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THE ECONOMICS OF TRAMLINE TRANSPORT FACILITY IN THE UPLANDS

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ABSTRACT

This paper discusses the financial and economic viability of putting up tramline transport facilities in the remote and mountainous uplands of Benguet province that have limited if any access roads. A tramline is an alternative means of transport of agricultural products in hard-to-reach mountainous production areas not accessible by farm-to-market roads that are very characteristic of many production areas in many countries in Asia. The viability of a tramline facility was assessed through accounting for the direct costs and benefits. These were considered from a private perspective, that is, a private investor and farmers' organization and societal perspective that treats it as a public investment.

The study shows that a tramline hauling facility is not a financially attractive investment for a private individual or farmers' cooperative in the Benguet Province. This is due to the high investment cost and low returns from a limited cluster of farms that are serviced in these areas if the existing hauling rates of the conventional hauling method are used. With an average seven-hectare service area, the limited volume of agricultural products that will be transported using the facility will not be sufficient to recover the investment. However, it is a good public investment given an economic rate of return of 33%. The main benefit from replacing the traditional method of manual transport with the tramline transport facility will generally come from the increase in yield and labor cost savings and in general, the improvement of the level of living of the target beneficiaries.

Key words: Feasibility, remote areas

INTRODUCTION

Throughout Asia, the increase in population and the resulting urbanization has forced the conversion of many agricultural lands to meet the requirements of a growing population for housing and other needs. This has resulted to the movement of the rural population to the more mountainous areas that are characterized by a rugged terrain, steep slopes and lack if not absence of access roads that makes it difficult and expensive to transport agricultural products to the markets.

In the Philippines, more than half of the vast agricultural areas can still be considered as either idle or unproductive. This can be attributed to the country's mountainous topography and the inherent problems associated with it. PCARRD (1992) reported that more than half of the country's land area is classified as uplands with slopes exceeding 18 percent. De Jesus (undated) reported that 28.7 percent of the country's land area or 8,557,479 hectares are steeply sloping while 6 million hectares have 30 to 50 percent slopes and over 2 million hectares have slopes greater than 50 percent. About 4 million hectares currently under cultivation are already severely eroded and only marginally

productive. Among the different needs of the country's mountainous regions, the most immediate is for farm-to-market roads (FMR) which would connect the production areas to local and regional markets (Ramos, 1998). To bring their farm products to the market, upland farmers would manually carry their produce on their backs and traverse the treacherous terrain of the mountainous slopes to the nearest road accessible by vehicle, before they can transport them to the nearest market centers (Figure 1). In the same way, they would also manually carry the farm inputs from the nearest road to the production areas. Given the drudgery of manual hauling, the cost of transporting the farm produce from the production area to the nearest road is quite expensive. The transport cost would range from 20 to 30 percent of the value of the produce (Paz, 2003). For production inputs, transport costs from the nearest road to the production areas range from PhP20-50 per bag, depending on the distance. At times, the available manpower for transporting the goods is scarce, especially during the peak season of harvest and farm operations.

In an effort to address this problem, the Department of Agriculture (DA) through the Agriculture and Fishery Modernization Program (AFMP) provided additional transport infrastructures such as FMR's, and in year 2000 to the present, they constructed 11 tramline transport facilities. The Bureau of Postharvest Research and Extension in collaboration with the Department of Agriculture spearheaded the program. The estimated cost of putting up the tramline system for every kilometer span ranges from P0.5M to P1M. The facility is easy to construct since majority of its parts are readily available in the local market.

A tramline utilizes a series of steel cables and post structures to haul products in remote areas not accessible through the road networks. These aerial tramways have a great advantage over most methods of transport in regions or areas where topography is extremely rough or down steep slopes. It is more environmentally friendly because the natural physical condition of the area is not altered. No vegetation cutting is necessary as long as the structures are properly or strategically positioned and selected.

A

B

Fig. 1. Manual hauling of produce from production area (A) to the nearest road accessible by vehicle (B).

