

## TRANSPORTATION ECONOMICS AND COSTS

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*It is one of the very important sectors in all national economies. Transportation companies have some characteristics which differ from the manufacturing companies. Some of these characteristics are the absence of inventory, different quality and quantity measurement.*

*Cost structure of transport modes varies according to form of transport. But common characteristic of costs is that the costs are generally non variable and mostly joint costs.*

*The cost of a particular transportation company may be classified by the units of activity. The purpose of such an allocation of costs is to provide management with the technical performance information. Management may be assisted by having these cost data to provide the various services and capacity planning and they may determine the prices which will be attached to each service.*

*Ulaştırma sektörü tüm ulusların ekonomileri için en önemli sektörlerden biridir. Ulaştırma işletmelerinin, sınai işletmelerden farklı özellikleri vardır. Bunlar stokların olmaması, girdi ve çıktı birimlerinin ve hizmet kalitesinin farklı şekilde ölçümleridir.*

*Maliyet yapıları ulaşım tipine göre farklı özellik gösterir. Fakat her ulaşım türündeki maliyetlerin ortak özellikleri, bunların genellikle sabit ve ortak karakterli olmalarıdır. Maliyet dağıtımı ve faaliyet birimlerine göre maliyet saptamanın amacı, yönetimi teknik verimlilik ve kapasite planlaması konusunda bilgilendirmek ve fiyat saptamaya yardımcı olmaktır.*

### FUNCTIONS AND ADVANTAGES OF TRANSPORT

Transportation activity is as old as humanity it self. The transportation necessity, brought the invention of wheel. Since then the movements of man and goods have been on an increasing scale.

Because of transportation activity, man is able to reach the natural resources which are scattered all over the world. Without transport, communities of people would dependent upon the natural resources which were in their environment. In each district

people tended to concentrate on the using of the natural resources. Because by exchanging their goods they have produced with the other peoples' goods, their needs and desires could be satisfied. In other words, the excess of their products could easily find markets if they were sent. That reality caused the increasing specialization in occupations. Specialization brought increasing amount in production. Population concentrated in cities. And cities became larger and larger. Traveling for pleasure as well as business trips was a need. Education and learning have been improved by the exchange of knowledge between countries. "The growth of transport facilities has brought great benefits to humanity and affected all aspects of life. At the same time, however, transport has created problems of such dimensions and complexity as to affect it with the public interest and to have it embraced in the public policies of every civilized country"<sup>1</sup>.

#### GENERAL CHARACTERISTICS OF TRANSPORTATION INDUSTRY

Transportation organizations are service organizations. The production and sale of services, has several implications for the management control process.

*Absence of Inventory Services* can not be stored. If the services are available today it does not mean they can be sold today. The transportation companies don't have any option to use their capacities for non current options. Their resources available for sale are essentially fixed. In the short run, a shipping company cannot increase its fleet utilization of capacity which may vary greatly by seasons of the year. The loss from unsold services is such an important factor that utilization rates and similar indications of success in selling available services are normally key variables<sup>2</sup>.

*Capital Intensive.* Although many service organizations tend to be labor intensive, transport organizations are highly capital intensive.

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- (1) L.A. SCHUMER; *The Elements of Transport*, (London; Butterworth & Co. Publ'g Ltd' 1967) p. 13.
  - (2) Robert N. Anthon & John Dearden, *Management Control Systems*, 3d Ed. (Homewood, ILL.; Richard D. Irwin, Enc., 1976) p. 628.

*Quantity Measurement.* It is very easy to keep track of the quantity of tangible goods which are produced and sold by manufacturing companies. But it is very difficult to measure the quantity of transportation service. First of all, it is very difficult to express the output of transport service. It is usually used ton-miles (or passenger-miles) as output units. But to use the same single "ton-miles" for empty biscuit tins and iron rods loaded truck, looks like to use the same (average) output unit for washing machine and refrigerator producer company.

*Quality Measurement.* The quality of tangible goods can be inspected in terms of physical evidence. But the judgment of the quality of transport service is subjective and it can be inspected during the time that the service is being rendered to the client. The quality of a transport service is expressed in terms of : speed, safety adequacy, frequency, regularity, comprehensiveness, responsibility, acceptable cost and comfort. All of these qualities are important to the user, but sometimes less than perfection may be acceptable because of financial or other considerations. The relative values of the qualities may change from one place to another or/and one movement to another. The constant problem is the determining of the qualities which are more important than others in each particular instance.

