

U6016: Cost-benefit Analysis

School of International and Public Affairs, Columbia University

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Assignment #1

Scenario: a financial appraisal of To Har Su Copper, Inc.

Introduction: You work as an analyst for the International Finance Corporation (i.e., the agency within the World Bank group that finances private sector ventures). The IFC has received a proposal for a joint venture from To Har Su Copper, Inc., a privately held company that owns mining interests in Indonesia. The proposal calls for the development of a copper mine in the Indonesian province of West Irian Jaya, and seeks equity financing from the IFC. You have been asked to review the proposal and to recommend whether the IFC should consider taking an equity stake in this venture.

Company background: To Har Su Copper, Inc. is a wholly-owned subsidiary of To Har Su Consolidated, Inc., which in turn is a privately held company with numerous commercial interests in Indonesia. To Har Su Copper, Inc. was formed specifically to exploit the rich copper deposits in the Indonesian province of West Irian Jaya. The company is reputed to have good connections with the political establishment in Indonesia and all the necessary clearances for development of the site, imports of machinery, etc. are expected to be obtained.

Investment and operating plan: The investment and operating plan submitted by To Har Su Copper, Inc. is shown in Exhibit A. The proposal calls for the development of a strip mine to recover the rich surface deposits of copper-bearing ore in a remote mountainous region of Irian Jaya. The proposed duration of the project is 8 years. The first two years will be dedicated to site development and preparation. Because the proposed site for the mine is in a remote region, there will need also to be significant expenditures on building up the infrastructure necessary to transport the copper once it has been extracted. The ore is to be crushed on site, the copper extracted, and then piped down conveyor belts (slurries) to cargo ships on the coast. Arrangements have been made with several Japanese companies that will purchase the copper and transport it to refineries in Japan where it will be processed into copper sheets, wire, and cathodes. The first year that the mine is in operation (i.e., the third year of the project), extraction rates are likely to be fairly low. Production is however expected to pick up rapidly, reaching a peak of 8000 tons in the third year of operation. Thereafter, as the surface deposits are gradually exhausted, extraction rates will fall. The mine is not expected to be profitable beyond the fifth year of operation. The investment plan therefore calls for the project to shut down after that time.

All monetary figures are expressed in Rupiah, the Indonesian currency. All the U.S. dollar-denominated transactions have been converted into Rupiah assuming a constant exchange rate of Rupiah 2000 per U.S. dollar. Projections for sales have been derived assuming a constant price for copper of U.S. \$ 1000 per ton. Working capital needs have been estimated after a detailed analysis of the payment arrangements and payroll needs that the project will face. The project will operate under a full tax holiday for its entire duration. It will therefore be exempt from all import tariffs, export and sales taxes, as well as profit-taxes.

The initial cash outlays are to be financed in part by To Har Su Copper, Inc. and in part through short and medium term loans, at a fixed interest rate of 10% per year. The residual financing is being sought from the IFC in the form of an equity investment.

Assignment #1

Scenario: a financial appraisal of To Har Su Copper, Inc.

To begin with, you are asked to carry out a basic discounted cashflow analysis using the information given in Exhibit A.

1. Constructing cash flow profiles Using the information given in Exhibit A, construct pro-forma financial statements displaying the profile of:

- (a) project cashflows (*Note: disaggregate the sources of cash inflows and outflows in as much detail as is possible given the available information.*)
- (b) financing cashflows (*Note: assume that the IFC, if it decides to invest in this project, will provide whatever equity financing is necessary to cover the residual after the equity investment by To Har Su Copper, Inc. and the loans are taken into account.*)
- (c) cashflows from the equity-holders' perspective

2. Evaluation under alternative investment criteria

- (a) calculate the net present value (NPV) of the project assuming a discount rate of 10%, which is the rate of interest being charged for both the short-term and long-term loans
- (b) calculate the benefit-cost ratio of the project
- (c) calculate the internal rate of return (IRR) of the project
- (d) determine the payback period for the project

Next you are asked to work through a series of modifications to the investment plan shown in Exhibit A, as a way of thinking a bit more deeply about the assumptions underlying the plan.

3. Opportunity costs Nowhere in the investment plan do you see any mention of the costs of the land on which the mine is to be developed. When you ask you are told that the land is already owned by To Har Su Copper, Inc., and that, therefore there are no costs associated with it.

- (a) Under what circumstances would this be a reasonable response ?

