Pump	150	1.361.304.000
14	Jockey Pump	7,5	68.065.200
15	Elevator	75	680.652.000
Total			25.816.676.592

**Maintenance Expense**

Maintenance expense for this cancer hospital project consist of building and medical & non-medical equipment management expense. For building maintenance expense used 0.33% of the total fixed asset of the project for year 1 and increase with assumed inflation. For medical & non-medical instrument expense use 0.75% of the total capex for medical & non-medical equipment for year 1 and also increase with assumed inflation. Total Maintenance expense for building and medical& non-medical equipment are Rp

1,659,076,354 and Rp 1,346,713,691 respectively.

TABLE 8: MAINTENANCE EXPENSE

Description	Value
Building Maintenance Expense in Year 1	1.659.076.354
Medical & Non-Medical Expense in year 1	1.346.713.691

C. Optimum Concession Period and Feasibility Analysis

Table 9 show the recapitulation of availability payment calculation in each scenario of concession period ranging from 10 year to 25 years. The scenario of 22 year concession period is the optimal concession period for this Cancer Hospital project as the AP payment by local government to paid business entity is at the lowest at Rp 287,712,786,883 per year compared to the other concession period scenario. The trend of Availability payment paid by local government is increasing as the concession period scheme decrease. The reason for that because if the project duration become shorter, while the target returns of investment (Target NPV of the project) is still the same, the profit for the firm should be higher in order to compensate the shorter project duration.

TABLE 9: RECAPITULATION OF AVAILABILITY PAYMENT IN EACH CONCESSION PERIOD SCENARIO

Concession Period (Years)	Target Project NPV (ROI: 14%)	AP Payment Per Year	Notes
25	99.703.043.186	294.544.420.589	
24	99.703.043.186	295.251.317.639	
23	99.703.043.186	296.135.132.134	
22	95.490.595.725	287.596.733.651	Optimal Concession Period
21	95.490.595.725	288.899.283.036	
20	95.490.595.725	290.521.853.229	
19	95.490.595.725	292.604.103.612	
18	95.490.595.725	295.212.957.034	
17	95.490.595.725	298.391.343.041	
16	95.490.595.725	302.257.690.493	
15	95.490.595.725	306.830.587.600	
14	87.952.064.590	292.517.696.017	
13	87.952.064.590	298.725.788.169	
12	87.952.064.590	306.385.827.556	
11	87.952.064.590	315.903.843.536	
10	87.952.064.590	327.845.090.938	

Table 10 show DCF analysis using 22 years concession period scenario. The Capital Expenditure required for this concession scenario Rp 1,135,834,554,688, while the present value of total capital expenditure Rp 682,075,683,748 and return for that investment of Rp 95,490,595,725 used as target ROI for the project. From the Availability payment calculation, Rp 287,712,786,883 of annual AP payment by local government for 22 years is needed for the cancer hospital project to meet the required ROI. This concession period resulted in positive Rp 95,490,595,725 of Net Present Value (NPV), the Internal Rate of Return (IRR) of 12,66% which is higher than Weighted average cost of capital (WACC) of 11,98% and

Payback Period of 10,66 years.

TABLE 10: AVAILABILITY PAYMENT CALCULATION USING 22 YEARS CONCESSION PERIOD

Description	Value (Rp)
Concession Period	22
ROI (%)	14%
Total Capex (Rp)	1.135.834.554.688
WACC (%)	11,98%
NPV Total Capex (Rp)	682.075.683.748
Target Project NPV (ROI: 14%)	95.490.595.725
AP Payment Required Per Year (Rp)	287.712.786.883
Capital Budgeting Analysis	
NPV	95.490.55.725
IRR	12,66%
Payback Period	10,66

D. Risk Analysis through Sensitivity, Scenario and Monte Carlo Analysis.

Figure 1 show sensitivity analysis of the hospital project. The list of independent variables that sensitive to the overall NPV are salaries expense growth, inflation rate, long term interest rate and COGS expense. While the list of independent variables that are not sensitive to the firm overall NPV are building management expense, G&A expense, medical & non medic management expense, and other expense.