**Speed :** Speed in transportation can be regarded in two ways :

- 1) Speed in the movement of vehicle.
- 2) Speed in the serving of transportation services. Speed is very important in some cases, especially if the goods are perishable or transportation is dependent on the natural phenomena. For instance if snow covers all the pass, commodities must be sent before snow falling.

**Safety :** In transportation systems, safety means adequate provisions which has been made for the protection of persons and property who were living in the surrounding as well as the people and property carried on the transportation system.

**Capacity :** Total carrying capacity must cover the maximum (peak) demand at any time.

**Frequency :** Frequency means less waiting time. If the intervals

between movements are short, the necessity to accumulate goods in storage before or/and after transport can be reduced up to a certain extent. Because in some cases, transporting in large quantities might be cheaper than transporting small quantities. If it is possible to consolidate the stocks, storage costs can be reduced because consolidation of stocks allows a reduction in the total quantity of stocks to be held.

If transport is to be in two or more stages, each with frequent service, if one connection is missed, another will be available within a short time.

**Regularity :** Regularity means that the movements are at known times. That enables people to organize their personal movements.

**Comprehensiveness :** Sometimes it is necessary to deal with more than two transportation companies to complete a journey. The connections must be taken without any break and without any change in the control of movement. Comprehensiveness may be measured by the extent to which one undertaking can accept the responsibility for a complete journey, although it may involve using facilities of more than one undertaking.

**Responsibility :** Responsibility means to have the liability to secure desirable quality in the transport service, but in any case of undesirable quality, to be able to compensate.

**Comfort :** The physical and mental relaxation.

**Acceptable Cost :** That reflects the price which is paid by client. That price must be reasonable to attract traffic. We will emphasize later on the pricing principles of transportation.

*Historical Development.* Cost accounting started in manufacturing companies because of the necessity for valuing work-in-process and finished good inventories for financial statement purposes. Also this cost data is being used for setting selling prices and for other management problems. Today, cost accounting text books deal only with manufacturing companies which are accustomed to using cost information.

Since service organizations have no inventories, they did not have the natural impetus to develop cost data. But today all service companies have accepted the importance of cost data. In transportation companies, cost data may help top management in controlling the technical efficiency and costs. Also, they may help in capacity planning, determining service quality and setting prices.

### THE COST STRUCTURE OF TRANSPORT MODES

The cost structures of transport varies according to form of transport. However we can say that the common characteristic of costs is that in all forms of transportation the costs are generally non - variable, because all the facilities and labor are established to meet a certain estimated demand. The variable costs are generated from movements. Even if movements of companies are dependent on fixed time - tables, movement costs can be considered to be non - variable because the cost must be incurred regardless of the traffic.

In railroad transportation, fixed costs proportions are greater than any other form of transportation. Because acquisition of land and vehicles, construction of ways and associated installations need high capital. That incurs some maintenance and depreciation cost which are fairly fixed costs.

In sea transport, transportation companies are not involved in infrastructure costs. First of all there is no way construction costs. Besides, usually ports are constructed and maintained by port authorities and/or governments. Mostly, fixed costs include depreciation of vessels and associated shore installations. The proportion of variable costs to fixed costs depends on the trade in which the vessels are employed. The proportions of time at port and on sea will vary according to its short haul or long haul movement.

In air transport, airports are constructed and maintained by governments in most countries. Operating costs may be considered in two forms : The costs of operating a fleet of aircraft which have fixed characteristic. An other form of operating cost is the costs of operating of particular aircraft. This type of

cost components are mainly fuel and oil costs, crew costs, landing and navigation fees, insurance maintenance and depreciation costs. Crew costs are approximately 20 % of total direct flying costs and fuel and oil costs which are completely variable costs are approximately 40 % of total direct flying cost<sup>3</sup>. Since large share of total fuel is consumed in take - off and landing processes, we could say that variable costs are affected by route density and stage length. Also plane type is an important deferminant of operating costs. Jet engined planes have higher capital costs than piston engined planes, but their speed is very high and since they can work for twice as long time between overhauls, their maintenance costs are relatively low.

