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The Impact of Financial Performance On the Development of Piping Drinking Water Supply Coverage

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Abstract: The PPP has been employed to finance Jakarta, Indonesia's drinking water supply, since 1998. Initially, drinking water supply coverage reached 52% of the total population in Jakarta. Twenty-five years later, the coverage remains around 65% of the total population. While in the 1998 contract, Suez promised the Jakarta Government to improve the coverage by 100% in 2022. The contract failed to reach its target in the contract draft in 1998, meaning that for 25 years, the collaboration has been unable to solve the problem of developing piped drinking water coverage. Moreover, the success rate of PPP collaboration in Jakarta from 1998 to 2022 has never been evaluated. In fact, it was continued on December 14, 2022, with a new model of PPP. To understand how the collaboration in 1998 - 2022 caused huge losses for the people of Jakarta, we want to highlight the essential part of the research that we conducted in the 2014 - 2020 period "low financial performance lead to low system performance."

Keywords: *Water Supply, PPP, Financial Performance, System Performances*

1. Introduction

In Indonesia, by law, The PPPs are a form of the licensed 'commercial use' of water rights. PPP requires the government to deliver assets, including space and 'consumers', within a certain period to private actors. The Private side of PPP should invest their Capital Expenditures in the form of a water supply infrastructure system. The system (technology) should be able to convert the raw water (input) into drinking water and then deliver it by the piping system (throughput) to the customer 24/7 (output). Moreover, the PPP as a financing mechanism continues to employ in Jakarta, although various research and article expose the failure of the PPP.

This article focuses on the effect of financial indicators as independent variables on the system indicator of the drinking water supply system as a dependent variable. Important to mention that this research primarily conducts between 2014 to 2020[1].

The system indicator is as follows (1) coverage [2]; (2) the addition of unit connections [2]; (3) the Volume of water produced [2]; (4) the Volume of distributed drinking water; (5) the Volume of water losses (Volume of water produced minus distributed drinking water); (6) drinking water quality [3-6]; and (7) the continuity of water [3, 7, 8]. The system indicator above is carefully studied from the worldwide literature on various drinking water utilities.

The financial indicator is as follows: (1) Capital

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Expenditure (IDR); (2) Operational Expenditure (IDR); (3) Basic Cost (IDR/m^3); (4) Tariff (IDR/m^3); (5) Margin (IDR/m^3); (6) Water Charge (IDR/m^3).

2. Method

The proposition is that "the better the PPP financial performance, the better the system performance." The case selection criteria are as follows: First, the cases should be operational and provide performance data. Secondly, the cases represent different administrative scales. The population of three cases is as follows: First, Tirta Benteng, Tangerang city with Moya Indonesia, and the operational period studied was from 2013 until 2017. The second case is the Government of Tangerang Regency and Aetra Air Tangerang, and the operational level was studied from 2008-2017. The third case is between PAM JAYA and PAM Lyonnaise Jaya; the operational level was between 1998 and 2017. We present our conceptual model in Figure 1.

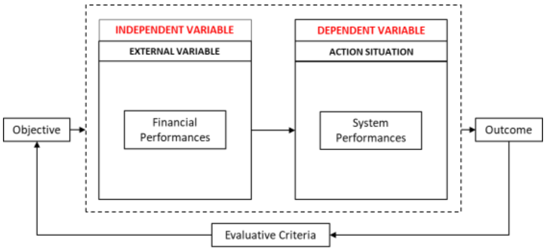


Figure 1 Conceptual Model

The Financial Performance serves as the independent variable (cause X), and the system performance serves as the dependent variable (effect Y). The model assumes that a proper Financial Performance creates a proper pre-condition for the operational actor to improve the performance of the system. The research hypothesis is that there is a positive relationship between financial performance and the performance of the drinking water supply system.

3. Result

The comparison of the cases is presented in two sequences. Firstly, by comparing the system performance (4.1), and secondly, by comparing the financial performance (4.2).

