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Social Cost-Benefit Analysis of a Paper Mill in Nepal

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INTRODUCTION

It was in the mid 1930s that cost-benefit analysis (CBA) was first employed in the United States as an administrative tool in the development of water resources. Nowadays, it is being rigorously applied in industrial projects, inter alia.

Three important approaches which have received considerable attention in project evaluation encompassing CBA are (a) the UNIDO method developed by Dasgupta, Sen and Marglin (1972), (b) the OECD approach formulated by Little and Mirrlees (1974), and (c) the World Bank method devised by Bruce (1976), van der Tak and Squire (1975).

The UNIDO method may be the most pragmatic for application in the Nepalese context. This view is supported by Mishan (1974) who, referring to this approach, wrote "Guidelines offer a more thorough treatment of cost-benefit techniques applied to poor countries than can be found ... in any other volume or monograph."

The main purpose of this paper is to discuss the important parameters in the UNIDO approach and apply it in a Chinese-aided paper mill in Nepal and also identify the gainers and losers of the project.

CENTRAL PARAMETERS

The important parameters are: (a) the shadow price of investment, (b) the shadow price of foreign exchange, (c) the shadow price of unskilled labour, and (d) marginal propensity to respond in a particular area. The last parameter figures importantly in the regional income multiplier.

The Shadow Price of Investment

This parameter assumes importance in project appraisal when market and social prices of consumption and capital goods do not tally.

"The shadow price of investment is the net present value of the aggregate consumption stream resulting directly and indirectly from a unit of marginal investment" (Dasgupta, Sen and Marglin, 1972).

There are three cases or stages involved in the derivation of the shadow price of investment.

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In the first case, we have

$$B^* = \sum_{t=1}^{\infty} \frac{B_t}{(1+i)^t} - K_o \qquad (1)$$

where B^* = net return,

K_o = cost of capital in year o.

The second case assumes that a portion of investment resources for a project must be provided by surrendering alternative investments and thus relinquishing consumption returns.

We have the expression

$$B^* = \sum_{t=1}^{\infty} \frac{B_t}{(1+i)^t} - \sum_{t=1}^{\infty} \frac{q K_o}{(1+i)^t} \qquad (2)$$

$$= \sum_{t=1}^{\infty} \frac{B_t}{(1+i)^t} - \frac{q K_o}{i}$$

In equation (2), because of the assumption, K_o of equation (1) is replaced by the stream of returns $q K_o$, where q represents the marginal productivity of capital. As $P^{inv} = q/i$ is the shadow price of investment, equation (2) can be rewritten as

$$B^* = \sum_{t=1}^{\infty} \frac{B_t}{(1+i)^t} - P^{inv} K_o \qquad (3)$$

In the third and most pragmatic case, the stream of returns q is divided into the consumed part $(1-s)q$, and the saved and reinvested part, sq, where s is the marginal rate of savings. Then the yearly value of consumption B_t composes of two parts, namely, the share which is actually consumed plus the consumption value of the reinvested part, sq, that is $P^{inv}sq$, where P^{inv} is the consumption value of investments (Weiss, 1976).

$$B_t = (1-s)q + P^{inv}sq \qquad (3a)$$

The present value of yearly returns of equation (3a) is equivalent to the shadow price of investment. In other words

$$P^{inv} = \sum_{t=1}^{\infty} \frac{(1-s)q + P^{inv}sq}{(1+i)^t} \qquad (4)$$

$$= \frac{(1-s)q + P^{inv}sq}{i}$$

$$= \frac{(1-s)q}{i-sq}$$

where i stands for the social rate of discount.

The Shadow Price of Foreign Exchange

It is a well established fact that the currencies of Third World economies are drastically over-valued. As the real price of foreign exchange surpasses the official exchange rate, it is essential to adjust the latter through the utilization of the shadow price of foreign exchange. The shadow price of foreign exchange is known as the contribution a unit of foreign exchange makes to aggregate consumption which hinges on how marginal increments of foreign exchange are utilized. It is determined in the UNIDO method as

$$P_D^F = \sum_{i=1}^{n} f_i \frac{P_i^D}{P_i^{cif}} + \sum_{i=n+1}^{n+h} X_i \frac{P_i^D}{P_i^{fob}} \qquad (5)$$

Where,

P_D^F = shadow price for foreign exchange,

P_i^D = domestic price,

P_i^{fob} = export price,

P_i^{cif} = import price,

$\sum_{i=1}^{n} f_i$ = share of import goods in foreign trade,

$\sum_{i=n+1}^{n+h} X_1$ = share of export goods in foreign trade,

$$\sum_{i=1}^{n} f_i + \sum_{i=n+1}^{n=h} X_i = 1$$

Shadow Price of Unskilled Labour

This parameter hinges upon two things namely, (a) the output lost by transfering workers from their previous employment to public-sector jobs and (b) the change in the output mix from investment to consumption by the expansion of public-sector employment (Dasgupta, Sen and Marglin, 1972). This definition covers two aspects. First, the output foregone from previous employment that is the marginal product of labour, m, stands much below the market wage when labour is drawn from the traditional sector. Second, assuming that wages are fully utilized, the

shift in the utilization of output from investment to consumption as a result of expanded employment is taken into consideration. This shift slashes investment and the future consumption streams from investment, namely, to the extent of the amount of investment sacrificed multiplied by the consumption value of investment, p^{inv}.