You persist, however, and upon further inquiry, are told that Husorta Timber, Inc., an Indonesian company with extensive timber interests, recently approached To Har Su Copper, Inc. with an offer to pay a sum of Rupiah 400,000,000 per year for the next ten years for the timber rights.

- (b) Incorporate this information into the project cashflow profile and recalculate the NPV and IRR of the project.
- (c) Suppose *instead* that there had been an internal appraisal by To Har Su, Inc. of the possibility of exploiting the timber resources on this land, and that the projected cashflow profiles from that appraisal are summarized in Exhibit B. How would you utilize that information ?

4. Non-conventional cashflow profiles *Return to the scenario in Exhibit A.* You have heard that there is a growing environmental movement in Indonesia, which is pushing for regulation requiring mining companies to invest in land reclamation after mining operations are terminated. This requirement has not been passed into law yet but there is a good chance that, given the backing of international donor agencies, it will be at some point in the next 5 years, i.e., before the end of the projected operational life of the mine. You therefore ask for an estimate of the reclamation expense that would be incurred in the final year of the project if the regulation were enacted into law. The estimate you receive is: Rupiah 6,000,000,000.

- (a) Re-evaluate the project (under the criteria listed in (2)) incorporating this information.
- (b) Are there any problems with applying some of the criteria ?

5. Breakeven analysis: cost overruns and delays *Return to Exhibit A.* The proposed site for the strip mine is on land, which though 'owned' by To Har Su Copper, has traditionally been used by the indigenous population of Irian Jaya. The development of the copper mine is likely, therefore, to encounter local resistance. In recent years there has also been increasing insurgent activity by separatists dedicated to securing independence for Irian Jaya and the mine, being a venture of an established Indonesian company, is likely to be a target of these groups. Agitation by the local population will have two effects: *i)* it will raise the costs of site preparation and development as well as the operating costs; *ii)* it may cause delays in the start of operations.

- (a) Do a breakeven analysis of how high the costs of site and infrastructure development and preparation (incurred in the first two years) could potentially be before the project no longer satisfies: *i)* the NPV criterion for acceptance; *ii)* the IRR criterion for acceptance.
- (b) Now suppose the costs of site preparation and development remain as in Exhibit A. However the start of operations is delayed. Determine the maximum permissible delay in the start of operations if the project is to satisfy the *i)* NPV criterion, and *ii)* the IRR criterion. Determine the cash infusions that will be necessary to keep the project liquid in the event of a delay.

6. Price fluctuations Much of the world's copper deposits are concentrated in a few countries: Chile, Zaire, Zambia, and Indonesia. Zaire and Zambia, in particular, are politically instable and as a result the price of copper, both in unprocessed and processed forms, is quite volatile. Prices can change by as much as 50% from year to year. The investment plan in Exhibit A assumes a constant price of \$ 1000 per ton of copper ore. Assuming that the projected extraction rates (i.e. production figures) are fairly accurate:

- (a) do a sensitivity analysis of the NPV of the project under 2 different projected price trends:
 - i) the price of copper falls to U.S.\$ 500 per ton and remains there; and ii) the price falls to U.S.\$ 500 per ton in the first year of operation and thereafter rises by 20% per year.
- (b) what is the lowest possible constant price at which the project remains acceptable under the NPV criterion ?

The scenarios you have been asked to consider so far have been mostly variations on the same underlying plan. Now you are asked to consider alternative plans that differ substantially from that shown in Exhibit A.

7. Project duration Given your concern about the potential reclamation expense that the project might face at the end of 8 years you consider the alternative of shortening the operational life of the mine.

- (a) Calculate the NPV and IRR of the project if it were to be terminated after 3 years (from the start of site preparation), after 4 years, after 5 years, etc., assuming that no land reclamation expenses would be incurred.
- (b) Redo the calculations incorporating the land reclamation expense.

8. Project scale As is evident from the investment plan, the remoteness of the project site requires significant initial expenditures on infrastructure. These expenditures are essentially fixed costs in the operation of the mine. The average total costs (i.e. fixed costs plus variable costs) of the project could possibly be lowered, therefore, if the scale of the project were increased. To investigate this possibility you request and receive the cashflow profile that would result if the mining operations were expanded to include extraction of subterranean deposits. This is shown in Exhibit C.

- (a) Calculate the NPV and IRR of the *expanded* project.
- (b) Using the information in *both* Exhibits A and C, calculate the NPV and IRR of the proposed *expansion*.