In road transportation, the roads are provided by governments too. The fixed costs include only depreciation costs, taxes and licence fees. Maintenance cost is semivariable. Operation costs are highly variable.

### COST ANALYSIS

The costs of a particular transportation company may be classified also according to units of activity. The purpose of such an allocation of costs is to provide the management of this company with the information which assists in formulation of operating policies and control which have been mentioned before. Management may be assisted by having these cost data to provide the vaious services and they may determine the prices which will attached to each service and the pricing policy must have regard to the cost of providing each service. This transport company may sell more than one type of service, to more than one type of user under differing conditions. Thus the decisions may be made as to drop any part of the traffic. It may be desirable to ascertain the relative profitability of the revenue derived from each activity. Since decisions are directed to maximizing the profit, it is necessary to get the cost information concerning these activities.

In any manufacturing activity, the cost of production depends on two factors :

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(3) Mahlon R. Straszheim; *The International Airline Industry* (Washington DC : The Brookings Institution 1969) p. 91.

1) The technical relationship between the quantities of inputs and outputs (the production function).

2) The economic relationship between the quantities of inputs and their prices.

Production function varies from industry to industry and transportation industry represents a very special application.

As we have said earlier, many questions arise from the choice of output unit. Ton - mile and passenger - mile are usually used as output units. But the most meaningful and appropriate output unit for costing must depend on the objective being achieved by costing exercise. A transport enterprise is a multiproduct enterprise in which the product is heterogeneous. So, the costs must be calculated for several output levels, each representing a different degree of disaggregation. Although passenger - mile is the common output definition, in some cases passenger numbers might be more meaningful. For instance, a bus company measures the demand in terms of passenger numbers, instead of passenger mile. Because of joint cost, selection of the unit of output is very important. However, it must be kept in mind that there is no "correct" output unit that can be used for all purposes.

A sequence of cost allocation which is done in cost accounting department can be illustrated as on the following page.

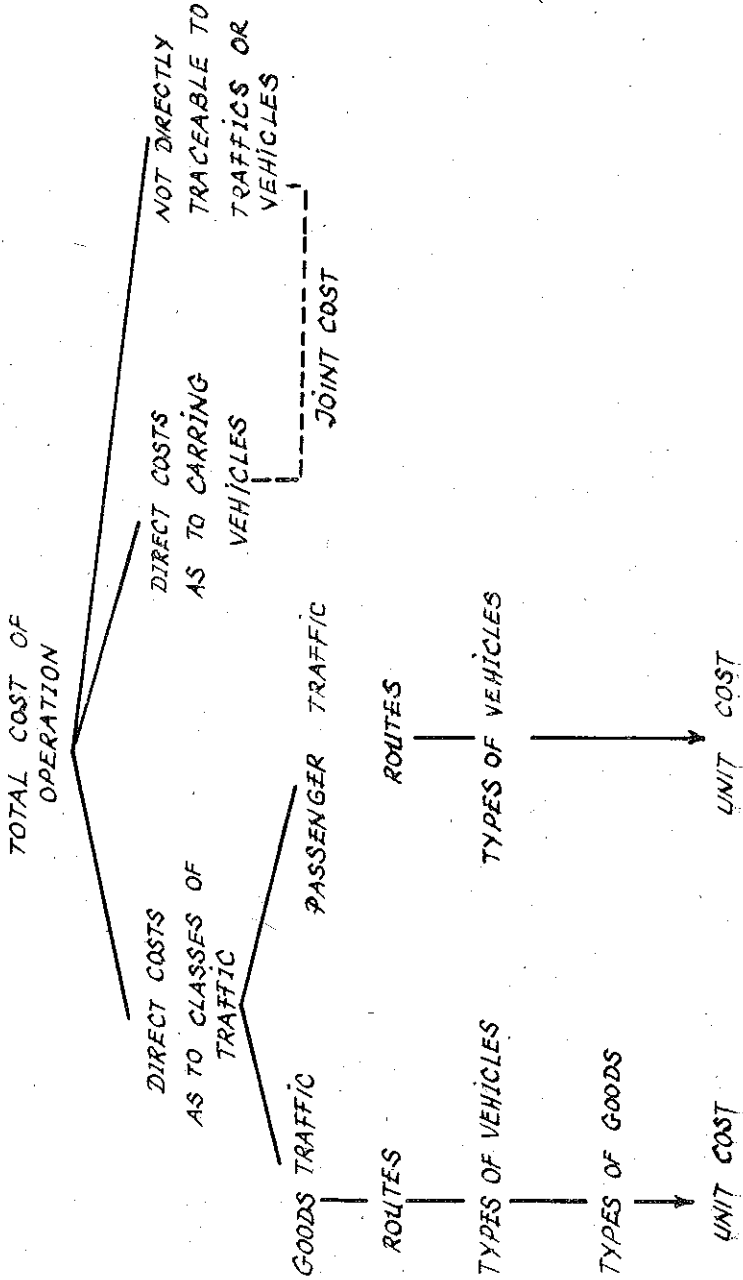
If it is desirable to have a fully distributed cost for each class, indirect and joint costs can be allocated on some arbitrary basis. For example, British Railways, for comparative and statistical purposes, allocates whole costs to several units: The units and allocation rates are as follows<sup>4</sup> :