We have equation (6) as such which takes into account the foregone factors.

$$SWR = m + [(1-s^k)w + s^k p^{inv} w - w] \qquad (6)$$

$$= m + s^k (p^{inv}-1)w$$

Where,

SWR = shadow price of unskilled labour,

m = opportunity costs of unskilled labour,

w = market wage,

p^{inv} = shadow price of investment,

s^k = rate of savings of tax payers.

Several things are clear from equation (6) such as (a) the shadow wage is a formulation of the opportunity costs of unskilled labour, m, and the alteration in the utilization output from investment to consumption, (b) it is assumed that public sector employment is financed by taxing the capital owners who consume and invest in the ratio $(1-s^k)$ to s^k, and (c) as the amount of wages, w, is taxed, consumption and investment must plummet (Weiss, 1976).

Marginal Propensity to Respond

As stated earlier, this parameter is important in determining the regional income multiplier which is applied when distributional aspects within an area are taken into account.

Whether the direct benefits assessed are invested or consumed, a part of them will be respent in the region. If they result in a net transfer of wage earnings from somewhere in the country to the region or activate otherwise unemployed resources, this will lead to a new gamut of benefits to the region. If δ signifies the marginal proportion of direct net redistributional benefits, $(AR)_s$, which - when respent - leads to additional net benefits to the region, then the value of the indirect net redistributional benefits $(AR)_i$, can be written as

$$(AR)_i = \delta (AR)_s + \delta(\delta(AR)_s) + \delta(\delta^2(AR)_s)$$

Thus, the total net redistributional benefits to the region, TNRB, is given by

$$TNRB = (AR)_s + (AR)_i = (AR)_s + (AR)_s + {}^2(AR)_s + {}^3(AR)_s$$

$$= \left[\frac{1}{1-\delta}\right] (AR)_s \qquad (7)$$

Equation (7) is the regional-income multiplier (Dasgupta, Sen and Marglin, 1972).

The foregoing discussions equip us with the necessary tools for the social cost-benefit analysis of a paper mill in the next section.

Social Cost-Benefit Analysis of the Paper Mill

This exercise is undertaken from the angle of two objectives indirectly delineated in various plans. They are: (a) increasing net aggregate consumption benefits, and (b) redistributing consumption benefits to less-developed areas - Chitwan and Nawalparasi in the case of the paper mill.[1]

Preamble

A covenant was concluded between Nepal and China on October 1, 1978 for the establishment of a modern paper plant in Nepal and a group of Chinese engineers undertook a feasibility study.[2] On December 27, 1979, an agreement was signed between His Majesty's Government (henceforth HMG) and National Complete Plant Export representing the Government of China to set up the paper mill at Gaidakot in the district of Nawalparasi which is abutted from the region of Uttar Pradesh in India from the South.[3]

In December 1981 an organisation was set up in the Department of Industry to implement the tasks to be undertaken by HMG, who decided in July 1972 that the Project be recognized as a Limited Company and named Bhrikuti Paper Mill Limited (henceforth BPML).[4]

Project Scenario

The construction of the BPML commenced in 1981/82 and trial production took place in 1985/86.[5] In other words, production started from year 4 and will continue for 9 years until year 13.

The BPML is to produce 10 tons of paper daily - 7 tons of writing paper and 3 tons of printing paper - when functioning at full capacity. On the assumption that the Mill operates for 300 days, this is equal to 3,000 tons of paper - 2,100 tons of writing paper and 900 tons of printing paper. The BPML, however, started from a capacity utilization of only 60 percent and will reach 90 percent during the last four years of operation. Table 1 displays the outputs and capacity utilization of the Mill.

Table I
Outputs of The Paper Mill

(in tons)

	Year						
	4	5	6	7	8	9	10-13
Capacity Utilization (in percentage)	60	65	70	75	80	85	90
Outputs							
1. Writing paper	1,260	1,365	1,470	1,575	1,680	1,785	1,890
2. Printing paper	540	585	630	675	720	765	810

Sources: (1) Unpublished report prepared by the BPML.

(2) Own computations.

Table II presents the c.i.f price of paper in Nepali currency and the foreign exchange saved by Nepal as an outcome of the Mill. In other words, the outputs of the Mill will supersede for equal amounts of imports from Bangladesh and China, respectively.