3.1. System Performances

Firstly, the planned number of connections should be realized, and the coverage area should be improved upon the balance between the number of subsidized and non-subsidized customers (see Figure 2):

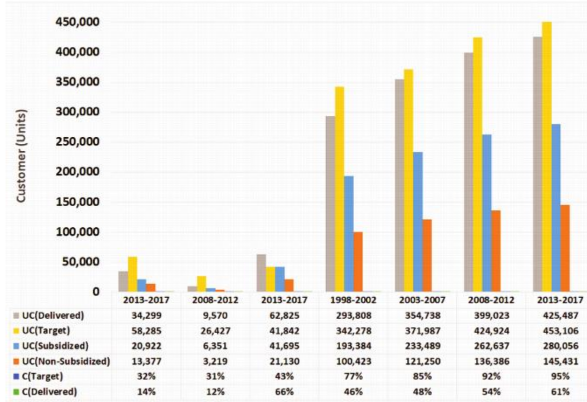


Figure 2 Targeted, Delivered Connection. *Year (X) and the connection number (Y). UC = Unit Connections. C = the Coverage is UC to the total population (%).*

In Case 1, the coverage is not achieved since the number of connections was 41% below the contractual planned connection. In Case 2, the two periods of observation showed a different pattern. In the 2008-2012 period, the number of connections was 64% (9.570 units) below contractual expectations (26.427 units) or 36% yet to be achieved. While In the 2013-2017 period, the increase in the number of connections exceeded the target (by 150%). Case 3 splits the observation into four periods (1998-2002, 2003-2007, 2008-2012, and 2013-2017). The number of connections was always below the target in all periods (14%, 5%, 6%, and 6%, respectively). Case 1 and case 3 is a failures.

Secondly, the focus is on whether the planned volumes produced and delivered are reached and whether water loss is within expectations. This is based on the data on water produced, Volume delivered, and volume losses (see Figure 3).

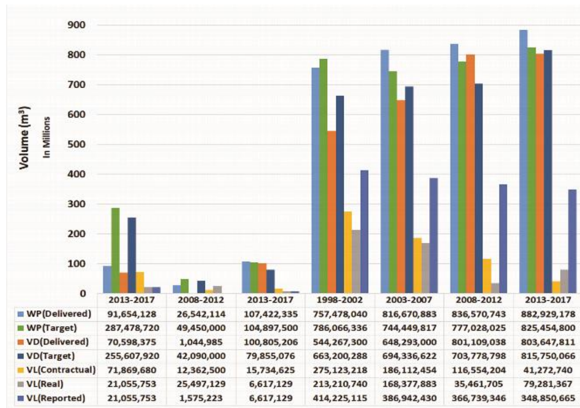


Figure 3 The Production, delivered (Sold), and Losses. *The horizontal axis (X) is the year, while the vertical axis (Y) is the Volume in cubic meters (m^3). WP = Water Produce (m^3/year); VD = Volume Delivered (m^3/year); VL = Volume Losses (m^3/year).*

In Case 1, the non-revenue water average in five years was consistent at 23%. However, the Volume of produced water fell short by roughly five years 68%. While the Volume of water sold fell short roughly over five years by 72%. In Case 2, results are split into two periods. In 2008-2012, the

Volume of water produced fell short by 24%, and the Volume sold fell short by 98% of the target. Total losses stood at the level of 6%. Meanwhile, from 2013-2017, the concessionaire was required to produce more water. Therefore, the Volume of water produced (111%) and the Volume sold (102%) both reached the target. Case 3 is split into four periods, which are 1998-2002, 2003-2007, 2008-2012, and 2013-2017. The Volume produced was respectively at minus 4%, plus 10%, plus 8%, and plus 7%. While the Volume sold was respectively at minus 18%, minus 7%, plus 14%, and minus 1%.