The Benguet province has been an ideal location for the use of tramline facilities given the rugged condition and terrain (Fig. 2). These facilities have been effectively and popularly employed for hauling of production inputs and vegetable produce in the area. In a study of postharvest practices of 137 farmers in Benguet, Ramos (1996) reported that 70 percent were serviced by a tramline facility. Although there is limited documentation of the spread of the use of tramline facilities in the country, it is believed that majority of these tramline facilities today evolved from the tramlines in the Benguet province. Miners and loggers in the province who were displaced from their work because of log bans and closure of mining operations shifted to farming and custom-designed the tramline facility for application in agriculture.

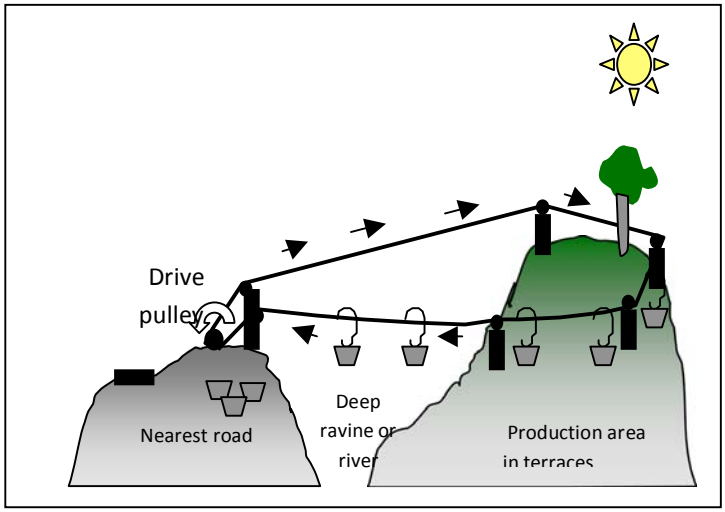

Fig. 2. The tramline facility used for hauling vegetables from the production area to the nearest farm-to-market road.

The tramline transport facility has gained some popularity given the potential contribution to the development of the mountainous hard-to-reach regions that represents a substantial percentage of the agricultural land of the country. However, to date, majority of the people in agriculture are not yet aware of its existence and application. There has been very limited documentation of this technology, more especially the economic viability of this kind of system. This is important if this technology is going to be introduced in other areas in the country with similar conditions.

This paper discusses the results of the assessment of the financial and economic viability of operating tramline facilities in Benguet. It considers specifically the minimum efficient level of service area that would make the operation of the tramline facilities viable and the most efficient scheme for operating these facilities.

THE STUDY AREAS AND DATA COLLECTED

The study was conducted in the top two temperate vegetable producing municipalities of Benguet Province with the highest number of existing tramline facilities, the municipalities of Atok and Buguias. Atok is a vast farming community located at the heart of Benguet Province and is situated 44 kms. away from Baguio City. Atok is quite popularly known as the top producer of potato in the province of Benguet because of its high elevation and favorable climatic condition. Buguias, another vast farming community, is located on the northern part of the province, 80 kms

away from Baguio City. Currently, it is regarded as the top temperate vegetable (cabbage, carrot and lettuce) producing municipality in terms of volume and area of production among the 13 municipalities of Benguet Province. The province of Benguet contributes 64 percent of the vegetables produced in the Cordillera Admistrative Region (CAR). On the other hand, CAR is considered as the major producer of highland temperate vegetables in the country.

The tramline facility in Atok that was installed sometime in 1988 was a pilot project of BPRE and DA-CAR. Its operation and maintenance was turned over to the farmer-cooperators upon completion of the research project in 2000. The tramline facilities in Buguias on the other hand were completed later in 2003 and were among the first batches of the tramline projects under the national tramline program that was funded by the infrastructure and facility assistance of the Department of Agriculture. After completion of construction, these tramline facilities were turned over and had been independently operated and managed by the beneficiaries.