HMG imposes a 1.1 percent tariff on imported writing and printing paper. Table III supplies the information about the tariffs that HMG imposes for the imports that the Mill will supplant. The outputs of the Mill will be sold to local consumers or the public at the c.i.f. price who will gain from the Mill by the amount depicted in Table III.

Financial Arrangement

The Mill is being constructed with the assistance from China and will be operated by the BPML, Ministry of Industry. During the construction period, the aggregate investment requirement has been estimated at Rs. 160 million. Of this more than 60 percent or Rs. 100 million has been provided by the Chinese government in the form of a grant, while the remaining part of Rs. 60 million has been supplied by HMG through share investment and bank loan. Of this, Rs. 15.1 million has formed initial working capital. To meet the working capital of Rs. 78.8 million during the operation period and other requirements, provision has been made for the BPML to obtain authorised capital up to Rs. 250 million through share floatation.

Table IV depicts investment in fixed capital which is equal to Rs. 144.9 million. Table V gives initial working capital required in the early years. Table VI divides working capital into foreign exchange and domestic currency which is built in the first five years of operation.

Table VII details the operating costs of the Mill after taking into account capacity utilisation. A vigorous study of the unpublished report was taken before the undertaking of this exercise.

Table II
Value of Products

Products	c.i.f. price per ton*	Value of products in years of operation (in thousand rupees)						
		4	5	6	7	8	9	10-13
1. Writing paper	14,044	17,695.4	19,170.1	20,644.7	22,119.3	23,594.0	25,068.5	26,543.2
2. Printing paper	14,107	7,617.8	8,252.6	8,887.4	9,522.2	10,157.0	10,791.9	11,426.7
Total		25,313.2	27,422.7	29,532.1	31,641.5	33,751.0	35,860.4	37,969.9

*The c.i.f. price per ton of writing paper and printing paper was obtained from National Trading Limited, Ministry of Commerce.

There is a difference of Rs. 63 between the c.i.f. price of writing paper and printing paper. The actual figures have been incorporated to be meticulous.

Source: Own computations.

Table III
Duty on Displaced Imports

(in thousand rupees)

Import	Year 4	5	6	7	8	9	10-13
1. Writing paper	194.6	210.9	227.1	243.3	259.5	275.8	292.0
2. Printing paper	83.8	90.8	97.8	104.7	111.7	118.7	125.7
Total	278.4	301.7	324.9	348.0	371.2	394.5	417.7

Sources: (1) MOF (1982, p. 21).
(2) Own computations.

Table IV
Fixed Capital Investment

(in thousand rupees)

Item	Year 0	1	2	3	Total
1. Land	3,000	-	-	-	3,000
2. Machinery & equipment	-	24,710	28,240	17,650	70,600
3. Building & other civil construction	26,054	26,054	13,027	-	65,135
4. Vehicles, furniture & other related items	231	231	231	231	924
5. Salaries to skilled labour*	616	710	710	1,046	3,082
6. Wages to semi-skilled and unskilled labour	864	756	453	86	2,159
Total	30,765	52,461	42,661	19,013	144,900

*This includes salaries to managerial and supervisory staff whose breakdown has not been given.

Sources: (1) Unpublished Report prepared by the BPML.
(2) Own computations.

Table V
Initial/Preliminary Working Capital

(in thousand rupees)

Resources	Year 0	1	2	3	Total
1. Foreign exchange	-	-	-	-	-
2. Domestic materials	2,265	3,020	4,530	5,285	15,100
Total	2,265	3,020	4,530	5,285	15,100

Source: Unpublished Report prepared by the BPML.

Table VI
Working Capital

(in thousand rupees)

Resources	Year 4	5	6	7	8	Total
1. Foreign exchange	2,924	3,169	3,412	3,657	3,899	17,061
2. Domestic materials	10,769	11,556	12,345	13,134	13,922	61,726
Total	13,693	14,725	15,757	16,791	17,821	78,787

Note: The unpublished report does not give a direct division of foreign exchange and domestic materials. However, in the estimation of working capital various items are given. It is obvious from the report that 93% of chemicals, 52% of repair and maintenance, and fuel and oil compose of foreign exchange. From this, foreign and domestic component of working capital was systematically computed.

Sources: (1) Unpublished Report prepared by the BPML.

(2) Own computations.