Especially for Case 3, since the beginning of the partnership, there were three different sets of data for water losses. First, the supposed real losses were 28%, 21%, 4%, and 9%. Respectively (Volume produced minus Volume sold). Second, the volume losses reported by PALYJA to PAM JAYA were at 55%, 47%, 44%, and 40%, respectively, while the targets of the losses to be achieved were at 35%, 25%, 15%, 5%, respectively.

Thirdly, the focus is on whether the water quality and water continuity met expectations (See Table 1):

Table 1 The System Performances at The Operational Level

Outcome Indicator	Unit	Case 1	Case 2		Case 3			
		(1)	(1)	(2)	(1)	(2)	(3)	(4)
5. Quality (Q)								
$Q_{(Target)} = VL_{(Real)(25\%)}$	Y/N	Y	Y	Y	Y	Y	Y	Y
Production	Y/N	Y	Y*	Y*	Y	Y	Y	Y
Distribution								
Primary	Y/N	Y	Y*	Y*	Y	Y	Y	Y
Secondary	Y/N	N	Y*	Y*	N	N	N	N
Tertiary	Y/N	N	Y*	Y*	N	N	N	N
$VL_{(12\%)/Non\text{-}Technical} \times 10^6$	m³/year	11	n.d.a	n.d.a	91	98	52	85
$VL_{(12\%)/Non\text{-}Technical}$	%	12%	12%	12%	12%	12%	6%	10%
$VL_{(5\%)/Illegal\ Use}$	m³/year	4,582,706	n.d.a	n.d.a	37,873,902	40,833,544	41,828,537	44,146,459
$VL_{(5\%)/Adm.\ Error}$	m³/year	4,582,706	n.d.a	n.d.a	37,873,902	40,833,544	41,828,537	44,146,459
$VL_{(1\%)/Wrong\ Account}$	m³/year	916,541	n.d.a	n.d.a	7,574,780	8,166,709	8,365,707	8,829,292
$VL_{(1\%)/Public\ Water\ Use}$	m³/year	916,541	n.d.a	n.d.a	7,574,780	8,166,709	8,365,707	8,829,292
$VL_{(13\%)/Technical}$	m³/year	9,966,470	n.d.a	n.d.a	98,472,145	70,377,377	n.d.a	n.d.a
$VL_{(13\%)/Technical}$	%	11%	13%	13%	13%	9%	n.d.a	n.d.a
$Un_{accounted\ for\ Water}$	m³/year	n.d.a	265,421	1,074,223	23,841,230	n.d.a	n.d.a	n.d.a
$Un_{accounted\ for\ Water}$	%	n.d.a	1%	1%	3%	n.d.a	n.d.a	n.d.a
$VL_{(<5\%)/Technical} \times 10^6$	m³/year	n.d.a	1	5	n.d.a	n.d.a	n.d.a	n.d.a
$VL_{(<5\%)/Technical}$	%	n.d.a	5%	5%	5%	5%	5%	5%
6. Quantity/Continuity (Q/C)								
$Q/C_{(Target)}$	Y/N	Y	Y	Y	Y	Y	Y	Y
$Q/C_{(Delivered)}$	Y/N	N	Y*	Y*	N	N	N	N
n.d.a = No Data Available								

In Case 1, volume losses were reported to be consistent with the real volume losses of 23%. The losses were above 5%, and the water was undrinkable. The supply was interrupted for one or two weeks every year due to dry seasons (and dry raw water supply).

In Case 2, for two five-year periods, 2008-2012 and 2013 -2017, volume losses were reported to be consistent with the real volume losses, which were 6%. The water delivered was drinkable. Since case 1 and case 2 derive the raw water from Similar to Case 1, the drinking water supply was interrupted every year for one or two weeks.