*Train Working* : Cost per engine - hour in traffic per engine mile and per train - mile; distinguishing between different modes of traction (steam, diesel, electric), but not between loaded and empty running.

*Track Costs* : For earthworks, bridges and tunnels cost per route - mile; for permanent way, cost per total track mile.

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(4) G.A. LEE; *Transport Finance and Accounting*, 2d Ed. (London : Sir Isaac Pitman and Sons Ltd., 1969) p. 210-12.





*Workshops* : Job costing is used to find the costs of repair and maintenance work, and of equipment and spares manufactured.

*Revenue* : Goods traffic receipts are stated per loaded wagon - mile per loaded wagon forwarded and per net ton - mile. The total number of net ton miles is found by multiplying the total of wagon - miles by the average load per wagon at the start of a journey.

Passenger traffic receipts are stated per loaded coaching train - mile per passenger journey and per passenger mile. Receipts per route - mile are also found for each type of traffic.

In airlines the revenue units in common use are the passenger mile, passenger journey and seat mile for passenger traffic and load ton - mile and capacity ton - mile for freight. These may be used as units of cost allocation.

In sea transport days on sea and days at port and milage may be cost allocation keys.

In road haulage vehicle miles and/or tons can be used as allocation basis.

Joint costs are very important. The first reason for the existence of them arise from initial high capital expenditure. Second reason is that the provision of one service often necessitates the provision of another. If a bus goes from A to B, it must return from B to A. Third reason is the time influence. Once a train driver is employed, the cost of employing him are the joint costs of all provided in that period and there is no way to avoid this cost until his employing period ends. The larger proportion of joint costs are unavoidable costs<sup>5</sup>. "The factors affecting the transportation of joint costs are :

1. The size of the output unit being costed.
2. The time period for which the costing is to be carried out.
3. The nature of assets involved, especially where indivisibilities occur"<sup>6</sup>.

The allocation of joint costs among traffics is one of the

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(5)(6) PC STUBBLS, W.J. TYSON and M.Q. DALVI: *Transport Economics*, (London : George Allen & Unwin Ltd., 1980) p. 58.

essential features of transport cost accounting. The principle on which the allocation is to be made should be stated explicitly. But first of all, accounting department should accurately identify the joint costs.

Cost of operation are distributed to users of the services through a pricing system or rate structure which will have regard to the behaviour of costs in relation to total volume of traffic, and the difficulties in determining fully distributed costs of units of traffic by statistical processes.

### COSTS AS THE BASIS OF PRICES

A pricing system or rate should cover all the costs and even imputed costs (money expenditures plus claims to profit) in the long run to ensure the company's survival. Theoretically, that means each user should pay an amount equal to the fully distributed cost of the service given. However, it is important to appreciate following :

The real fully - distributed cost can never be determined because of the arbitrary cost allocation. On the other hand, the indirect costs include some elements which don't vary in amount with the volume of traffic and fully distributed cost per unit of any particular service will change with changes in the total volume of traffic. But this difficulty sometimes is met by using the normal capacity of facilities.