Table VII
Operating Costs By Year And Input

(in thousand rupees)

Items	Year						
	4	5	6	7	8	9	10-13
Primary Inputs							
1. Water	220	230	240	250	260	270	280
2. Electricity	2,481	2,608	2,735	2,862	2,989	3,117	3,244
3. Coal	2,100	2,275	2,450	2,625	2,800	2,975	3,150
4. Grease & Lubricants	48	52	56	60	64	68	72
Production Chemicals							
5. Caustic soda	6,658	7,213	7,768	8,323	8,878	9,432	9,987
6. Bleaching powder	79	86	92	99	106	112	119
7. Rosin	378	410	441	473	504	536	567
8. Alum	324	351	378	405	432	459	486
9. Soda ash	21	23	25	26	28	30	32
10. Talc	540	585	630	675	720	765	810
11. Miscellaneous	60	65	70	75	80	85	90
Raw Materials							
12. Sabai grass	1,502	1,628	1,753	1,878	2,003	2,128	2,254
13. Wheat straw	908	984	1,060	1,136	1,211	1,287	1,363
Salaries & Wages							
14. Salaries to managerial and supervisory staff	499	507	516	524	532	540	549
15. Salaries to skilled labour	663	718	774	829	884	939	995
16. Wages to semi-skilled and sunskilled labour	535	580	624	669	714	758	803
Repair & Maintenance							
17. Machinery & equipment	424	459	494	530	565	600	635
18. Building and other civil construction	391	423	456	488	521	553	586
Miscellaneous							
19. Depreciation	8,363	8,363	8,363	8,363	8,363	8,363	8,363
20. Insurance	1,357	1,357	1,357	1,357	1,357	1,357	1,357
21. Administrative overheads	749	749	749	749	749	749	749
22. Financial overheads	1,800	1,800	1,800	1,800	1,800	1,800	1,800
23. Amortization of pre-operational expenses	617	617	617	617	617	617	617
24. Packing materials	248	269	290	311	331	352	373
Total	30,965	32,532	33,738	35,124	36,508	37,892	39,281

Sources: (1) Unpublished Report prepared by the BPML.

(2) Own computations.

Table VIII which informs about the cash flow account of the BPML has been arrived at with the help of several tables presented in the foregoing sections.

National Economic Profitability of the BPML Investment

Various plans list indirectly that augmenting aggregate consumption benefits as one of the primary objectives to be attained. Another important objective is to redistribute consumption benefits to less-developed areas where a vast majority of the population reside. The social benefit-cost analysis of the BPML will be scrutinized from the angle of these two objectives.

In the assessment of the benefit and cost of the Mill, imported and local inputs and different qualities of labour have been differentiated. The following distinction is made: domestic inputs (outputs), foreign exchange inputs (outputs), semi-skilled and unskilled labour, and domestic skilled labour. Machinary and parts, packing material and nearly 90 percent of chemicals (direct product materials) are imported into Nepal. It is taken for granted that they will continue to be imported until the Mill ceases to operate.

The ultimate benefits from the BPML, that is, writing paper and printing paper, will substitute the imports of these two commodities. These benefits are assayed in terms of the foreign exchange resources that is saved as a consequence of not importing.

Table IX is a reproduction of Table II and shows the time profile of foreign exchange.

Table X divulges the investment flow in fixed capital in terms of the different resources required and has been computed from Table IV with the help of the unpublished report. Item (1) in Table X is equal to Item (2) in Table IV. Item (2) of Table X forms 30 percent of Item (5) in Table IV. The remainder of Item (5) in Table IV composes of Item (3) in Table X. Item (4) of Table X is equivalent to Item (6) of Table IV. Finally, the total of the remaining components of Table IV is Item (5) of Table X.

Table XI, which has been reproduced from Table VII, again with reference to the unpublished report, shows the operating costs of the Mill in terms of the resources used. Item (1) of Table XI consists of Items (3), (4), (17), (24), 92.5 percent of Items (5-11), 19.6 percent of Item (23) and 50 units of Item (1) in Table VII. Likewise, Item (2) of Table XI forms 10 percent of Item (15) in Table VII. Item (3) of Table XI is the summation of Item 14) and 90 percent of Item (15) in Table VII. Items (4) and (5) in Table XI are equivalent to Items (16) and (19), respectively, in Table VII. The remaining items and portions of Table VII form domestic materials of Item (6) of Table XI.

Table VIII
Benefits And Costs For The BPML

(in thousand rupees)

Items	Year 0	1	2	3	4	5	6	7	8	9	10-13
1. Gross Revenue	-	-	-	-	25,313	27,423	29,532	31,642	33,751	35,860	37,970
2. Investment in fixed capital	30,765	52,461	42,661	19,013	-	-	-	-	-	-	-
3. Working capital	2,265	3,020	4,530	5,285	13,693	14,725	15,757	16,791	17,821	-	-
4. Operating costs	-	-	-	-	30,965	32,532	33,738	35,124	36,508	37,892	39,281

Sources: (1) Previous tables.

(2) Own computations.