In Case 3, four five-year periods, 1998-2002, 2003-2007, 2008-2012, and 2013-2017, the reported volume losses were inconsistent with the real volume losses, which were at 55%, 47%, 44%, and 40%, respectively. The supposed real losses were 28%, 21%, 4%, and 9%, respectively. In both situations, the water was undrinkable. The supply was never interrupted during the years included in the analysis.

In conclusion, the system performances in reaching drinking water coverage in Case 2 are significantly higher than for Case 1 and Case 3. As a dependent variable, we look for the relationship between system performance and financial performance.

3.2. Financial Performances

Firstly, the focus is on the balance between capital expenditures and operational expenditures. The balance indicates the division of costs and benefits, as shown in, Figure 5:

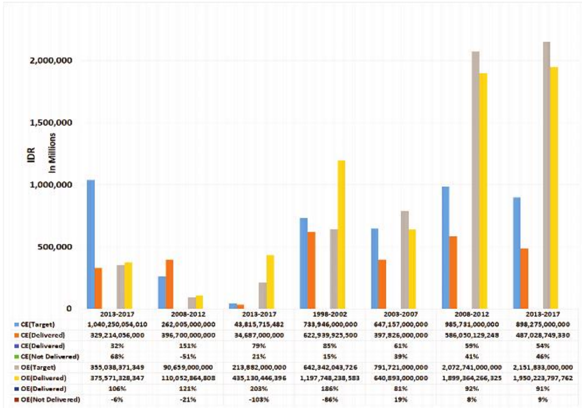


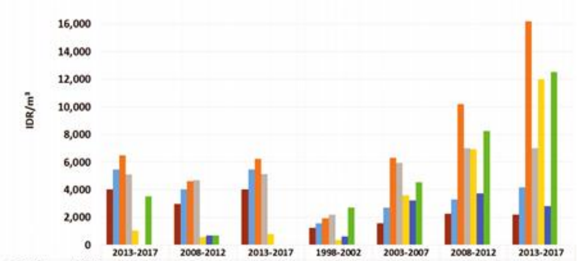
Figure 4 The Capital Expenditure and Operational Expenditure.
Notes: (X) is the year, while (Y) is the Expenditure in IDR. CE = Capital Expenditure (IDR/year); OE = Operational Expenditure (IDR/year).

In Case 1, the results illustrate that the disappointing system performances are in line with the equally marginal financial performances. Roughly 68 % of the contractual capital expenditure was not realized, while the operational expenditure was 60% lower than the target.

In Case 2, during the first five-year period (2008-2012), capital investments reached 151% of the target, a sign that the construction process absorbed the capital. The operational expenditure was 63% of what was expected. In the second five-year period (2013-2017), the Investment of capital was 21% below the target. The operational expenditure exceeded expectations (114%).

In Case 3, the capital expenditures were below the target (15%, 39%, 41%, and 46%, respectively). In contrast, the operational expenditure was not stable. They exceeded the target by 134% in the first five years. In the second period, the costs were 40% below target, in the third period, 8% below target, and in the fourth period, 9% below the target.

Secondly, the focus is on the relationship between financial performances for the basic cost (COM), tariff (contractual vs. real tariff), and margin (contractual vs. real margin) (See Figure 5)



	2013-2017	2008-2012	2013-2017	1998-2002	2003-2007	2008-2012	2013-2017
OE(Delivered) /WP	4,020	2,955	4,020	1,253	1,572	2,270	2,209
COM + CCh	5,451	4,024	5,451	1,589	2,716	3,290	4,183
Fin.Pro (TFP)	6,503	4,615	6,251	1,939	6,316	10,222	16,177
Reg. Head (TBR)	5,100	4,700	5,120	2,203	5,952	7,025	7,025
Contractual (CM)	1,052	591	800	350	3,600	6,932	11,994
Real (RM)	-351	676	-331	614	3,236	3,735	2,842
Water Charge (WC)	3,517	676	-331	2,715	4,540	8,258	12,523
Royalty (R)	0	12	16	0	0	0	0
Shortfall (S)	-3,868	0	0	-2,101	-1,305	-4,523	-9,681

