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Vehicular Operational Cost : Prospects For Cleaner Vehicles In The Kathmandu Valley

Devendra Prasad Adhikari*

INTRODUCTION

Vehicles operational cost is dependent on many factors. The major cost determinants are vehicle price, government duties, and operation and maintenance costs. It is further dependent on the life and annual distance covered by the vehicle. This article illustrates the operational cost of the vehicles on their life cycle basis in the Kathmandu Valley. The life cycle cost was derived in terms of ruppees per kilometer of the distance traveled by each vehicle type and is presented here from both an individual and the national viewpoints.

METHODOLOGY

There are basically four types of fuels that are being used in the transport sector in the Valley. These are diesel, gasoline, electricity, and liquefied petroleum gas (LPG). The life-cycle cost of the vehicles was calculated using the pratical operating characteristics. Information on vehicle parameters was obtained through the vehicle survey conducted during the month of April in 1997. A slight readjustment has been made in order to obtain the costs comparable among the similar vehicle types, such as diesel, electric and LPG three–wheelers, etc. Furthermore, information on vehicle price was obtained from the market survey. Other essential information was collected from the concerned government and private organisations.

A concept of levelised cost was used for integrating the cash flows that occurred at different periods. Net present value (NPV) of the expenditures, which were spent at different time period, was transferred to an annuity for an equal installment to arrive at the levelised cost (LC), which was calculated using the following relation:

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* *Mr. Adhikari is an Energy and Environmental Economist, Agricultural Development Bank, Kathmandu, Nepal.*

$$LC = NPV \frac{i}{1 - (1 + i)^{-n}}$$

Where,

i = discount rate
n = life of the vehicle

The life cycle cost was obtained by dividing the levelised cost with the annual distance traveled by each vehicle type, where the annual distance traveled for each vehicle was obtained through the survey.

Eight percent discount rate was used to obtain the present value for the future expenditures in case of the life cycle cost calculation for the individual perspective. Likewise, ten percent discount rate was used for the life cycle cost calculation from the national perspective. Government duties, taxes, registration and other in-country costs were deducted from the prevailing market price of vehicles, batteries, lubricants etc. in order to obtain the national shadow price. The boarder price for the petroleum products was estimated from the post information on import and payment made by the country for such import. There were no marked differences in market prices among the petroleum products in the international market. The economic price for all petroleum products was, therefore, calculated equal to NRs. 12 per liter. This price was estimated for the period of early 1997. Fifty percent of the total cost required for the vehicle operation and maintenance was considered as local and remaining fifty percent as foreign cost components. Shadow price for the electricity was taken from its long run marginal cost (LRMC).

RESULTS AND DISCUSSION

The Table 1 exhibits the life cycle cost of the vehicles operating in the Valley. Further details related with the cost parameters and other essential information required for the cost calculation for the individual perspective are shown in Annexure Table 1 and likewise for the national perspective in Annexure Table 2.

Table 1

Life Cycle Cost Of The Vehicles In The Valley

Fuel Type	Vehicle Type	Life Cycle Cost (NRs./km.)	
		Individual Perspective	National Perspective
Diesel	Bus	9.67	7.62
	Minibus	8.30	6.67
	Car	7.21	3.80
	3 - wheeler	2.91	2.15
Gasoline	Car	7.85	3.43
	3 - wheeler	4.75	2.43
	2 - wheeler	2.30	1.11
Electricity	Trolley	16.20	13.54
	3 - wheeler	5.75	5.32
LPG	3 - wheeler	2.97	2.89

Source : Computed by the Author Based on the Survey Conducted by the Author in 1997.

Three-wheelers operating on diesel, electricity and LPG are running on the fixed routes for providing the similar type of services to the local people. These vehicles could be a substitute for one another. Looking into the life cycle cost of these vehicles, it is obvious why Vikram tempo (operating on diesel) has become so popular in a short span of time in the Valley. It cost NRs. 2.91 per kilometer of the distance covered while the electric three-wheeler cost NRs. 5.75 for providing the similar services. Diesel three-wheeler has a bad reputation of being the worst polluter in the Valley. Air pollution caused by the vehicular sector imposes a significant amount of social and environmental costs to the nation. Electric three-wheelers have environment benefits but was proved a costlier option. The government's ban on further registration of diesel and gasoline three-wheelers played a catalyst role for introducing the electric and LPG three-wheelers in the Valley. LPG Tuk-Tuk has emerged as a close competitor to the diesel and electric three-wheelers and it could replace the existing diesel tempo under the present tax rates. At present, it enjoys the tax privilege almost equal to that of the electric three-wheelers.

Likewise, diesel and gasoline car could be a close substitute for each other. From the individual viewpoint, gasoline car cost more to operate compared to its diesel counterparts, but it was vice versa from the national viewpoint. The nation could benefit by encouraging the gasoline car equipped with catalytic converter. The catalytic converter could lower emissions of harmful pollutants from the vehicles. It furthermore does not impose any addition costs to the national economy.

