Financial Analysis of Operation-Transfer Projects

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Abstract

The ministry of education urgent the authority of colleges adopting the BOT (Build-Operate-Transfer) approaches for campus development, especially for new college dormitories. In general, it is very difficult to meet the financial need of BOT investors for sole rent income of college dormitories. Hence, there is a need to find a new solution in stead of the BOT. OT (Operate-Transfer) is a possible option to substitute the BOT.

We establish a financial model to simulate the investment of an OT project of a new college dormitory. Three cases are considered in an empirical study of a new college dormitory of the National United University. The first case is assumed that total fund is from the college foundation. The second case is 50% of the funds from college foundation and 50% of the funds from bank loan. The third case is 100% of fund from the bank loan. All of the funds are recovered as a loyalty paid by the project company. The results demonstrate that OT is quite a possible solution which all the financial results seem promising. Only the payback period is 20 years which looks too long for common investors.

Keyword: BOT, OT, Financial Model

1. Introduction

Tam [1] and McCowan, et al [2] show that BOT is very popular in last decade. Many governments in Asia like to adopt the BOT scheme for infrastructure constructions. The world bank [3] issues a handbook to provide a guideline for the investors to follow in doing their financial analysis of BOT projects. To calculate the financial feasibility, there are many works to do in advance, such as capital structure [4] and

cost estimate [5] of the BOT projects. After the cost and revenue estimate, an analysis of financial feasibility indices become very important in order to demonstrate the feasibility of the BOT projects[6,7,8]. However, there is not that all projects are good for BOT scheme. Especially for those projects which profitability indices values are to hurdle rates. In those cases, some measures must be taken to enhance the financial indices. The projects are like railway projects, college dormitory projects, etc. An OT scheme is used in this study. OT means that building work is not including in the contract. Less funding is required for investors in OT cases. The results could provide some insights for those who are interesting on BOT projects.

2. Theoretical Framework

In order to analyze the financial feasibility of privatized projects, a sound financial model is very important. We establish a financial model to calculate the financial index of the projects. A cash flow is established by considering the cash outflow during construction stage and cash inflow during operation stage.

(1). Construction stage

The total construction cost, TPC, is shown in the equation below.

$$TPC = BC + EDC + IDC$$

Where TPC =Total project cost, BC=Base cost, EDC=the cost escalation during construction, and IDC=Interest during construction.

The base cost is calculated by the following equation.

$$BC_i = P_i \times BC$$

Where BC_i=the outlay of BC in the ith year of construction duration, and P_i=the percentage of construction progress in the ith year of construction duration.

$$BC = \sum_{i-1}^{C_d} BC_i \quad i = 1, C_d$$

Where C_d=the construction duration.

$EDC_i = 0$. Because that the construction period is short, in general 1~2 years, the cost escalation is not considered in this study.

Interest during construction phase is shown as

$$IDC_j = (1-\alpha) \times BC \times i_r \times \sum_{i=1}^{j} P_i \quad i = 1, j$$

Where α is the rate of financial contribution of equity in BOT model, and the rate of financial contribution of fund of National United University in OT model. IDC_j=the outlay of IDC in the jth year of construction duration. And, i_r=the interest rate.

The total interest during construction phase is as follows:

$$IDC = \sum_{j=1}^{C_d} IDC_j \quad j = 1, C_d$$

In summary, the total project cost is shown below.

$$TPC_i = BC_i + EDC_i + IDC_i = BC_i + IDC_i$$

Where TPC_i=the outlay of TPC in the ith year of construction duration.

A_i is the financial contribution of equity in BOT model and the rate of financial contribution of fund of National United University in OT model.

$$A_i = \alpha \times BC_i + IDC_i$$

(2). Operation period

The annual cash income is shown as follows:

$$PB_k = PBIT_k = PBRT_k = RI_k - OMC_k$$

Where PB_k=the profit before interest or royalty and tax in the kth year of operation period, $PBIT_k$=the profit before interest and tax in the kth year of operation period, $PBRT_k$=the profit before royalty and tax in the kth year of operation period, RI_k=the rental income in the kth year of operation period, OMC_k=the operation and maintenance cost in the kth year of operation period, and PBIT stands for profit before interest and tax in BOT model and PBRT is profit before royalty and tax in OT model.

The debt is calculated in the following equation.

$$D_k = (1-\alpha) \times BC \times \frac{i_r \times (1+i_r)^{DRP}}{(1+i_r)^{DRP} - 1}$$

Where D_k=the debt service to be paid in the kth year of operation period, and DRP=the debt repayment period.

The annul interest is

$$INT_k = D_k \times (1+i_r)^{-(DRP-k+1)}$$

Where INT_k=the interest to be paid in the kth year of operation period.

The deprecation is calculated by assuming straight line deprecation.

$$DEP_k = \frac{BC - SAL}{O_p}$$

The taxes for BOT cases is then calculated by the following

$$TAX_{k,BOT} = (PB_k - INT_k - DEP_k) \times t_i$$

Where $TAX_{k,BOT}$=tax in BOT model in the kth year of operation period, and t_i=the rate of income tax in the kth year of operation period.

The taxes for OT cases is then calculated by the following

$$TAX_{k,OT} = (PB_k - RYT_k) \times t_i$$

Where $TAX_{k,OT}$=tax in OT model in the kth year of operation period, and RYT_k=the royalty to be paid in the kth year of operation period.