Generally transport prices are fixed for some lengthy period ahead. It is not necessary to change prices from time to time according to changes in costs, but the changes should be made orderly and known in advance to users of transport services.

Traffic may fluctuate in volume from one season to another, but there may be necessity to maintain prices at the same level throughout a long period. In that case, full costs may not be covered in a period of low volume but may be exceeded in a period of high volume.

If traffic volume shrinks permanently, average cost per unit of traffic will rise because of the incidence of fixed costs. The increase in unit cost may not be covered because user will always seek another transportation alternative or undertaking which will give the required service at the lowest price. With the cost data,

it can be found, whether long run marginal cost is covered. If costs are not covered, the traffic may be abandoned or repriced as soon as possible to avoid these costs, or it might be necessary to reduce the capacity.

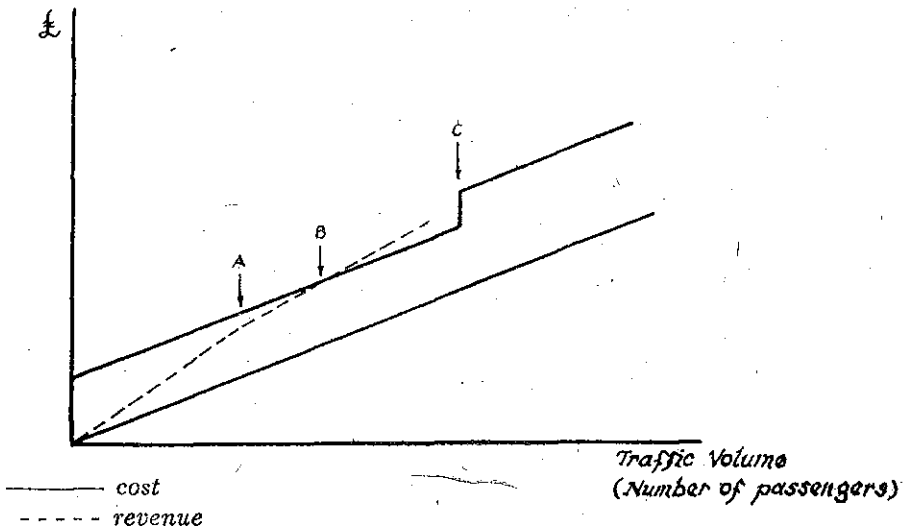
**DIFFERENTIAL PRICING**

The dominant factor placing limits on the prices is the effect of prices on the demand for services. The prices which the market yields may be under or over its fully distributed cost. Cheap transport is essential to maintenance and expansion of the standard of living. If the rate is based completely on fully distributed costs, prices may fail to attract a desirable volume of traffic. They must be analysed to determine :

- (a) Whether or not each covers the out - of - pocket costs of giving the service, and
- (b) The additional amount (if any) available as a contribution to the relief of fixed and joint costs.

The aim, then is to secure traffic of such volume and mixture that in total it will provide revenue to cover the total costs.

To keep the appropriate traffic balance, in short term, the acceptable price level must cover at least the out of pocket costs. A certain amount of traffic is obtained at a common rate. Let's assume the first point that has been reached is A at the following figure :



At this point, revenue exceeds out of pocket costs, but it can't cover fixed costs. The volume can be expanded by taking additional passengers at a lower rate without disturbing the other traffic. The volume, costs and revenue then move to the point B where all costs are covered by revenues and some capacity is still unused. At the point C, capacity must be raised but this causes the fixed costs to increase. Without differential pricing, a charge based on average total costs, would be higher than the prices which the traffic volume between A and B could bear.

Discrimination in pricing, or differential pricing, is a realistic distribution of the fixed costs but the extent to which it can be practised depends largely on proportions of those costs in the total cost.

### CONCLUSION

The behavior of costs is very complex because of indivisibilities. In some cases it is possible to provide extra output at a fairly low marginal cost, while in others marginal costs are very high and in the excess of average costs because of low capacity utilization. In public transport it is usually possible to create extra demand without increasing output. For these reasons, costing needs to be carried out on a specific basis, which must take into account the policy decisions based on it.

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