The study utilized cross-section data from the two municipalities covering the wet and dry seasons. The data included information on the production aspects of the direct ("WITH") and potential ("WITHOUT") beneficiaries of the tramline facility. Farmers "WITHOUT" tramline transport facility were those that came from remote farms that utilized only conventional methods of hauling their produce. Farmers "WITH" tramline transport facility referred to remote farms that utilized tramline transport facility. A sample of 15 percent of the farmers in Benguet with farms serviced by tramlines was selected for the interviews. Of the 180 respondents of the study, 116 respondents were from Atok and the rest from Buguias. The total number of respondents was equally divided between the "with" and "without" tramlines facilities. The study sites and respondents were chosen from production areas that were not serviceable by farm-to-market roads. The need for tramline facilities were based on: a) the distance of the farm to the nearest road; b) travel time; c) cost of hauling or transport; and d) ruggedness of area/steepness of slope. These production areas were not accessible by farm-to-market roads and typically employed labor for the transport of their products from the farm to the nearest road accessible by vehicle.

Data were gathered using a structured survey questionnaire, Key informant interviews (KII) and focused group discussions (FGDs).

COST-BENEFIT FRAMEWORK

The cost-benefit framework that was used for analyzing changes in the streams of costs and benefits is illustrated in Figure 3. The financial and economic viability of the tramline facility were evaluated by comparing the "WITH" and the "WITHOUT" tramline situations.

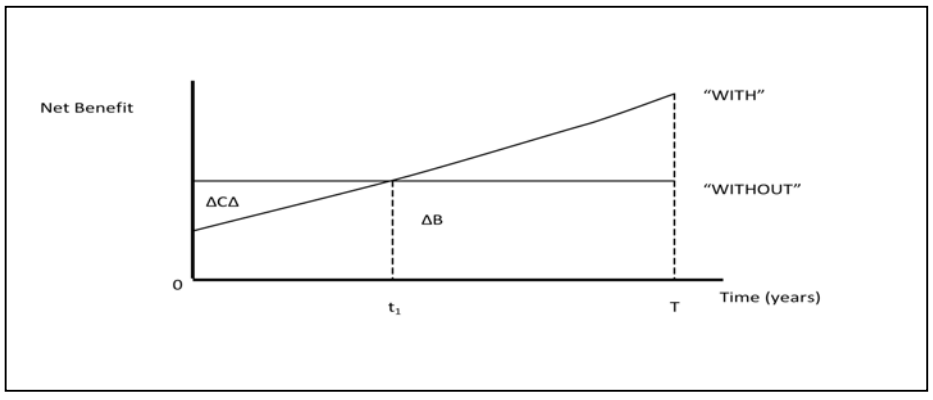

Fig. 3. Net benefits for "With" and "Without" tramline situations.

Mathematically, the relationships can be presented as follows: (Boardman et.al, 1996)

$\Delta B = \sum B_{n\,(with)} - \sum B_{n\,(w/o)}$; $\Delta C = \sum C_{n\,(with)} - \sum C_{n\,(w/o)}$

$NPV = [\Delta B/(1+i)^n] - [\Delta C/(1+i)^n]$;

if NPV > 0, accept "WITH" if NPV ≤ 0, retain "WITHOUT"

where:

NPV = net present value of incremental net benefit, in pesos
ΔC = incremental costs, in pesos
ΔB = incremental benefits, in pesos
B_n = benefits occurring at time period n, in pesos
C_n = costs occurring at time period n, in pesos
n = time period, in years
i = % discount rate

Without the tramline facility, it was assumed that the amount of net benefit across time period T, the effective life span of the tramline facility, was generally fixed or constant. With the tramline facility, it was assumed that there would be changes in the streams of costs and benefits. Costs would generally include the direct costs of putting up the facility and the negative impacts associated with it. Benefits, on the other hand, would include the value of the increase in the level of production. During the early part of the project life before time t_1, the net benefit of "WITH" situation would be lower than the "WITHOUT" tramline situation because the bulk of the costs, i.e. the cost of putting up the tramline facility would be incurred during this period. After t_1 however, the benefits for the "with" is greater than the "without" tramline situation.