The debt service to be paid for college is shown in the following equation.

$$RYT_k = RYT1_k + RYT2_k$$

where $RYT1_k = D_k$, $RYT1_k$=the debt service to be paid for school sector in the kth year of operation period.

$$RYT2_k = (1-\alpha) \times \frac{b_r \times (1+b_r)^{O_p}}{(1+b_r)^{O_p} - 1} \times \sum_{i=1}^{C_p} BC_i \times (1+b_r)^{C_p - i}$$

Where $RYT2_k$=the royalty to be paid in the kth year of operation period, and b_r=B bond rate.

The annual net income for BOT cases is

$$NIC_{k,BOT} = PB_k - D_k - TAX_k$$

Where $NIC_{k,BOT}$=net income in BOT model in the kth year of operation period.

The annual net income for OT cases is

$$NIC_{k,OT} = PB_k - RYT_k - TAX_k$$

$NIC_{k,OT}$=net income in OT model in the kth year of operation period.

(3). Financial feasibility indices

There are NPV, IRR, PI, PB, DPB, DSCR, and ROE to serve as the financial fesibilty indices for the BOT or OT projects.
The NPV is shown as

$$NPV_{BOT} = \sum_{i=1}^{C_d} \frac{TPC_i}{(1+d_r)^i} + \sum_{k=1}^{O_p} \frac{NIC_{k,BOT}}{(1+d_r)^{k+C_d}}$$

Where NPV_{BOT}=Net present value for BOT model.

$$NPV_{OT} = \sum_{k=1}^{O_p} \frac{NIC_{k,OT}}{(1+d_r)^k}$$

Where NPV_{OT}=Net present value for OT model.
The IRR is calculated by the following equation.

$$f(IRR)_{BOT} = \sum_{i=1}^{C_d} \frac{TPC_i}{(1+IRR_{BOT})^i} + \sum_{k=1}^{O_p} \frac{NIC_{k,BOT}}{(1+IRR_{BOT})^{k+C_d}} = 0$$

Where IRR_{BOT}=Internal rate of return for BOT model.

$$f(IRR)_{OT} = \sum_{k=1}^{O_p} \frac{NIC_{k,OT}}{(1+IRR)^{k+C_d}} = 0$$

Where IRR_{OT}= Internal rate of return for OT model.
The profitability index is shown as

$$PI_{BOT} = \frac{\sum_{k=1}^{O_p} \frac{NIC_{k,BOT}}{(1+d_r)^{k+C_d}}}{\sum_{i=1}^{C_d} \frac{TPC_i}{(1+d_r)^i}}$$

Where PI_{BOT}=profitability index for BOT model.

$$PI_{OT} = \frac{\sum_{k=1}^{O_p} \frac{NIC_{k,OT}}{(1+d_r)^{k+EIP}}}{\sum_{k=0}^{EIP} \frac{NIC_{k,OT}}{(1+d_r)^i}}$$

Where PI_{OT}=profitability index for OT model, and EIP represents the end of the investment period; it is the period (year) before the project beginnings to generate positive cash flow.
The pay back period is found in the equation

$$\sum_{i=1}^{C_d} TPC_i + \sum_{k=1}^{K} NIC_{k,BOT} = 0 \quad K = PB_{BOT}$$

Where $PB_{k,BOT}$=payback for BOT model.

$$\sum_{k=1}^{K} NIC_{k,OT} = 0 \quad K = PB_{OT}$$

Where $PB_{k,OT}$=payback for OT model.

The discount pay back period is found in the equation

$$\sum_{i=1}^{C_d} \frac{TPC_i}{(1+d_r)^i} + \sum_{k=1}^{K'} \frac{NIC_{k,BOT}}{(1+d_r)^{k+C_d}} = 0 \quad K' = DPB_{BOT}$$

Where $DPB_{k,BOT}$=discounted payback for BOT model.

$$\sum_{k=1}^{K'} \frac{NIC_{k,OT}}{(1+d_r)^k} \quad K' = DPB_{OT}$$

Where $DPB_{k,OT}$=discounted payback for OT model.
The debt service coverage ratio is

$$DSCR_{k,BOT} = \frac{PBIT_k}{D_k}$$

Where $DSCR_{k,BOT}$=debt service coverage ratio for BOT model.

$$DSCR_{k,OT} = \frac{PBRT_k}{RYT1_k}$$

Where $DSCR_{k,OT}$=debt service coverage ratio for OT model.
The return on equity is shown as follows:

$$ROE_{k,BOT} = \frac{NIC_{k,BOT}}{\sum_{i=1}^{C_d} A_i}$$

Where $ROE_{k,BOT}$=return on equity for BOT model.

$$ROE_{k,OT} = \frac{NIC_{k,OT}}{\sum_{k=0}^{EIP} NIC_{k,OT}}$$

Where $ROE_{k,OT}$=return on equity for OT model, and The k in the numerator is always greater than EIP

3. Empirical study- stage 1: the financial feasibility study of BOT scheme

We adopt the college dormitory of National United university as a case study. The fundamental assumption are shown as follows

Item	Details	Remark
Concession period	40	
Construction duration	2	
Operation period	38	
Inflation rate	2%	
Income tax	25%	
Business tax	5%	
Rate of equity	30%	
Rate of debt	70%	
Interest rate	5%	
Grace period of debt	2	Repay interest during construction.
Debt repayment period	15	Repay debt service.
Discount rate	10%	Capital cost of equity.