Figure 5 Basic Cost, Tariff and Margin. *Notes: Operational Expenditures (OE) delivered per Water Production (WP) is the Cost of Operation & Maintenance (COM) (in IDR/m³). CCh is Capital Charge per water production (in IDR/m³). TFP is the Tariff of the Financial Projections (contractual) (in IDR/m³). TBR is the Tariff base on Regional Head Decision (in IDR/m³).*

In Case 1, Figure 5 shows the margin between the basic cost (COM) and the tariff. The result shows the real margin was far below the contractual margin. In Case 2, in 2008-2012, the real margin was bigger than the contractual margin. While in 2013-2017, the real margin was below the contractual margin. In Case 3, the real margin was always positive in four five-year periods but not as big as the contractual margin.

Thirdly, the focus is on the financial performance of the water charge and giving special attention to the ability of the contractual margin and real margin to pay the water charge and to elaborate on this aspect and compare the cases.

Table 2 The System Performances at The Operational Level

Outcome Indicator	Unit	Case 1	Case 2		Case 3			
		1	1	2	1	2	3	4
12. Water Charge (WC) or Royalty (R)								
Royalty (R)	IDR/m³	n.d.a	12	16	n.d.a	n.d.a	n.d.a	n.d.a
R X WP x 10^9	IDR	n.d.a	12,345,454	2	n.d.a	n.d.a	n.d.a	n.d.a
Water Charge (WC)	IDR/m³	3,517	676	-331	2,715	4,540	8,258	12,523
WC X WP x 10^9	IDR	322	18	-36	2,051	3,708	6,909	11,057
13. Shortfall								
Shortfall (S)	IDR/m³	-3,868	n.d.a	n.d.a	-2,101	-1,305	-4,523	-9,681
S X WP x 10^9	IDR	-355	n.d.a	n.d.a	-1,592	-1,066	-3,784	-8,548
n.d.a = No Data Available								

In Case 1, Table 2 shows the water charge resulted in a shortfall when the real margin was not as big as the contractual margin. In Case 2, the margin in the first five-year period showed a positive real margin. In contrast, the real margin was negative in the second five-year period. In Case 3, the water charge mechanism was stone solid for 20 years and in continual shortfall. The real margin was already positive but not as big as the contractual margin.

Case 1: Both system performances and financial performances were significantly behind their targets. Not enough connections were realized, and the concessionaire did not invest enough. Only the low percentage of leakage was worth noticing as that shows positivity, although the water was still not drinkable.

Case 2: Overall, for the first period, system performances were below their targets. This was caused by the delay in construction activities. Unit connections improved rapidly, and the water was drinkable. In the second period, system performances surpassed the contractual targets, although the real margin was negative.

Case 3: System performances were slightly below their target for connections. The volume losses were inconsistent if the data set was related to the volume losses. Notably, there seems to be no convincing fit between reports and reality. The water quality was not drinkable, and there was no continuous 24/7 supply. Furthermore, there was substantial under-investment with regard to financial performance, while the shortfall was enormous.

4. Discussion

The financial performances in the second case were better than in the first and third cases. We would like to point out three points as follow:

4.1. The importance of balance between capital expenditure and operational expenditures

In Case 1 and Case 3, the total Capital Expenditure and Operational Expenditure do not balance. I cannot see the proper capital expenditures implemented in Case 1 and Case 3. Moreover, the overhead cost (salary, bonus, etc.) surpasses the variable cost (chemical expenses for treating water). In case 1 and case 3, I notice that the biggest part of the capital expenditure is not spent during the first two to three years in the first five-year plan period (the pre-construction and the construction period). It is proven that the private do not invest properly. Moreover, the operational expenditure already surpasses the capital expenditure. Normally, the capital expenditures should spend for the first five years, see Figure 6.