Table IX
Social Value of Products

(in thousand rupees)

Outputs	Year 4	5	6	7	8	9	10-13
1. Writing paper	17,695.4	19,170.1	20,644.7	22,119.3	23,594.0	25,068.5	26,543.2
2. Printing paper	7.617.8	8,252.6	8,887.4	9,522.2	10,157.0	10,791.9	11,426.7
Total Foreign Exchange Saved in round figures	25,313	27,423	29,532	31,642	33,751	35,860	37,970

Source: Table II.

Table X
Investment in Fixed Capital

(in thousand rupees)

Resources	Year 0	1	2	3	Total
1. Foreign exchange (materials)	-	24,710	28,240	17,650	70,600
2. Foreign personnel	185	213	213	314	925
3. Skilled domestic labour	431	497	497	732	2,157
4. Semi-skilled and unskilled labour	864	756	453	86	2,159
5. Domestic materials	29,285	26,285	13,258	231	69,059
Total	30,765	52,461	42,661	19,013	144,900

Source: Table IV.

To proceed, out of the total investment of Rs. 160 million during the construction period, Rs. 100 million has been provided by the Chinese government in the form of a grant. Since this amount of foreign aid would not have been provided in the absence of the Mill, this component has zero opportunity cost for Nepal. As Table X shows, only Rs. 70.6 million has been used in the form of foreign exchange (materials) which means that Rs. 29.4 million is also costless to the Nepali economy and could have been used for building and civil construction. It is assumed, for want of better information, that the remaining amount is used for domestic materials. All Chinese personnel receive salaries in Nepali rupees but they are permitted to take any part of their salary out of Nepal. In view of this, though not wholly correct, it is included in actual Nepali funds as it forms only 2 percent of the funds. The Nepali funds of Rs. 44.9 million employed for investment in fixed capital are yielded by Table XII. It is clear that Items (2), (3) and (4) in Table XII are equivalent to the same items in Table X.

Table XIII which has been systematically arranged from the previous tables gives a detailed picture of all Nepali resource flows that result from the Mill. Item (1) of Table XIII has been generated from Table IX and displays the benefits measured in terms of foreign exchange. Item (2) which provides the actual resources of Nepal used in the construction of the Mill is exactly similar to Table XII. Item (3) has been obtained from Tables V and VI. Item (4) of Table XIII is made up of all the items in Table XI, except Item (5), depreciation. Item (5) gives the working capital composing of sabai grass, wheat straw and processed commodities that will be captured by Nepal at the end of the Mill's operation, that is, year 14.

Tariff on import substitutes is a money transfer to the public since they pay less by this amount for writing and printing paper as a result of the Mill and is equivalent to the rounded figures of Table III.

Net Aggregate-Consumption Benefits

The net aggregate-consumption benefits to Nepal emanating from the Mill is estimated in a sequence. First, it is assumed that market prices reflect social opportunity costs and, therefore, the final consumption benefits and costs. The aggregate-consumption benefits resulting from the Mill composes of Items (1) and (5) as depicted in Table XIII and represents actual gains to the total Nepali economy since they would not have occurred in the absence of the Mill. From now onwards, all references will be made to Table XIII. Items (2), (3) and (4) are resources that could have been employed elsewhere in the economy in the non-existence of the Mill. Hence, they denote costs borne by the economy because of the Mill. The market worth of the net aggregate-consumption benefits in any year is yielded by

$$FB = (1) - (2) - (3) - (4) + (5) \qquad (8)$$

Second, it is assumed that the resources that call for price adjustment are foreign exchange, skilled labour and semi-skilled and unskilled labour.

Table XI
Operating Costs By Input And Year

(in thousand rupees)

Resources	Year						
	4	5	6	7	8	9	10-13
1. Foreign exchange (materials)	10,477	11,304	12,160	13,018	13,874	14,730	15,587
2. Foreign personnel	66	72	77	83	88	94	100
3. Domestic skilled labour (including salaries to managerial and supervisory staff)	1,096	1,153	1,213	1,270	1,328	1,385	1,444
4. Semi-skilled and unskilled labour	535	580	624	669	714	758	803
5. Depreciation	8,363	8,363	8,363	8,363	8,363	8,363	8,363
6. Domestic materials	10,458	10,880	11,301	11,721	12,141	12,562	12,984
Total	30,965	32,352	33,738	35,124	36,508	37,892	39,281

Source: Table VII.

Table XII

Actual Nepali Funds Utilized In Fixed Capital Investment

(in thousand rupees)

Resources	Year 0	1	2	3	Total
1. Foreign exchange (materials)	-	-	-	-	-
2. Foreign personnel	185	213	213	314	925
3. Skilled domestic labour	431	497	497	732	2,157
4. Semi-skilled and unskilled labour	864	756	453	86	2,159
5. Domestic materials	16,818	15,095	7,614	132	39,659
Total	18,298	16,561	8,777	1,264	44,900

Source: Table X.