The data for Project Cost

Item	Cost (NTD)	Remark
A. Direct cost		
Building structure	323,125,000	Unit price : NTD 47,000 Total area:6,875 坪
Upholstery	34,375,000	Unit price : NTD 5,000 Total area：6,875 坪
Electromechanical devices	55,000,000	Unit price : NTD 8,000 Total area：6,875 坪
Landscape	6,875,000	Unit price : NTD 1,000 Total area：6,875 坪
subtotal	419,375,000	
B. Indirect cost		
Project management fee	6,290,625	Direct cost×1.5%
Boring test and survey fee	1,500,000	
Planning fee	6,290,625	Direct cost×1.5%
Construction management fee	4,193,750	Direct cost×1.0%
subtotal	18,275,000	
Base cost	437,650,000	
C. Insurance	3,355,000	Direct cost×0.4%
D. Establishment charge	2,188,250	Base cost×0.5%
E. Royalty of development	1,000,000	
F. Rent of land	27,458	
Total	**444,220,708**	

The data for debt

Construction period	1st year	2nd year	Total
Percentage of progress	60%	40%	100%
Cost (NTD)	266,594,179	177,626,529	444,220,708
Debt (NTD)	186,615,925	124,338,570	310,954,496
Interest (NTD)	9,330,796	15,547,725	24,878,521

The data for Rental income

Item	Rent (NTD)	Remark
A.Student dormitory		

Single room	6,209,910	Rent：4,500(NTD/per bed per month)；Num of bed：140(bed)； Rate of rent：98.57%；Num of month：10(month per year)
Double bedroom	17,760,600	Rent：3,000(NTD/ per bed per month)；Num of bed：600(bed)； Rate of rent：98.67%；Num of month：10(month per year)
Quad room	10,724,416	Rent：1,600(NTD/ per bed per month)；Num of bed：680(bed)； Rate of rent：98.57%；Num of month：10(month per year)
subtotal	34,694,926	
B.Student convenient facilities		
Canteen	3,510,000	Rent：650(NTD/坪-月)；Total area：450(坪)； Rate of rent：100%；Num of month：12(month per year)。
Convenience	2,925,000	Rent：650(NTD/坪-月)；Total area：375(坪)； Rate of rent：100%；Num of month：12(month per year)。
subtotal	6,435,000	
Total	**41,129,926**	Inflate per year under the rate of 2%

The data for Operation and maintenance cost at the 1st of the concession period:

Item	Cost (NTD per yr)	Remark
Payload	2,160,000	Salary：20,000(NTD/per person per month)； Inflate rate2%；Num of people：8； Num of month：13.5(month per year)
Utility fee	411,299	Annual operation income×1%
Building maintenance fee	629,063	Direct cost×0.15%
Other fee	308,474	Annual operation income×0.75%
House Tax	1,523,353	House value×3%×50%(former 5 yrs of concession) House value×3%(after the 5th year of concession)
Land Value Tax	0-	Tax free
Land rent	41,188	Land worth：1,372,920；
Insurance	1,682,750	1. property insurance 2. Public accident insurance 3. Personnel insurance
Operation royalty	411,299	Annual operation income×1%(fixed rate)
Business Tax	2,056,496	Annual operation income×5%
Total	9,223,921	Increase irregularly

The data for replacement.

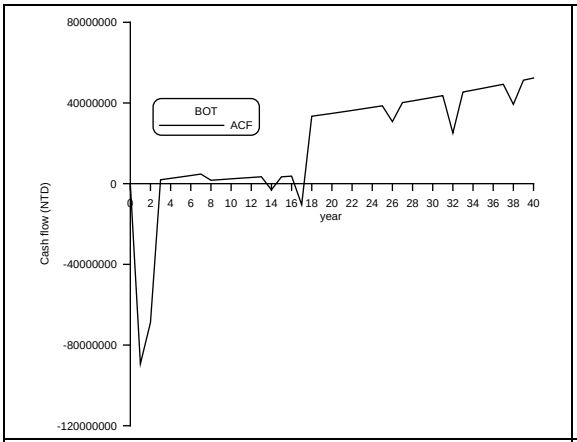
Item	Cost of refitting (NTD)	The year of refitting
Room finishing	8,984,406	14th of concession

(Rate of refitting 20%)	11,129,168	26th of concession
	13,785,929	38th of concession
Electromechanical devices	18,956,698	17th of concession
(Rate of refitting 25%)	24,773,044	32nd of concession

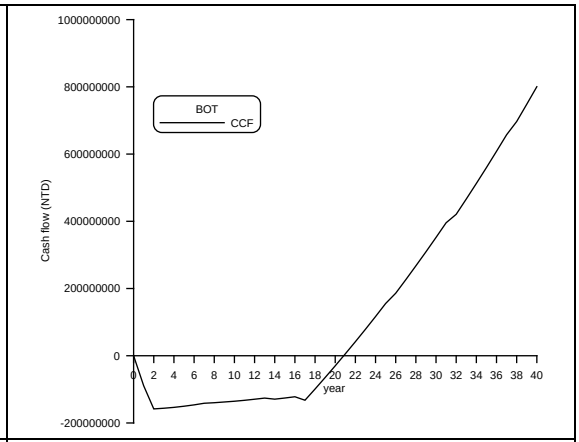
The data for depreciation

Item	Amount	Remark
Building structure	6,462,500	Construction cost：323,125,000；Life length：50；Salvage：77,550,000. (3rd ~40th of concession)
Room finishing	2,864,583	Construction cost：34,375,000；Life length：12；Salvage：0. (3rd ~14th of concession)
Electromechanical devices	3,666,667	Construction cost：55,000,000；Life length：15；Salvage：0. (3rd ~17th of concession)
Establishment charge	1,312,950	Establishment*60%. (3rd of concession)
	875,300	Establishment*40%. (4th of concession)