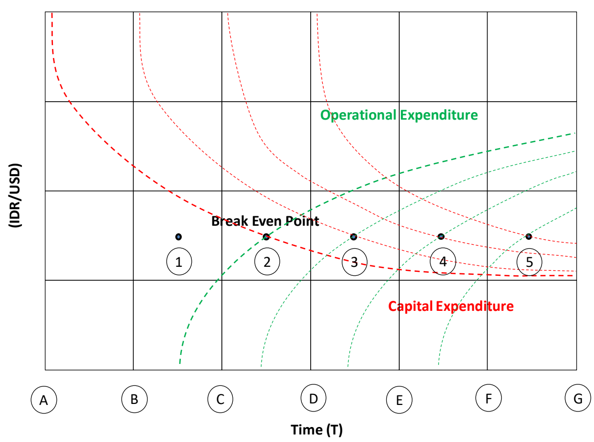


Figure 6 The Capital Expenditure And Operational Expenditure. *Notes: A = Capital Expenditure starts to be invested; A-B = Operational Expenditures < Capital Expenditure; B-C = Break Event Point; D= Operational Expenditures >*

Capital Expenditure.

4.2. The structure of basic cost (COM), capital charges (CCh), and opportunity cost;

The capital expenditure and operational expenditure are implemented, and both are blended in the form of the cost of operation and maintenance (COM). Therefore, the variable and overhead costs are blended in the form of the cost of operation & maintenance (E-F). Rogers et al. (1998, p. 6) said, "*the costs per cubic meter of water produced that incorporate all expenditures are associated with facility operations and maintenance in delivering drinking water over a certain period*" (See Figure 7).

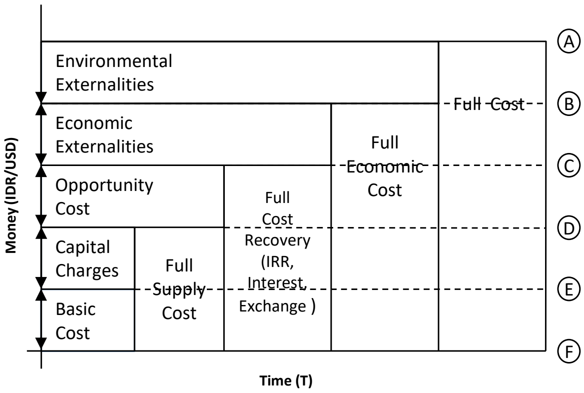


Figure 7 The Cost Components. *C = Tariff; E = The cost of Operation & Maintenance as the Basic Cost; Margin= C-E; Opportunity Cost=C-D; Capital Charges = D-E. Adapted from Rogers, et al. [9]*

The capital charge is attached to the financial transaction. The capital charge (D-E) was defined by Rogers et al. (1998, p. 6) as "the Capital Charges (payments to the equity sponsor) should include the capital consumption (i.e., Interest Charges or exchange rate) and interest costs associated with reservoirs, treatment plants, conveyance, and distribution systems."
An opportunity cost (C-D) is the cost to compensate the equity sponsor for the next best-lost opportunity that they did not take. The public (customer) responsible for producing and delivering drinking water must cover this opportunity cost.

4.3. The balance between the rate of return, tariff, and the water charge;

The return on Investment or stable opportunity cost is represented by the level of Internal Rate of Return (IRR). The IRR is set at 22%. IRR of 22% means the PPP provides stable opportunity costs for the private. Moreover, stable opportunity cost demands a stable margin over the capital charge and the basic cost. The stable margin on the side of the equity sponsor is arranged by creating an imaginary tariff (T_n):