Table XIII
Recources Flows For The BPML

(in thousand rupees)

Item	Year											
	0	1	2	3	4	5	6	7	8	9	10-13	14
1. Output (foreign exchange)	-	-	-	-	25,313	27,423	29,532	21,642	33,751	35,860	37,970	-
2. Construction costs	18,298	16,561	8,77	1,264	-	-	-	-	-	-	-	-
2a. Foreign exchange (materials)	-	-	-	-	-	-	-	-	-	-	-	-
2b. Domestic materials	16,818	15,095	7,614	132	-	-	-	-	-	-	-	-
2c. Foreign personnel	185	213	213	314	-	-	-	-	-	-	-	-
2d. Domestic skilled labour	431	497	497	732	-	-	-	-	-	-	-	-
2e. Unskilled and semi-skilled labour	864	756	453	86	-	-	-	-	-	-	-	-
3. Working capital	2,265	3,020	4,530	5,285	13,693	14,725	15,757	16,791	17,821	-	-	-
3a. Foreign exchange	-	-	-	-	2,924	3,169	3,412	3,657	3,899	-	-	-
3b. Domestic materials	2,265	3,020	4,530	5,285	10,769	11,556	12,345	13,134	13,922	-	-	-
4. Operating costs	-	-	-	-	22,602	23,989	25,375	26,761	28,145	29,529	30,918	-
4a. Foreign exchange (materials)	-	-	-	-	10,447	11,304	12,160	13,018	13,874	14,730	15,587	-
4b. Foreign personnel	-	-	-	-	66	72	77	83	88	94	100	-
4c. Domestic skilled labour	-	-	-	-	1,096	1,153	1,213	1,270	1,328	1,385	1,444	-
4d. Unskilled and semi-skilled labour	-	-	-	-	535	580	624	669	714	758	803	-
4e. Domestic materials	-	-	-	-	10,458	10,880	11,301	11,721	12,141	12,562	12,984	-
5. Reclaimed working capital	-	-	-	-	-	-	-	-	-	-	-	93,887
5a. Foreign exchange	-	-	-	-	-	-	-	-	-	-	-	17,061
5b. Domestic materials	-	-	-	-	-	-	-	-	-	-	-	76,826
Money Transfer												
6. Tariff on import substitutes	-	-	-	-	278	302	325	348	371	395	418	-

Source: Previous tables.

Like in any less-developed country, the rupee is overvalued. Let $(1 + \psi)$ signify the opportunity cost of foreign exchange relative to its official price, where ψ refers to the positive foreign premium which is expected to remain constant throughout the operation of the Mill.

Skilled workers in Nepal receive much less than their marginal-revenue-products. The marginal skilled worker contributes much more to total consumption benefits than the salary he obtains. The social premium on the market wage of skilled labour is denoted by v which is positive.

There is a plethora of semi-skilled and unskilled labourers in Nepal. If $(1 + \phi)$ represents the opportunity cost of semi-skilled and unskilled labour, then ϕ indicates the social labour premium which is negative.

As mentioned earlier, the salary of foreign employees will be given in rupees but they will be allowed to take away any part of it. Let χ be the proportion of the salary to Chinese personnel that will be disposed in the country, more particularly Chitwan and Nawalparasi.

After inserting the opportunity cost premiums, the net aggregate-consumption benefits of the Mill in a given year is

$$SB = FB + \psi E + \phi U + vL \qquad (9)$$

where,

$$E = (1) - (2a) - (1-\chi)\,(2c) - (3a) - (4a) - (1-\chi)\,(4b) + (5a) \qquad (9a)$$

$$U = -(2e) - (4d) \qquad (9b)$$

$$L = -(2d) - (4c) \qquad (9c)$$

Equation (9) reveals that the second approximation, SB, is derived by summing the three terms to the first approximation, FB. They rectify FB for the opportunity costs of the three resources through the multiplication of each net resource component by its premium.

Finally, the third correction to the net aggregate-consumption benefits is made. This incorporates the fact that the social value of funds devoted to investment is greater than the social value of the same funds devoted to consumption. This characteristic is relevant in any less-developed country like Nepal where the central government is unable to utilize fiscal and monetary tools effectively to attain the maximal rate of investment for the country.

The net effect on the mix of consumption and investment resulting from the Mill has to be considered to assess the indirect future benefits and costs. Hence, it becomes essential to distinguish all the benefit and cost profiles that make up SB, in accordance with the group that gains or loses, and to derive the relevant marginal saving propensities of each group.

Four groups of gainers and losers have been identified with respect to the BPML. They are: (a) the Government, HMG or simply G, (b) the private sector, P, (c) semi-skilled and unskilled labour, U, and (d) the public sector (consumers of paper), C. Hence

$$SB = SB^G + SB^P + SB^U + SB^C \qquad (10)$$

where,

$$SB = FB + \psi E - (6) \qquad (10a)$$

$$SB^P = vL \qquad (10b)$$

$$SB^U = \Phi U \qquad (10c)$$

$$SB^C = (6) \qquad (10d)$$

An explanation is indispensible for equation (10a), (10b), (10c) and (10d).