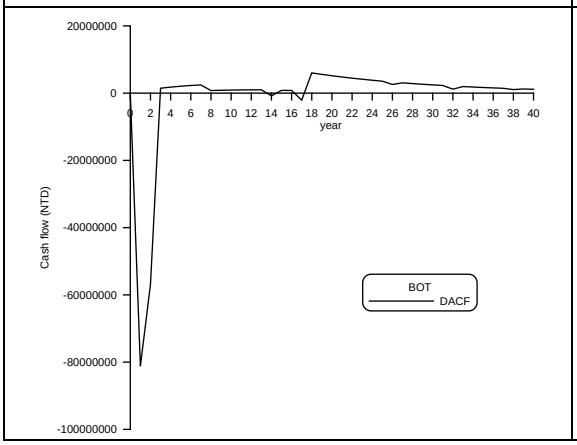
The equity’s cash flow

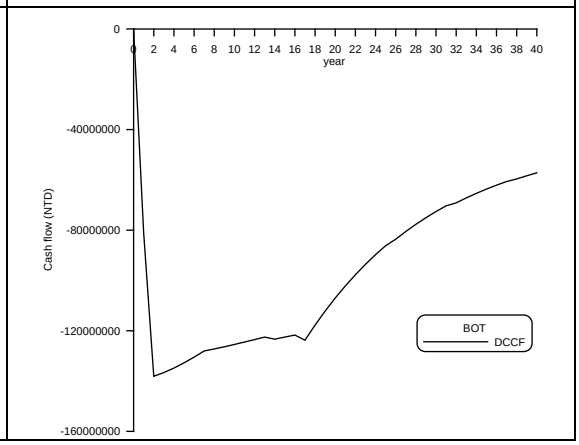


BOT-Annual Cash Flow



BOT-Cumulate Cash Flow





BOT-Discounted Annual Cash Flow	BOT-Discounted Cumulate Cash Flow

The financial feasibility indices

Index	NPV	IRR	PI	PB	DPB	ADSCR	AROE	EIP*
BOT	-57,210,989	7.34%	0.59	22	-	1.15	16%	2

BOT model is not feasible because NPV is less than zero, IRR doesn't match the capital cost of equity, PI is less than one and DPB is over the concession period.

4. Empirical study- stage 2: the financial feasibility study of OT scheme

Project cost in OT model

Item	Cost (NTD)	Remark
D. Direct cost		
Building structure	323,125,000	Unit price : NTD 47,000 Total area:6,875 ping(坪)
Upholstery	34,375,000	Unit price : NTD 5,000 Total area：6,875 ping(坪)
Electromechanical devices	55,000,000	Unit price : NTD 8,000 Total area：6,875 ping(坪)
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subtotal	419,375,000	
E. Indirect cost		
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Construction management fee	4,193,750	Direct cost×1.0%
subtotal	18,275,000	
Base cost	437,650,000	
F. Insurance	3,355,000	Direct cost×0.4%
G. Establishment charge	2,188,250	Base cost×0.5%
Total	**443,193,250**	

There are two items of project cost include in BOT model but not in OT model, the Royalty of development and Rent of land. The financial funding are from the fund of National United University & the bank. We study five scenarios.

Source	Rate of financial contribution from the fund of NUU	Rate of subsidy from the fund of NUU	Rate of Financial contribution from the bank
Scenario 1	100%	0%	0%

Scenario 2	50%	0%	50%
Scenario 3	0%	0%	100%
Scenario 4	10%	0%	90%
Scenario 5	0%	10%	90%

Annual financial contribution from the fund of National United University during construction

Construction period	1st year (NTD)	2nd year (NTD)	Total (NTD)
Percentage of progress	60%	40%	100%
Scenario 1	265,580,450	177,612,800	443,193,250
Scenario 2	132,790,225	88,806,400	221,596,625
Scenario 3	0	0	0
Scenario 4	26,558,045	17,761,280	44,319,325
Scenario 5	0	0	0

Annual financial contribution from the bank during construction

Construction period	1st year (NTD)	2nd year (NTD)	Total (NTD)
Percentage of progress	60%	40%	100%
Scenario 1	0	0	0
Scenario 2	132,790,225	88,806,400	221,596,625
Scenario 3	265,580,450	177,612,800	443,193,250
Scenario 4	239,022,405	159,851,520	398,873,925
Scenario 5	239,022,405	159,851,520	398,873,925

Annual interest contribution from the fund of National United University during construction

Construction period	1st year (NTD)	2nd year (NTD)	Total (NTD)
Scenario 1	0	0	0
Scenario 2	7,967,414	13,295,798	21,263,212
Scenario 3	15,934,827	26,591,595	42,526,422
Scenario 4	14,341,344	23,932,436	38,273,780
Scenario 5	14,341,344	23,932,436	38,273,780

Annual royalty payment for the concessionaire during concession period.