Exhibit A
Investment and operating plan for To Har Su Copper, Inc.

	Project year							
	1	2	3	4	5	6	7	8
Production								
Copper (tons)	0	0	2500	4000	8000	7000	5000	0
Receipts (Rupiah '000,000)								
Sales of copper	0	0	4000	8500	16250	14000	10000	250
Liquidation of assets	0	0	0	0	0	0	0	3000
Expenditures (Rupiah '000,000)								
<i>A. Site preparation and infrastructure development</i>								
Equipment	3000	1000	0	0	0	0	0	0
Materials/services (imported)	1500	1500	0	0	0	0	0	0
Materials/services (domestic)	1500	1500	0	0	0	0	0	0
Skilled labor (foreign)	2000	2000	0	0	0	0	0	0
Skilled labor (domestic)	1000	1000	0	0	0	0	0	0
Unskilled labor	1000	1000	0	0	0	0	0	0
<i>B. Operating expenditures</i>								
Materials (imported)	0	0	500	1000	1500	1250	750	0
Materials/services (domestic)	0	0	500	700	800	750	600	0
Skilled labor (foreign)	0	0	1000	1000	1000	1000	1000	250
Skilled labor (domestic)	0	0	1000	1000	1000	1000	1000	250
Unskilled labor	0	0	500	500	500	500	500	100
Depreciation expense	0	0	1100	1100	1100	1100	1100	0
<i>C. Working capital (stocks)</i>								
Accounts receivable	0	0	400	800	1600	1400	1000	0
Accounts payable	0	0	100	200	200	200	100	0
Inventories	0	0	1000	500	250	250	250	0
Cash	0	200	200	200	200	200	200	0
Financing (Rupiah '000,000)								
Short-term loans								
Disbursement	1000	1000	0	0	0	0	0	0
Repayment	0	0	210	2310	0	0	0	0
Long-term loans								
Disbursement	3000	3000	0	0	0	0	0	0
Repayment	0	0	630	630	630	6930	0	0
To Har Su Copper equity	3000	3000	0	0	0	0	0	0

Exhibit B
Summary cashflow profile for timber project

	Project year				
	1	2	3	4	5
Cash inflows	0	3000	4000	3000	2000
Cash outflows	5000	1000	1000	1000	1000

Exhibit C
Investment and operating plan for To Har Su Copper, Inc.
Expanded operations: extraction of surface and subterranean deposits

	Project year							
	1	2	3	4	5	6	7	8
Production								
Copper (tons)	0	0	3000	5000	9000	8000	6000	0
Receipts (Rupiah '000,000)								
Sales of copper	0	0	5000	10500	18250	16000	12000	250
Liquidation of assets	0	0	0	0	0	0	0	4000
Expenditures (Rupiah '000,000)								
<i>A. Site preparation and infrastructure development</i>								
Equipment	4500	3000	0	0	0	0	0	0
Materials/services (imported)	2000	3500	0	0	0	0	0	0
Materials/services (domestic)	1500	2000	0	0	0	0	0	0
Skilled labor (foreign)	4000	2000	0	0	0	0	0	0
Skilled labor (domestic)	1000	2000	0	0	0	0	0	0
Unskilled labor	1000	1200	0	0	0	0	0	0
<i>B. Operating expenditures</i>								
Materials (imported)	0	0	500	1000	1500	1250	750	0
Materials/services (domestic)	0	0	600	1000	1000	1000	750	0
Skilled labor (foreign)	0	0	1000	1000	1000	1000	1000	250
Skilled labor (domestic)	0	0	1000	1000	1000	1000	1000	250
Unskilled labor	0	0	600	600	600	600	600	200
Depreciation expense	0	0	1600	1600	1600	1600	1600	0
<i>C. Working capital (stocks)</i>								
Accounts receivable	0	0	400	800	1600	1400	1000	0
Accounts payable	0	0	100	200	200	200	100	0
Inventories	0	0	1000	500	250	250	250	0
Cash	0	200	200	200	200	200	200	0
Financing (Rupiah '000,000)								
Short-term loans								
Disbursement	1000	1000	0	0	0	0	0	0
Repayment	0	0	210	2310	0	0	0	0
Long-term loans								
Disbursement	3000	3000	0	0	0	0	0	0
Repayment	0	0	630	630	630	6930	0	0
To Har Su Copper equity	3000	3000	0	0	0	0	0	0