Financial and Economic Analysis

The financial analysis was used to determine the financial viability of operating the tramline. The objective of the analysis was to determine whether it would be worthwhile or profitable for a private individual or group to engage in the operation of a tramline facility. This was analyzed using the data on the cost of tramline installation, operating costs, capacities, repair and maintenance required, hauling rates, inputs utilization and volume of production. The profitability parameters used were benefit-cost ratio (BCR), net present value (NPV), payback period (PB) and internal rate of return (IRR). The breakeven analysis was used to determine the minimum efficient level of operation of the tramline facility. On the other hand, sensitivity analysis was undertaken to determine the effects of size of service areas and interest rates on the viability of tramline operations.

Partial budget analysis was also used to assess the viability of adapting the tramline facility as an alternative means of transport for farm products and farm inputs over the traditional manual hauling. In the analysis, all incremental costs and returns and reduced cost and returns were considered on a per-hectare, per-cropping season basis. A positive change in income meant that the farmer was better off using the tramline facility over the traditional manual method of transport.

On the other hand, the economic analysis was undertaken to determine whether the tramline facility was a worthwhile public investment. Table 1 shows the associated benefits and costs for the "with" and "without" tramline situation. The benefits included the increase in yield, improved quality of the farm product and labor savings while the additional costs were related to the installation, operation and maintenance of the facility. For this purpose, the necessary adjustments to convert the financial prices into the opportunity cost or efficiency prices using the shadow exchange rate (SER) method was done. This way, the stream of economic costs and benefits over different time periods could be determined and compared. The effect of SER method was to make traded items relatively more expensive in domestic currency by the amount of foreign exchange premium.

The SER was computed using the following formula:

SER = OER (1 + *fep*)

where: OER = official exchange rate, in pesos

fep = foreign exchange premium, in percent; based on the tariff rate imposed by Bureau of Customs on some of the traded components of the tramline facility i.e. engine, cables and its accessories

The Economic Rate of Return (ERR) and Net Present Value (NPV) were used as indicators of the economic viability of the project. The ERR is a measure of the economic returns to society of a public investment.

Financial Viability of Tramline Facility

The amount of investment on a tramline facility is affected by the following factors: (1) distance covered given that the longer the tramline the higher the investment; (2) terrain, slope and topographic characteristics of the area to determine the number of posts/structures which affect investment cost; and (c) hauling capacity given that higher hauling capacities require higher levels of investment from the bigger sizes of structures and power requirement.

Table 1. Economic benefits and costs components of "WITH" and "WITHOUT" tramline transport facility .

VARIABLES	**ECONOMIC VALUES**	
	"With"	**"Without"**
Benefits		
Vegetable produce *(P1Q1)*	√	√
Additional yield *(P2Q2)*	√	X
Preservation of quality/averted postharvest loss from delay in transport *(P3Q3)*	√	X
Savings from manual hauling *(P4W1)*	√	X
Labor saved, man-days/ha/year *(P5W2)*	√	X
Total Benefits ("with") = $\sum$ *(PiQi)* + $\sum$*(PiWi)*		
Total Benefits ("without") = *P1Q1*		
Cost		
Transport cost		
Tramline hauling *(C1)*	√	X
Manual hauling *(C2)*	X	√
Production cost *(C3)*	√	√
Tramline establishment *(C4)*	√	X
Operation and repair & maintenance cost of tramline facility *(C5)*	√	X
Additional use of fertilizer inputs *(C6)*	√	X
Additional use of labor for application of inputs and increase in yield *(C7)*	√	X
Total Cost (with) = *C1+C3+C4+C5+C6*		
Total Cost (without) = *C2+C3*		
Net benefit (with) = Total benefits (with) –Total Cost(with)		
Net Benefit (without) = Total Benefits (without) –Total cost (without)		
Incremental net benefit =Net benefit (with) –Net benefit (without)		

The study considered an average size/length of tramline that commonly exists in Benguet as the basis for estimating the amount of investment for the tramline facility. The average length of this common tramline facility is 400 meters with a hauling capacity of 200-250kg/trip. As shown in Table 2, the approximate cost of this tramline is PhP700,000. The bulk of this cost includes the labor cost for hauling and installation (27%); the cost of service cables (19%); prime mover (16%); and towers (15%).