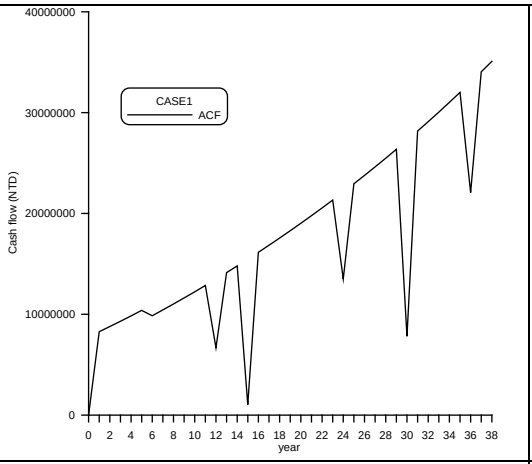
	Royalty1 (NTD per year)	Royalty2 (NTD per year)	Total (NTD per year)
Scenario 1	0	20,876,306	20,876,306
Scenario 2	22,816,201	11,432,572	34,248,773
Scenario 3	45,632,402	1,988,838	47,621,240
Scenario 4	41,069,162	3,877,585	44,946,747
Scenario 5	41,069,162	1,789,954	42,859,116
Remark	Royalty1: Payment for debt service. Royalty2: Payment for the fund of NUU.		

At operation stage, the profit before royalty and tax at the 1st of the concession period:

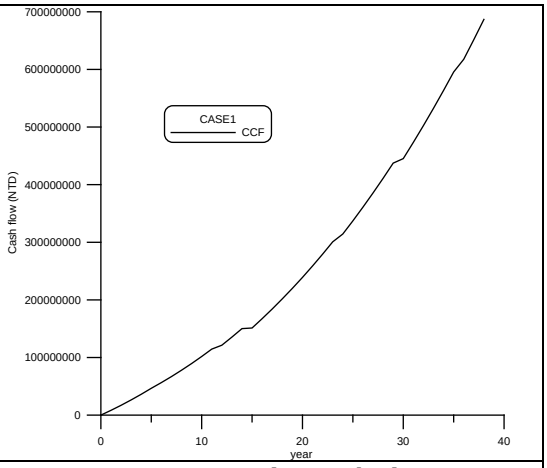
Item	Amount at the 1st year (NTD)	Remark
Rental income	41,129,926	Inflate per year under the rate of 2%
Operation & maintenance cost	9,223,921	Increase irregularly

Scenario 1: Full of the financial contribution from the fund of NUU.

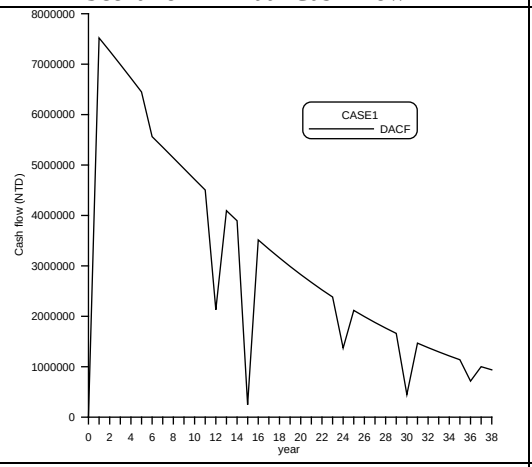
Equity's cash flow



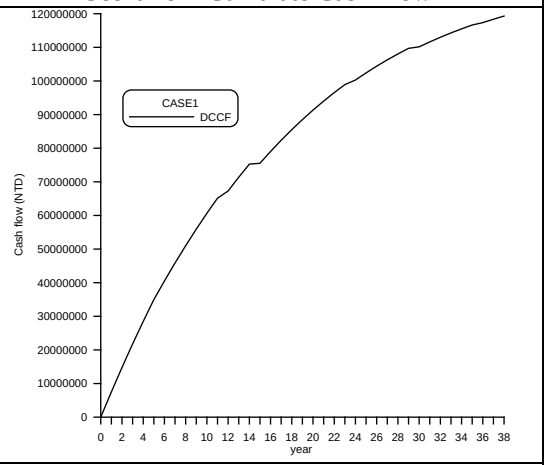
Scenario 1-Annual Cash Flow



Scenario 1-Cumulate Cash Flow



Scenario 1-Discounted Annual Cash Flow



Scenario 1-Discounted Cumulate Cash Flow

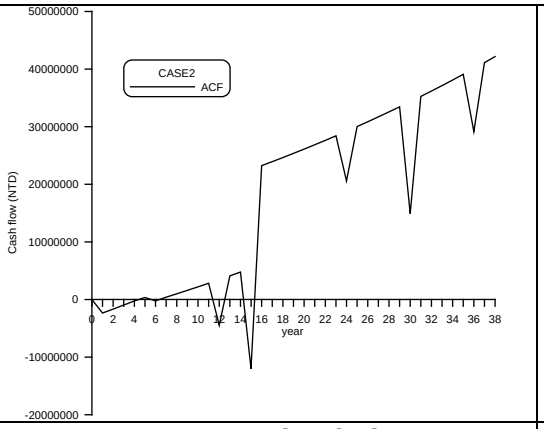
The financial feasibility indices

Index	NPV	IRR	PI	PB	DPB	DSCR	ROE	EIP*
Numerical value	119,298,394	-	-	-	-	-	-	-

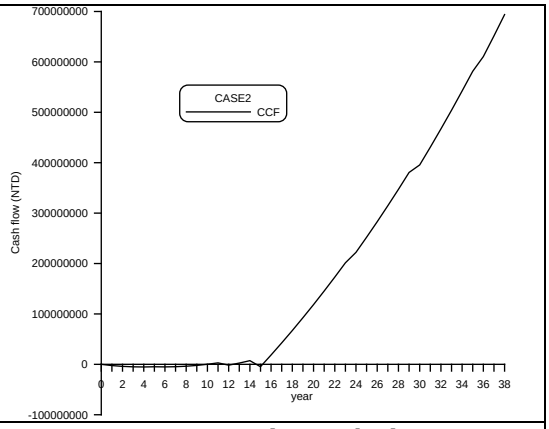
1. Cash flow is positive every year in the concession period.
2. Rental income at the end of each period (year) can totally cover all the operation cost invested at the beginning of the period.