G obtains (1) and (5) but loses (2), (3), (4) and (6). Since it controls the foreign exchange market, it captures $\psi(1)$ and $\psi(5a)$. It loses $\psi(2a)$, $\psi(1-\chi)$ (2c), $\psi(3a)$, $\psi(4a)$ and $\psi(1-\chi)$ (4b).

It is supposed that domestic skilled labour employed during the construction and operating tenure is enlisted from the private sector. In other words, the onus of the opportunity cost vL falls on the private sector.

The social labour premium for semi-skilled and unskilled labour is exactly analogous to the net extra income received by semi-skilled and unskilled labour on account of the Mill. That is, the (negative) costs, $-\phi(2e) + (4d)$ accrue to U.

Finally, the public sector captures (6) since it purchases paper at a reduced rate because of the Mill.

To arrive at the final social value of net aggregate-consumption benefits, B, it is exigent to correct SB^G, SB^P, SB^U and SB^C according to the proportions in which each is dichotomized between consumption and investment. If G saves a part s_G of marginal gains, the social value of net consumption benefits resulting to the Government is

$$B^G = \left[(1-s_G) + s_G P^{inv}\right] SB^G \qquad (11a)$$

where P^{inv} is the shadow price of investment. Similarly, if sp, sU and sC are the marginal propensities to save of P, U and C, respectively, then the social value of net consumption benefits that P, U and C capture are

$$B^P = \left[(1-s_p) + s_p P^{inv}\right] SB^P \qquad (11b)$$

$$B^U = \left[(1-s_U) + s_U\ p^{inv}\right]\ SB_U \qquad (11c)$$

$$B^C = \left[(1-s_C) + s_C\ p^{inv}\right]\ SB_C \qquad (11d)$$

Hence, the estimation of net-aggregate consumption benefits on a conclusive basis is given by

$$B = B^G + B^P + B^U + B^C \qquad (11)$$

Redistribution to Chitwan and Nawalparasi

In investigating the benefits and costs, the second objective is the redistribution of benefits to the districts of Chitwan and Nawal-parasi. Some of the items of Table XIII are very vital while others simply are not of importance.

Item (1) and $\psi(1)$ are not direct benefits, and the construction and operating expenditures are not direct costs. All (2d), (2e), (4c) and (4d) are benefits since they take shape of wages to skilled, semi-skilled and unskilled labour. Likewise, x(2c) and x(4b) signify benefits. Thus, the total value of net aggregate-consumption benefits distributed to Chitwan and Nawalparasi can be written as

$$(AR)_s = (2d) + (2e) + (4c) + (4d) + \chi(2c) + \chi(4b) \qquad (12)$$

A vital adjustment is a sine qua non to compute the total net consumption benefits distributed to Chitwan and Nawalparasi by the BPML as adumbrated in Section 2.4. If δ represents the portion of marginal benefits to Chitwan and Nawalparasi, which spent again leads to more gains to the region, then the total value of net regional benefits in any one year - as shown by equation (7) - is

$$TRCN = (AR)_s \left(\frac{1}{1-\delta}\right) \qquad (13)$$

Interpretation

Table XVI clearly shows that the Mill is viable upto a discount rate of 10 percent through both objectives. At a social discount rate of 12.5 percent, the project can be defended only through the second objective since net aggregate consumption benefits would be - Rs. 6 million, semi-skilled and unskilled labour being the group capturing benefits after HMG.

Conclusion

The paper mill financed by China has been established in Nawalparasi in Inner Terai to produce 10 tons of paper daily. It is to save foreign exchange by not having to import paper.

Table XIV
Values of National Parameters

1.	Foreign exchange premium	$\Psi = + 0.83$
2.	Semi-skilled & unkilled labour premium	$\phi = - 0.5$
3.	Domestic skilled labour premium	$v = + 1.50$
4.	Marginal rate of return on investment	$q = 0.13$
5.	Marginal rate of savings	$s = 0.09$
6.	Social rate of discount	$i = 0.05, 0.075, 0.10, 0.125$
7.	Related shadow price of investment	$Pinv = 3.09, 1.87, 1.34, 1.04$
8.	Marginal propensities to save:	
	(a) Government	$sG = 1.00$
	(b) Private Sector	$sP = 0.40$
	(c) Semi-skilled & unskilled labour	$sU = 0.00$
	(d) Public Sector (taxed public)	$sC = 0.11$
9.	Marginal propensity to respond in Chitwan and Nawalparasi	$\delta = 0.15$
10.	Proportion of foreign personnel salary spent in Chitwan and Nawalparasi	$\chi = 0.50$

Sources: (1) Baum and Tolbert (1985)
(2) Dasgupta, Sen and Marglin (1972)
(3) UNIDO and IDCAS (1980)
(4) Own computations.