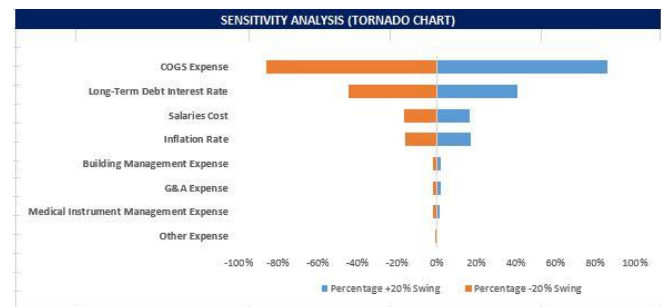


Fig. 1. Sensitivity analysis result.

Scenario analysis is a process of examining and evaluation of possible events that could happen in the future by considering various outcomes. In this cancer hospital project, the worst case, base case and best case scenario are used. To determine the worst and best scenario for the project, 4 years historical data is used. For the worst case scenario, the NPV of the project still positive Rp 40.041.126.128.

TABLE 11: SCENARIO ANALYSIS

Description	Worst Case	Base Cae	Best Case
Long Term Debt Interest Rate	10,25%	9,95%	9,85%
Inflation Rate	5,32%	4,12%	2,99%
Salaries Expense Growth	8,71%	8,38%	8,03%
Building Management Expense	0,33%	0,33%	0,32%
Medical & Non-Medical Instrument Mangement Expense	0,75%	0,75%	0,75%
COGS expense	32,87%	31,28%	29,69%
G&A Expense	1,02%	0,66%	0,64%
Other Expense	0,1%	0,09%	0,08%
NPV	40.041.126.128	95.345.805.365	139.405.938.777

Figure 2 show Monte Carlo Simulation of cancer hospital project overall NPV. The variable that included in this simulation consist of long term debt interest, inflation rate, salaries growth, building management expense, medical & non medic management expense, COGS, G&A and other expense. Based on 10,000 trial of Monte Carlo simulation, the NPV of this project lies between positive Rp 59,335,915,203 to Rp 121,260,967,584 with 95% certainties with 0% probabilities that project NPV <0.

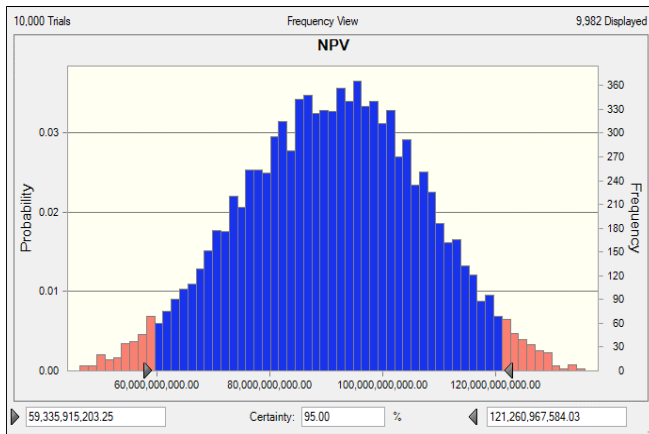


Fig. 2. Monte Carlo Analysis.

## V. CONCLUSION

From the simulation of Availability Payment (AP) calculation in each scenario of concession period ranging from 10 to 25 years, the cancer hospital project has optimal concession period of 22 years. The scenario of 22 Years concession period generates the lowest annual AP payment of Rp 287,712,786,883 compared to the other concession period scenario, therefore this scenario provide convenience for the Directorate General of Health Service as GCA to pay for its AP payment obligation.

Based on the feasibility study through financial projection on 22 years concession period using NPV, IRR and payback period, this hospital project require Rp 1,135,834,554,688 of total Capital Expenditures. The project resulted in positive NPV of Rp 95,490,595,725 and the IRR of 12.66% greater than the weighted average cost of capital (WACC) of 11.98% and the project payback period for 10,66 years, it can be concluded that the project is financially for the business entity to build.

Based on the risk analysis through sensitivity, scenario and monte carlo analysis. This cancer hospital project is financially safe to build by BUP, based on 10,000 trial of Monte Carlo simulation that the project NPV will lies between Rp 59,335,915,203 to Rp 121,260,967,584 with 95% certainties while from the worst case scenario the project NPV still positive Rp 40,041,126,128. Based on the sensitivity analysis the COGS expense is the variable that most affecting the firm overall NPV.

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