Scenario2: Half of the financial contribution from the fund of NUU and the other half from the bank.

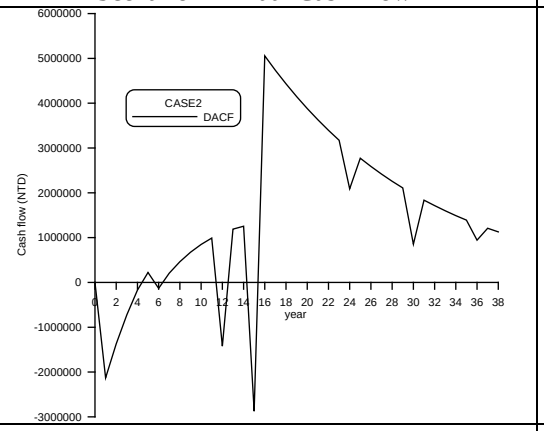
Equity's cash flow



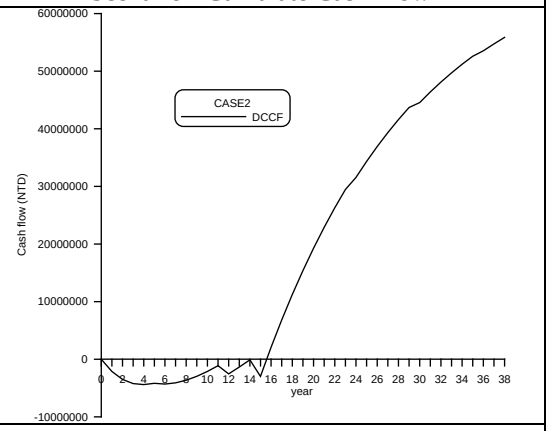
Scenario2-Annual Cash Flow



Scenario2-Cumulate Cash Flow



Scenario2-Discounted Annual Cash Flow



Scenario2-Discounted Cumulate Cash Flow

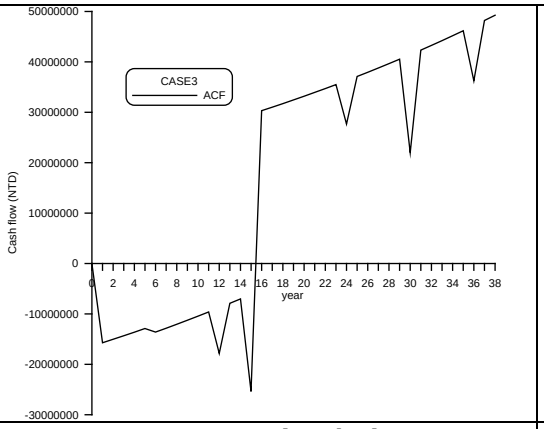
The financial feasibility indices

Index	NPV	IRR	PI	PB	DPB	DSCR	ROE	EIP*
Numerical value	55,870,787	26.51%	13.71	10	16	1.00	394%	4

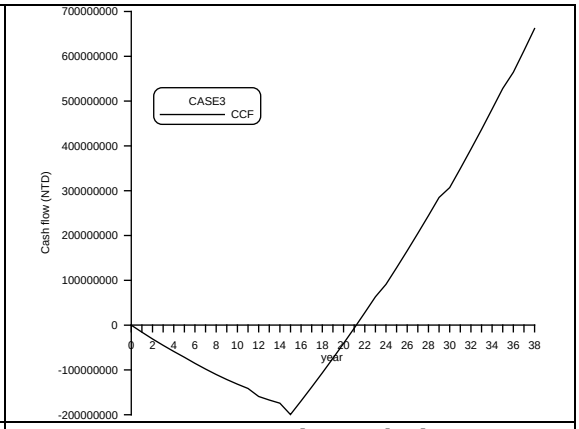
1.

Scenario3: Full of the financial contribution from the bank.