Table 2. Investment cost of a tramline facility with a 400-meter length, 2008.

MAJOR ITEMS	PERCENTAGE SHARE OF COST	COST (PhP)
1. Service cables, IWRC	19	133000
2. Primemover, diesel engine, 70hp	16	112000
3. Powerhouse	7	49000
4. Towers and anchors	15	105000
5. Accessories	2	14000
6. Labor, hauling and installation	27	189000
7. Contractors profit	14	98000
Total	**100**	**700,000**

The study considered the following key questions. Is the tramline a financially viable operation? What would be a good arrangement for managing the operation? Two different arrangements were considered and evaluated: (1) Private Investor Operating the Tramline Facility and (b) Farmer-Beneficiaries Owning and Operating the Tramline Facility. If the arrangement is financially attractive to the operator of the tramline facility, will it also be financially attractive to the farmers who will be using it? Would farmers be better off with the provision of a tramline facility? Would it be a worthwhile public investment?

Arrangements for Operating the Tramline Facility

The first arrangement is for a private individual investor to own and operate the tramline facility. Under this arrangement, a private individual would invest in the facility and operate it to replace manual hauling in a location where the cluster of farms has at least a total aggregated area of seven hectares. The seven-hectare service area is the average size of a cluster of farms in Benguet. Assuming two croppings of vegetables a year, the tramline facility would be utilized for hauling production inputs and vegetables during the 10-year life span of the facility.

A sensitivity analysis was undertaken to determine the effect of a change in tramline hauling fees on the minimum service area that is still financially viable, on the payback period, and the financial rates of return. The minimum hauling fees considered in the sensitivity analysis were P12.50/bag and P0.34/kg for farm inputs and vegetables respectively, corresponding to the existing tramline fees paid using the tramline facility. Financial analysis using these rates showed that it would not be financially viable since the investment of PhP700,000 would not be recovered within the project life of the facility and given a negative NPV (Table 3).

The result of the sensitivity analysis on the other hand showed that tramline facility would be financially viable if the hauling fee charged was P50/bag and P1.50/kg for inputs and vegetables, respectively. At this rate of hauling fees, the investment would be recovered in 4 years. The BCR for the project under this arrangement would be 2.94 while the IRR and NPV would be 32% and PhP2,068,772, respectively.

Table 3. Financial analysis of a 7-ha., private investor operated tramline facility using existing tramline and recommended hauling rates, Benguet, 2008.

Existing Tramline Rate P12.50/bag; P0.34/kg				**Sensitivity Analysis P50/bag; P1.50/kg**			
7 Hectares				7 Hectares			
Benefits (Php)		Costs (Php)		Benefits (Php)		Costs (Php)	
Period (Yrs.)	Amount (Php)	Period (Yrs.)	Amount (Php)	Period (Yrs.)	Amount (Php)	Period (Yrs.)	Amount (Php)
1 to 10	140,543	1 to 2	286,042	1 to 10	562,174	1 to 2	286,042
		3	590,390			3	590,390
		4 to 5	90,042			4 to 5	90,042
		6	202,042			6	202,042
		7	90,042			7	90,042
		8 to 10	104,042			8 to 10	104,042
Net Present Value = PhP (1,465,033)				Net Present Value= PhP2,068,772			
Payback Period = >10 years				Benefit Cost Ratio = 2.94			
				Internal Rate of Return = 32%			
				Payback Period = 4 years			

The second kind of arrangement is for farmer-beneficiaries to own and operate the Tramline Facility. Although most of the tramlines in Benguet were established through government or international grants, some tramlines were established and financed by farmers. Assessment of the financial viability of this type of arrangement where farmer-beneficiaries would own and operate the tramline facility showed that it would also not be financially attractive if the existing tramline rate is used. Results of the sensitivity analysis showed that to be financially viable under this kind of arrangement, the hauling fees should at least be P37.5/bag and P1.05/kg for inputs and vegetables, respectively (Table 4). Given this rate, the investment could be recovered in 4.97 years with a BCR of 1.91 and an NPV and IRR of PhP1,345,697 and 20.68%, respectively.