Life cycle cost was the highest for the trolley bus in the Valley. Government undertaking has been operating the trolley bus services. It is noteworthy to mention that most of the government organisation is functioning in economically inefficient manner. Trolley bus would be a better option on emission ground for the country like Nepal where the electricity comes primarily from the renewable hydropower sources. It cost almost double of that required for the diesel bus. This has become one of the reasons for being the trolley bus service stagnant in the Valley. Nepal has received trolley bus as grant assistance from the Peoples Republic of China. Indeed the price quoted in the grant may not reflect its true price. It could be cheaper if it was purchased in the international market. Involving the private parties for its operation could further lower its operation cost.

The life cycle cost of the two-wheeler was the lowest in the Valley. We were paying about NRs. 2.50 per kilometer of the distance traveled. If we calculate the cost per passenger then it becomes the costliest means of transport. Public transport services have been operating a far below the required standards in the Valley. Inconvenience and unreliability are few reasons for helping rapid increase the number of two-wheelers in the Valley.

It is believed that mass transit system is cost-effective option compared to personalised transport vehicles such as two-wheelers and cars while considering the cost of service per passenger. It is, however, uncertain in the case of the Valley because of the insufficient and narrow roads in the Valley. There needs a comprehensive study before drawing any trustworthy conclusions on determining the effectiveness of the mass transit system in the Valley. Despite its high operating cost, electric three-wheeler has already been successfully operating in the Valley. Three-wheelers, therefore, seem to be the most desired and competent means of transport option for the Valley topography.

CONCLUSION

Government can effectively control, encourage or discourage certain type of vehicle with economic instruments. Electric and LPG three–wheelers could enhance the image of the Valley as a model city for having the vehicles, which are environment friendly. It could have long-term economic benefits to the Valley. Rate liberalisation could encourage the speedy dissemination of electric and other vehicles, which could displace personalised vehicular options to some extent. It is noteworthy to mention that additional supports and encouragement are essential to make the cleaner vehicle programme a success, so that it would displace or replace the position that has been occupied by the polluting vehicles from the Valley. The government has already introduced unleaded gasoline. It is essential for those cars that are equipped with catalytic converter. Policies that regulate the import of new cars that are equipped with catalytic converter seem to be indispensable for mitigating air pollution in cost-effective manner both from the national and individual viewpoint.

ANNEXURE

Table 1
Life-cycle Costs For Vehicles In The Valley (Individual Perspective)

Particulars	Diesel				Gasoline			Electric		LPG
	Bus	Minibus	Car	3 - wheeler	Car	3 - wheeler	2 - wheeler	Trolley	3 - wheeler	3 - wheeler
Price ($)	24254	21856	10342	2927	8696	1716	826	75770	5043	5339
Government Duties. ($)	7034	6338	13006	1478	11392	927	511	0	50.4	54
Registration ($)	115	115	106	21	106	8.8	5	0	21	88
Fuel ($)	3172	3524	398	661	966	600	132	5136	419	892
O & M and Lubrication ($)	1276	878	488	457	488	391	97	1451	2195	160
Taxes($)	70	70	106	5	105	11	5	0	0	0
Insurance ($)	176	158	141	0	141	0	44	0	0	0
Life (Years)	20	20	25	20	25	20	20	30	30	20
Distance Covered (km/year)	45000	50000	25000	30000	25000	15000	10000	45000	30000	30000
Life-cycle Cost (cents/km)	17.04	14.62	12.71	5.14	13.85	8.35	4.05	28.54	10.13	5.25
Life-cycle Cost (NRs./km)	9.67	8.3	7.21	2.91	7.85	4.75	2.3	16.2	5.75	2.97

Source : Computed by the Author Based on the Survey Conducted by the Author in 1997.

Note : 1US $ = NRs. 56.75

Table 2
Life-cycle Costs For Vehicles In The Valley (National Perspective)

Particulars	Diesel				Gasoline			Electric		LPG
	Bus	Minibus	Car	3 - wheeler	Car	3 - wheeler	2 - wheeler	Trolley	3 - wheeler	3 - wheeler
Price ($)	24254	21856	10342	2927	8696	1716	826	75770	5043	5339
Government Duties. ($)	0	0	0	0	0	0	0	0	0	0
Registration ($)	0	0	0	0	0	0	0	0	0	0
Fuel ($)	2718	3020	341	566	341	211	47	1540	126	396
O & M and Lubrication ($)	757	554	301	165	301	223	60	777	1911	80
Taxes($)	0	0	0	0	0	0	0	0	0	0
Insurance ($)	0	0	0	0	0	0	0	0	0	0
Life (Years)	20	20	25	20	25	20	20	30	30	20
Distance Covered (km/year)	45000	50000	25000	30000	25000	15000	10000	45000	30000	30000
Life-cycle Cost (cents/km)	13.42	11.76	6.7	3.79	6.04	4.09	1.95	23.85	9.37	5.09
Life-cycle Cost (NRs./km)	7.62	6.67	3.80	2.15	3.43	2.32	1.11	13.54	5.32	2.89

Source : Computed by the Author Based on the Survey Conducted by the Author in 1997.
Note : 1US $ = NRs. 56.75

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