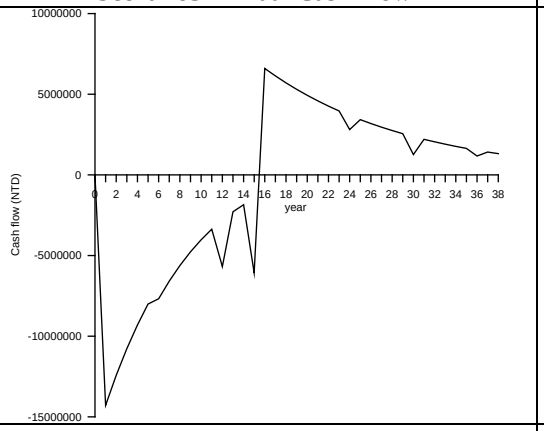
Equity’s cash flow



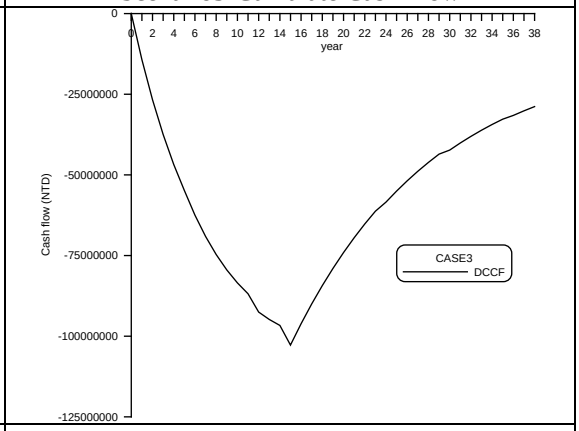
Scenario3-Annual Cash Flow



Scenario3-Cumulate Cash Flow



Scenario3-Discounted Annual Cash Flow



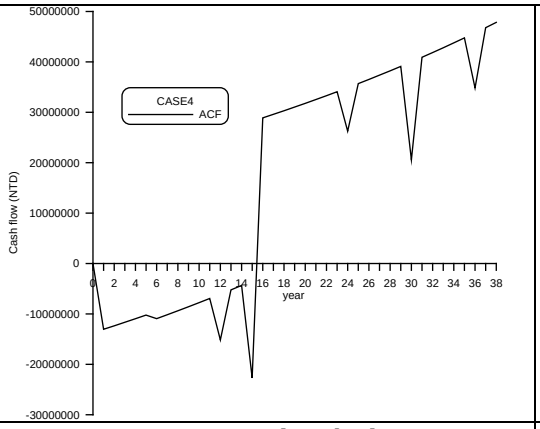
Scenario3-Discounted Cumulate Cash Flow

The financial feasibility indices

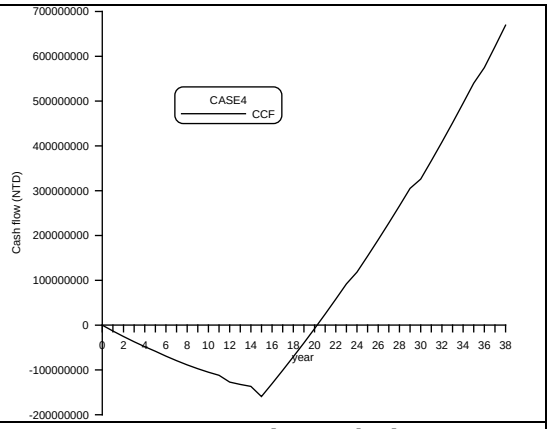
Index	NPV	IRR	PI	PB	DPB	DSCR	ROE	EIP*
Numerical value	-28,831,068	8.00%	0.72	22	-	0.71	19%	15

Scenario4: 10% of the financial contribution from the fund of NUU and 90% from the bank

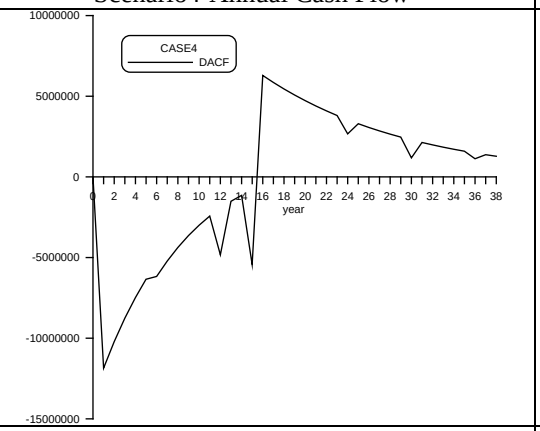
Equity's cash flow



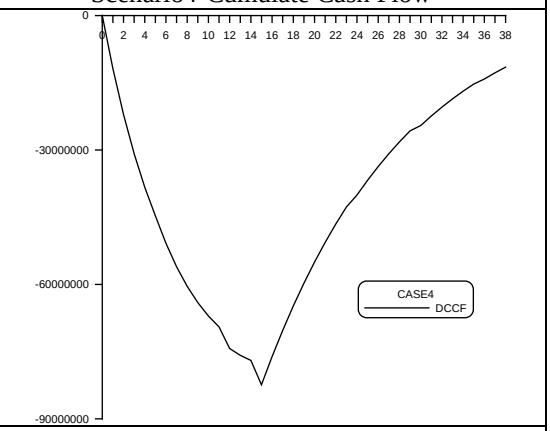
Scenario4-Annual Cash Flow



Scenario4-Cumulate Cash Flow



Scenario4-Discounted Annual Cash Flow

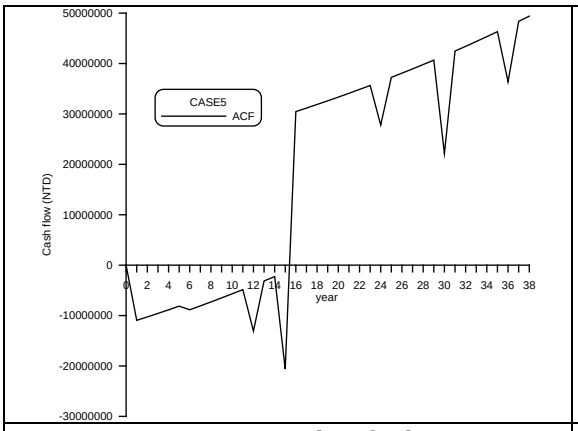


Scenario4-Discounted Cumulate Cash Flow

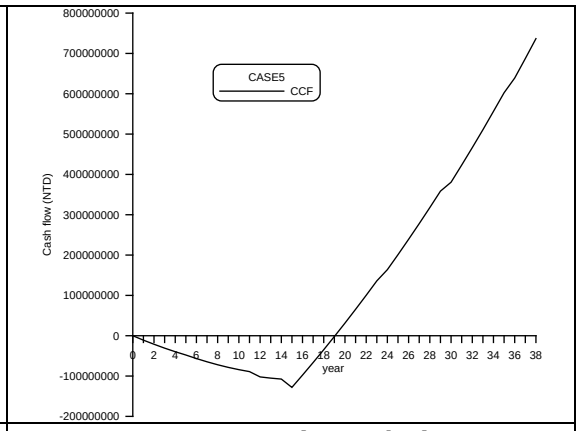
The financial feasibility indices

Index	NPV	IRR	PI	PB	DPB	DSCR	ROE	EIP*
Numerical value	-11,501,075	9.08%	0.86	21	NA	0.74	23%	15