The water charge (C_n) is a formulation or mechanism to pay back the basic water charge (C_0) that involves time lag with four factors, as follows: (1) Coefficient of adjustment (G_n) and weighting (F_n) of the capital expenditure; (2) the Coefficient of adjustment (O_n) and weighting(H_n) of the operational expenditures; (3) Compensation for the interest rate (K_in); and (4) Compensation for the exchange rate (K_{in}). The water charge concept and mechanism are arranged to ensure the cash flow for the equity sponsor is always positive (full cost recovery). The water charge (C_n) payment is taken from the balance of (1) Basic cost (E'-F) or (E-F)); (2) Capital charge (D'-E); and (3) Opportunity cost/the benefits (C'-D) (see Figure 2-4) (see Equation 2-5) [10]. However, the money to pay the water charge is taken from the real margin (C-E).

Equation 1 The water charge to be paid

$$C_n = (C_0\, x\, \{F_n\, x\, G_n + H_n\, x\, O_n\}) + K_{\$n} + K_{in}$$

Where,

C_n	:	The Water charge to be paid
C_0	:	The Basic Water Charge
F_n	:	The Weight Allocated for Capital Expenditure
G_n	:	The Coefficient Adjustment for Capital Expenditures
H_n	:	The Weight Allocated for Operational Expenditure
O_n	:	The Coefficient Adjustment for Operational Expenditure
$K_{\$n}$	:	The Compensation for exchange rate variation
K_{in}	:	The Compensation for interest rate variation
0	:	t = 0
n	:	t = n

Source : Jaya and Jaya [10]

5. Conclusion

The better the PPP financial performance, the better the system performance, and the hypothesis is confirmed. To be clear, Financing Drinking Water Infrastructure using the PPP involves capital expenditures from the equity sponsor. When the operation started, the operational expenditures per m^3 of water produced involved the balance of the variable cost per m^3 and overhead cost per m^3 to reach the break-even point. The operational activity is expected to maintain the balance of the variable and overhead cost per cubic meter. The basic cost is the variable cost plus the overhead cost per m^3 divided by the total Volume of water produced.

The PPP operational activity involves the cost for the capital charges: (1) compensation to the interest rate (K_{in}); and (2) compensation to the exchange rate ($K_{\$n}$).

The opportunity cost for the equity sponsor maintains over the basic cost (the fluctuation of the variable cost and the stability of the overhead cost) and the capital charge (exchange cost and interest cost, which is also fluctuated). Paying back the capital and operational expenditures (the basic cost, the capital charge, and the opportunity cost) need a water charge mechanism.

The water charge mechanism is built at the planning level upon basic water charge (C_0). The basic water charge (C_0) is calculated based on the total expenses on capital, operational, and opportunity costs. The time lag in paying the basic water charge (C_0) considers: (1) adjustment coefficient (G_n) and weighting (F_n) for the capital expenditure; (2) adjustment coefficient (O_n) and weighting (H_n) for the operational expenditures; (3) compensation for the interest rate (K_{in}); (4) compensation for the exchange rate $(K_{\$n})$. When adjustment coefficient and weighting are involved, the basic water charge (C_0) becomes the water charge (C_n).

When planned, the stable margin for the equity sponsor requires an initial imaginary tariff. The imaginary tariff is set by dividing the target Volume produced (V_n) with the total cash flow per year (R_n). The contractual tariff is the imaginary tariff plus the level of internal rate of return. The IRR is obtained in procurement. The stable opportunity demands a stable margin over the fluctuation capital charge and the basic cost.

When operational, the equity sponsor assumes the money to pay the water charge is taken from the margin between the contractual tariff minus the basic cost. The money to pay the water charge is taken from the real margin (C-E), i.e., the margin between the real tariff and the basic cost.

Finally, of the three cases in this research, the water charge mechanism arranged to maintain the cash flow equity sponsor must always be positive (full cost recovery).

6. Acknowledgments

Any comments and suggestions are welcomed so that we can constantly improve this template to satisfy all authors' research needs. I'm very grateful to the experts for their appropriate and constructive suggestions to improve this template.

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