Table XV

Present Values In Year 0 Of Items In Table 6.13

(in thousand rupees)

Items	Social Rate of Discount			
	5%	7.5%	10%	12.5%
1. Output (foreign exchange)	219,639	180,277	149,243	124,686
2. Construction costs	43,117	42,309	41,551	40,843
(2a) Foreign exchange (materials)	0	0	0	0
(2b) Domestic materials	38,209	37,549	36,928	36,345
(2c) Foreign personnel	852	820	790	763
(2d) Domestic skilled labour	1,987	1,912	1,843	1,780
(2c) Semi-skilled & unskilled labour	2,069	2,028	1,990	1,955
3. Working Capital	72,387	64,099	57,041	51,054
(3a) Foreign exchange	12,676	11,002	9,586	8,393
(3b) Domestic materials	59,711	53,097	47,455	42,661
4. Operating costs	184,145	151,446	125,623	105,157
(4a) Foreign exchange (materials)	90,313	74,136	61,381	51,287
(4b) Foreign personnel	576	473	391	327
(4c) Domestic skilled labour	8,707	7,167	5,950	4,984
(4d) Semi-skilled & unskilled labour	4,644	3,812	3,156	2,636
(4e) Domestic materials	79,905	65,858	54,745	45,923
5. Reclaimed Working Capital	47,413	34,081	24,692	18,120
(5a) Foreign exchange	8,616	6,193	4,487	3,293
(5b) Domestic materials	38,797	27,888	20,205	14,827
Money Transfers				
6. Tariff on Import Substitutes	2,417	1,984	1,642	1,372

Source: Previous tables and own computations.

Table XVI
Present Value of Net Benefits Of The BPML In Year 0

(in thousand rupees)

Item	Equation number	Social Rate of Discount 5%	7.5%	10%	12.5%
Aggregate Consumption					
FB	(8)	-32,597	-43,496	-50,280	-54,248
E	(9a)	+124,552	+100,686	+82,173	+67,754
U	(9b)	- 6,713	- 5,840	- 5,146	- 4,591
L	(9c)	-10,694	-9,079	-7,793	- 6,764
SB	(9) & (10)	+58,097	+29,374	+ 8,807	+ 5,862
SB^G	(10a)	+68,364	+38,089	+16,282	+ 616
SB^P	(10b)	-16,041	-13,619	-11,690	-10,146
SB^U	(10c)	+ 3,357	+ 2,920	+ 2,573	+ 2,296
SB^C	(10d)	+ 2,417	+ 1,984	+ 1,642	+ 1,372
B^G	(11a)	+211,245	+71,226	+21,818	+ 641
B^P	(11b)	-29,451	-18,358	-13,280	-10,308
B^U	(11c)	+ 3,357	+ 2,920	+ 2,573	+ 2,296
B^C	(11d)	+ 2,973	+ 2,174	+ 1,703	+ 1,378
B	(11)	+188,124	+57,962	+12,814	- 5,993
Redistribution to Chitwan and Nawalparasi					
TRCN	(13)	+21,319	+18,312	+15,917	+14,000

Source: Previous tables, equations and own computations.

The Mill was evaluated on the basis of the two objectives of the various plans, namely, increasing net aggregate consumption benefits and redistribution of consumption benefits to Chitwan and Nawalparasi. The result suggested that at a discount rate of 10 percent, both the objectives were supported amounting to Rs. 12.8 million and Rs. 15.9 million respectively. The beneficiaries will be HMG, semi-skilled and unskilled labour and the public sector.

NOTES

1. As the UNIDO approach is employed, it is but rational for the analysis to following the pattern of UNIDO case studies.

2. The report is in Chinese and no copy or translated version has been provided to His Majesty's Government of Nepal. Our study borrows facts and figures to a certain extent from an unpublished Nepali report prepared by the Bhrikuti Paper Mill Limited for the expected visit of King Birendra in January 1985. Surprisingly, there was only one copy of the report which belonged to the General Manager who kindly lent it for our study.

3. Since Gaidakot is very close (about 1km) to the district of Chitwan it is assumed that the impact of the Mill is felt on this district also.

4. The terms BPML and paper mill or mill are used interchangeably.

5. Year 0 denotes 1981/82; year 1 signifies 1982/83 and so on.

6. Sabai grass is abundantly available in the forests of Nepal. To ensure a steady flow to the mill, an area of forest has been identified for protection allowing only authorized persons to collect the grass. Wheat straw will be locally purchased from farmers without difficulty since wheat is one of the main crops of the region.

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