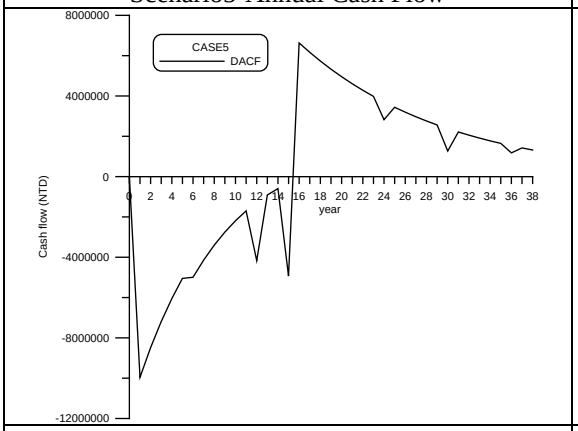
Scenario5:10% subsidy from the fund of NUU and 90% of the financial contribution from the bank.



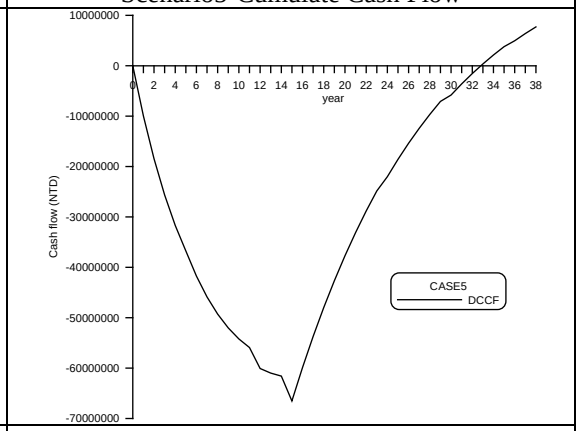
Scenario5-Annual Cash Flow



Scenario5-Cumulate Cash Flow



Scenario5-Discounted Annual Cash Flow



Scenario5-Discounted Cumulate Cash Flow

The financial feasibility indices

Index	NPV	IRR	PI	PB	DPB	DSCR	ROE	EIP*
Numerical value	7,707,232	10.68%	1.12	20	33	0.79	29%	15

We summarize the final results as below.

Index	NPV	IRR	PI	PB	DPB	ADSCR	AROE	EIP*
Scenario1	119,298,394	-	-	-	-	-	-	-
Scenario2	55,870,787	26.51%	13.71	10	16	1	394%	4
Scenario3	-28,831,068	8.00%	0.72	22	-	0.71	19%	15
Scenario4	-11,501,075	9.08%	0.86	21	-	0.74	23%	15
Scenario5	7,707,232	10.68%	1.12	20	33	0.79	29%	15
BOT	-57,210,989	7.34%	0.59	22	-	1.15	16%	2

5. Conclusions

By the financial analysis of college dormitory of NUU seems financial infeasible for BOT scheme. Hence, some measures are required for improving the financial status of the project. One of the improvement measure is to adopt the OT scheme instead of BOT scheme. The results are quit well. Five scenarios are considered to investigate the financial feasibility of OT projects. The scenarios 1, 2 and 5 are financial feasible to investors. In case to consider the pay back year, the scenario 5 is very likely to eliminate for PY =22 years. Scenario 1 and Scenario 2 show that all of financial indices are very attractive for investors. We believe if a careful arrangement of financial plan can further improve

the financial status of the projects.

References

[1]. C. M. Tam, 1999, “Build-operate-transfer model for infrastructure development in Asia: reasons for successes and failures”, International Journal of Project Management, Vol. 17, No.6, pp.377-382.

[2]. McCowan, A.K. and Mohamed, S., 2002, “Evaluation of build-operate-transfer (BOT) project opportunities in developing countries”. *Proc. of the 1st Int. Conf. on Creating a Sustainable Construction Industry in Developing Countries*, November, South Africa, 377-386.

[3]. “Handbook on Economic Analysis of Investment Operations”, Operations Policy Dept., World Bank.1996.

[4]. Sandalkhan Bakatjan, Metin Arikan, and Robert L.K. Tiong, 2003, “Optimal capital structure model for BOT power projects in Turkey”, Journal of Construction Engineering and Management, Vol. 129, No.1, pp. 89~97.

[5]. G. H. Kim, S. H. An, K I. Kang, 2004, “Comparison of construction cost estimating models based on regression analysis, neural networks, and case based reasoning”, Building and Environment, 39, pp.1235-1242.

[6]. Xueqing Zhang, 2005, “Financial Viability Analysis and Capital Structure Optimization in Privatized Public Infrastructure Projects”, Journal of Construction Engineering and Management, Vol. 131, No.6, pp. 656-668.

[7]. W. L. Winston, 2001, ”Financial Models Using Simulation and Optimization II – Investment Valuation, Options Pricing, Real Options & Product Princing Models”, Publised by Palisade Corporation, Newfield, NY.

[8]. L. Y. Shen, H. Li, and Q. M. Li, 2002, “ Alternative Concession Model for Operate Transfer Contract Projects.”, Journal of Construction Engineering and Management, Vol. 128, No. 4. pp. 326-330.