Table 4. Financial analysis of a 7-ha., farmer-beneficiary operated tramline facility using existing tramline and recommended rates, Benguet, 2008.

Existing Tramline Rate P12.50/bag; P0.34/kg				**Recommended Rate P37.50/bag, P1.05/kg**			
7 Hectares				7 Hectares			
Benefits (Php)		Costs (Php)		Benefits (Php)		Costs (Php)	
Period (Yrs.)	Amt./yr. (Php)	Period (Yrs.)	Amt./yr. (Php)	Period (Yrs.)	Amt./yr (Php)	Period (Yrs.)	Amt./yr (Php)
1 to 10	140,543	1 to 2	254,542	1 to 10	421,630	1 to 2	188,042
		3	202,690			3	512,116
		4 to 5	156,542			4 to 5	90,042
		6	268,542			6	202,042
		7	156,542			7	90,042
		8 to 10	170,542			8 to 10	104,042
Net Present Value = PhP (410,376)				Net Present Value= PhP1,345,697			
Benefit Cost Ratio = 0.76				Benefit Cost Ratio = 1.91			
Payback Period = >10 years				Internal Rate of Return = 20.68%			
				Payback Period = 4.97 years			

The difference of the first arrangement with this kind of arrangement is attributable to the difference in the interest rates imposed by the banks on loans for individual investor and farmers' organization or cooperative. The interest rate imposed by bank on facility loan for private individual is higher at 30% compared to a farmers' cooperative at only 18%. This is intended to support the cooperative movement in the Philippines. Thus, the hauling fees that can be charged by farmers' cooperative for the services of the tramline facility can be lower than that of an individual operator.

Effect of size of service area on the viability of tramline operations

The effect of the size of service area on the viability of operating a tramline facility by a farmers' cooperative and private investor is shown in Table 5. To be viable, a tramline facility operated by a farmers' group should be able to service at least 23 hectares of farm area given the existing tramline rate. Given this level of operation, the investment can be recovered in about 8 years with an IRR and NPV of 5.2% and P365T, respectively. If however the recommended tramline rate is charged, the minimum service area will be reduced to 15 hectares with a shorter payback period of about 4 years and an IRR and NPV of 34.31% and P1,368T, respectively.

With a private investor, the minimum service area to be financially viable assuming that the existing rate is used is also 23 hectares with a payback period of 9.29 years and an IRR and NPV of 1.91% and P146T, respectively. However, if the recommended tramline rate is used, the minimum service area is 15 hectares with payback period of 4.28 years, IRR of 28.80% and NPV of P1,179T, respectively.

Considering that the difference between the farmers' coop and private individual is in their cost of investment, then the implication of the result of the sensitivity analysis is that viability of the operation is greatly affected by the interest rate, size of service area and tramline rate. To be able to lower the tramline rate, it will be necessary to increase the service area and vice-versa. However, given the size of the farms in Baguio, the only alternative for the operation to be viable is to increase the tramline rates. In addition, it will greatly help if the cost of investment or money is reduced since this also has an impact on the financial viability of the operation.

Table 5. Sensitivity to changes in service areas given existing and recommended tramline rates for farmers' coop and private investor, Benguet, 2008.

Indicators of Financial Viability	**Existing Tramline Rate (P12.50/bag & P0.34/kg) Service area (has)**				**Recommended Tramline Rate (P37.50/bag & P0.65/kg) Service area (has)**			
Farmer's Coop (Interest rate of 18%)	7	15	23	31	7	15	23	31
NPV ('000)	-1,296	-716	365	441	88	1,368	3,059	4,750
IRR	*	*	5.20	16.64	1.29	34.31	67.89	103.6
Payback Period (years)	**	**	8.23	5.77	9.50	3.79	1.46	0.84
Private Investor (Interest rate at 30%)								
NPV('000)	-1.484	-905	146	253	-129	1,179	2,870	4,561
IRR	*	*	1.91	12.54	*	28.80	60	94
Payback Period (years)	**	**	9.29	6.57	**	4.28	2.04	0.94

* not calculable

** Investment cannot be recouped within the 10-year project life

Financial Attractiveness to Farmers

The financial analysis was undertaken to determine whether the tramline facility would be attractive enough for farmers to use considering the minimum hauling rate that should be charged to ensure a viable hauling operation under different management arrangements. The partial budget analysis showed that if farmers shifted from conventional to tramline hauling assuming that a private individual would operate it, the estimated change was a net loss of Php6,887/ha/season (Table 6). The assumption here was that the private investor would charge hauling rates of P50/bag and P1.50/kg for inputs and vegetables, respectively. On the other hand, if a farmers' cooperative would operate it and charge P37.50/bag and P1.05/kg for inputs and vegetables, respectively, the net loss would be P2,972/ha/season (Table 7). Thus, it can be concluded that without subsidy, the tramline hauling operation would not be financially viable to operate. It would be more expensive for farmers to use the tramline hauling than the manual hauling method. Farmers thus would have no incentive to use the tramline facility.

Table 6. Partial budget analysis for manual vs. tramline hauling, per hectare per cropping season, private investor operation, Benguet, 2008.

PROPOSED TECHNOLOGY: MANUAL VS. TRAMLINE HAULING			
ADDED COSTS (A)		ADDED RETURNS (B)	
1 Additional Fertilizer	11,250	Increased yield of various vegetables	
-Organic 75 bags @ PhP150/bag		7,942kg @PhP8/kg	63,536
-Inorganic, 2.5bags @PhP900/bag	2,250		
2. Transportation by bus of additional fertilizer, 78bags @ PhP50/bag	3,900		
3. Hauling Cost of fertilizer using Tramline, 290 bags @ PhP50/bag	14,500		
4. Labor cost of fertilizer application, 78 bags @PhP50/bag	3,900		
5. Labor, handling & hauling cost of harvesting additional yield,7,942kg PhP4.00/kg	31,768		
6. Opportunity cost, 8%	5,405		
REDUCED RETURNS		REDUCED COSTS	
None		Time saved from manual hauling 17man-days @PhP150/man-day	2,550
Subtotal A	72,973	Subtotal B	66,086
		Estimated change in income (B-A) = PhP-6,887/ha/season	

Table 7. Partial budget analysis for manual vs. tramline hauling, per hectare per cropping season, farmers' group operation, Benguet, 2008.

PROPOSED TECHNOLOGY: MANUAL HAULING PRACTICE VS. TRAMLINE TRANSPORT FACILITY			
ADDED COSTS (A)		ADDED RETURNS (B)	
1 Additional Fertilizer	11,250	Increased yield of various vegetables 7,942kg @PhP8/kg	63,536
-Organic 75 bags @ PhP150/bag			
-Inorganic, 2.5bags @PhP900/bag	2,250		
2. Transportation by bus of additional fertilizer, 78bags @ PhP50/bag	3,900		
3. Hauling Cost of fertilizer using Tramline, 290 bags @ PhP37.50/bag	10,875		
4. Labor cost of fertilizer application, 78 bags @PhP50/bag	3,900		
5. Labor, handling & hauling cost of harvesting additional yield,7,942kg PhP4.00/kg	31,768		
6. Opportunity cost, 8%	5,115		
REDUCED RETURNS		REDUCED COSTS	
None		Time saved from manual hauling 17man-days @PhP150/man-day	2,550
Subtotal A	69,058	Subtotal B	66,086
		Estimated change in income (B-A) = PhP-2,972/ha/season	

ECONOMIC ANALYSES

Economic Viability of Putting Up Tramline Facility as Public Investment

The economic analysis was undertaken to determine whether the tramline facility would be a worthwhile public investment, that is, whether the societal benefits would be greater than the societal costs. In the economic analyses, immediate costs and benefits were identified and their corresponding economic costs and benefits were quantified. Streams of benefits and costs were projected over the 10-year project life of the hauling facility.

In the analysis, the shadow exchange rate (SER) method was used to adjust the values of costs and benefits. SER was used because some of the materials and parts used for the establishment

of the tramline transport facility were traded items. These traded items included service cable, prime mover and accessories. The foreign exchange premium used for the computation of SER was 12 percent, a rate that is usually used by the National Economic Development Authority (NEDA) in their economic evaluations. Given the foreign exchange adjustment, the investment would be adjusted from PhP700,000 using the financial prices to PhP731,080 using its efficiency prices (Table 8). Thus, from the point of view of the society, the cost of putting up a tramline facility would be more expensive than looking at it from the point of view of a private investor because of the foreign exchange premium.

Table 8. Adjustment of tramline investment costs from financial to economic prices, 2008.

MAJOR ITEMS	MARKET SOURCE	FINANCIAL COST (PhP)	ECONOMIC COST (PhP)
1. Service cables, IWRC	Imported	133000	148960
2. Primemover, diesel engine, 70hp	Imported	112000	125440
3. Powerhouse	Local	49000	49000
4. Towers & anchors	Local	105000	105000
5. Accessories	Imported	14000	15680
6. Labor, hauling and installation	Local	189000	189000
7. Contractors Profit	Local	98000	98000
	Total	700,000	731,080

Note: Imported items were multiplied by 1.4 to adjust for the 40% tariff rate.

In the "WITHOUT" scenario, the benefits were derived mainly from the value of the crops produced while the costs were estimated based on the current cost of production. For the "WITH" scenario, the benefits included the: a) additional yield; b) savings from manual hauling; c) preservation of quality/averted postharvest loss, and d) labor saved. On the other hand, the costs included the costs of: a) additional fertilizer; b) additional labor; c) payment for the tramline operator; d) repair and maintenance of tramline facility; e) fuel, oil and grease, and f) depreciation of the tramline facility.

The incremental net benefit was estimated by subtracting the total net benefits of the "WITHOUT" scenario from the "WITH" scenario. Based on the result of the BCA, putting up a tramline facility serving a seven hectare area and treating it as public investment will give an Economic Rate of Return of 37% and a Net Present Value of PhP2,035,845.62 assuming an interest rate of 12% (Table 9). The result of the break-even analysis also showed that there should at least be 5 hectares that should be serviced by the tramline facility to be economically viable. With a minimum area of 5 hectares, the economic rate of return (ERR) for this public investment would be 16% with a net present value (NPV) of PhP1,244,118.46.

Table 9. Economic analysis of putting up tramline transport facility to replace manual method of transport, 7 and 5 ha. farm areas, Benguet, 2008.

SERVICE AREA							
7 Hectares				5 Hectares			
Benefits (PhP)		Costs (PhP)		Benefits (PhP)		Costs (PhP)	
Period (Yrs.)	Amount (Php)	Period (Yrs.)	Amount (Php)	Period (Yrs.)	Amount (Php)	Period (Yrs.)	Amount (Php
1 to 3	1,146,600	1 to 10		1 to 3	788,640	1 to 2	188,042
4 to 5	1,130,528			4 to 5	772,568	3	512,116
6	1,001,952			6	643,992	4 to 5	90,042
7	1,130,528			7	772,568	6	202,042
8 to 10	1,114,456			8 to 10	756,496	7	90,042
						8 to 10	104,042
ERR = 37 NPV = PhP2,035,845				ERR = 16 NPV = PhP1,244,118			

CONCLUSION

The introduction of tramline facilities is a welcome development for farmers in the remote and inaccessible upland areas considering the difficulty and cost of transporting the farm products to the market using the conventional method of manual hauling. Farmers have been using these facilities in areas where they have been introduced. However, the returns to investment for a private investor or a farmers' cooperative in a tramline facility will not be attractive if the existing rates for conventional hauling are applied. If the rates however are increased to ensure a viable operation of the tramline facility, then it will be more expensive for farmers who may not patronize it.

The tramline facility however can be treated as a public investment. The result of the economic analysis showed that the economic returns to investment would be high and from the viewpoint of society would be a worthwhile investment. The returns to society would justify investment of public money for such facilities. It will be worthwhile for government to put more funds into putting up such facilities that would link the farmers in these remote areas to the market and help uplift their economic conditions.

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