
UNIT 14 TRANSPORTATION MIX

Objectives

After reading this unit you would be able to:

- describe the tools, techniques of cost reduction;
- depict the modes of transportation;
- elucidate MTO (multi-modal transport operation);
- describe methods of selection of carrier;
- throw light on routing, scheduling & fleet sizing; and
- discuss the futuristic trends & achieving transportation efficiency.

Structure

- 14.1 Introduction
- 14.2 An Illustration
- 14.3 Transportation Briefly
- 14.4 Warehousing
- 14.5 Tools & Techniques of Reducing Costs
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14.1 INTRODUCTION

Transportation happens to be the most fundamental part of strategic logistic management (unit 4). Transport costs include all costs associated with movement of products from one location to another. The average transport costs ranges from 5 to 6% of the recommended retail price of the product. Transportation is the movement of products, materials and services from one area to another, both inbound and outbound. It can also be said as movement from one node of the supply chain to the other.

‘The ideal organization following the MTO is the Indian Army; with the principle, wherever you are we reach you, in time, and in the best and cheapest mode available’. Indian Army is a typical example of ideal transportation mixes in our country. It uses the aerial, land, sea and rail routes to maintain its forces strewn all over the country and abroad. The logistics is enormous and the various modes of transport are, aircraft, train, trucks, animals, and human beings. It transports supplies, ration, fuel, oil lubricants, arms, ammunition, clothing and personal loads over vast distances and over varied terrain and climatic conditions.

14.2 AN ILLUSTRATION

Assume the movement of kerosene oil from one of the central depots in Central India to the Northern sector, say, Jammu and Kashmir at a place called Kupwara. The initial movement is by rail to the nearest railhead and that is Jammu. From there the bulk is transferred to BPL lorries and moved to the forward depots by road. Depending upon where it has to go the same is further broken at the depots and distributed as per demand and requirement to the forward areas, either by trucks or animal transport, human labor or by airdrops; a versatile mix of transport system, which is unique in being. One got to see it to believe it, and experience it, to realize it too. Such a shift does take time, but within the available resources and time constraints this the best that can be organized to maintain an even logistics chain down to the end user. It is a time-tested system in vogue since pre-world war days. Let us see this with the help of a figure 14.1.

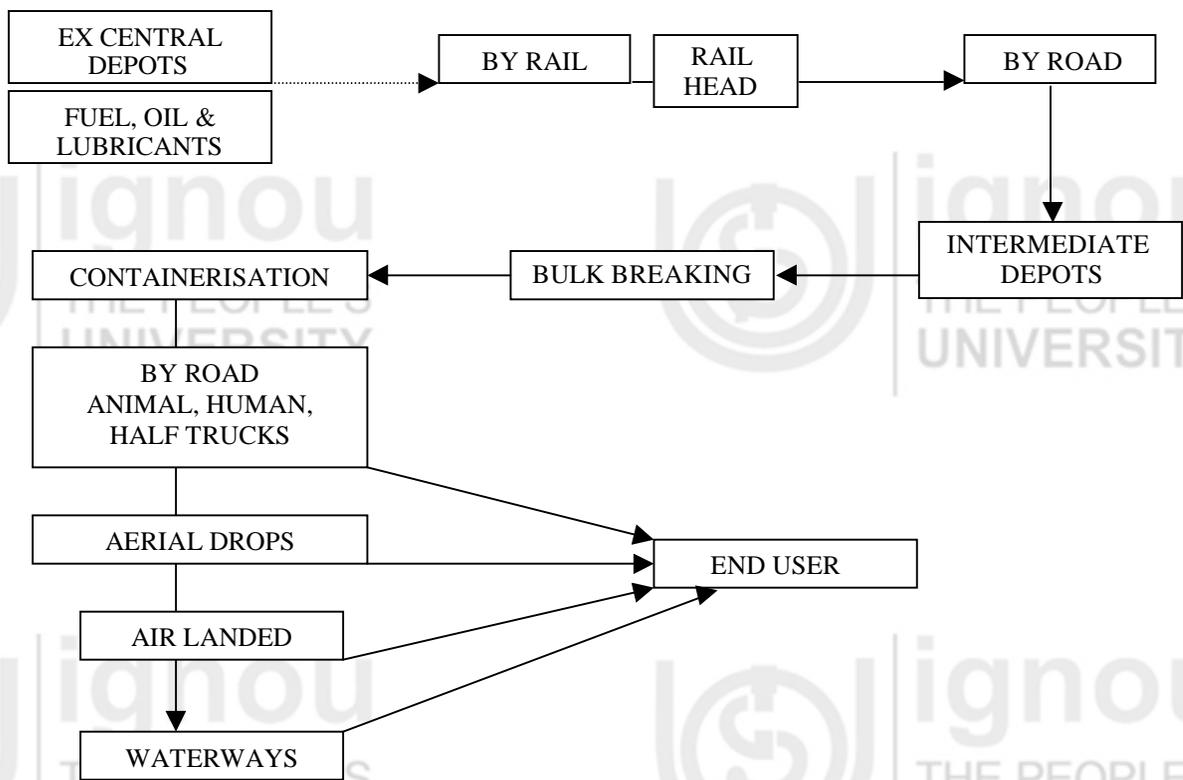


Figure 14.1 : An Ideal Transportation Mix Network

This can also be validated by an advertisement of Indian Oil, which shows elephants carrying oil barrels to the consumers at unreachable areas. Therefore, before we start with the theoretical aspects of transportation and its nuances and applicability, you as a supply chain manager must understand the practical side of it too. As discussed in unit 4 and 5 earlier, transportation plays an important role in the logistics channel and will continue to do so. Selecting the right transport for the right material, time factor, demand per se, cost and related factors of urgency is the ultimate aim of the supply chain manager. He has to deliver, and how he does it within the constraints of environmental realities is his job too. Therefore, let us see a rundown on the transportation in general even at the cost of repetition, since; if you understand transportation in the SCM, you have understood 75% of the system.

14.3 TRANSPORTATION BRIEFLY

You have already studied in unit 4 that transportation is the most fundamental part of strategic logistic management. Transport costs include all costs associated with movement of products from one location to another. The average transport costs ranges from 5 to 6% of the recommended retail price of the product.

Transportation is the movement of products, materials and services from one area to another, both inbound and outbound. It can also be said as movement from one node of the supply chain to the other. As Deshmukh & Mohanty (2004) says, “by providing for the swift and uninterrupted flow of products back and forth through the chain, transportation provides a sort of lubrication to run the chain smoothly. It also permits deeper penetration of newer markets far from the point of production.”¹ Therefore, in order to effectively manage this transportation system the first step would be to establish a cost effective transportation mode. In other words highest customer service in lowest price, leads to company growth.

Transportation system has a strategic bearing on a company’s operation efficiency. Therefore, failure to identify the best transportation mode can directly affect the growth of a company. Since, higher transport costs will raise prices, which will directly affect the customer satisfaction in a negative way. The three factors as mentioned by Gattoma & Walters required to consider are:

- Customer
- Environment
- Product & company

Organization, which involves physical movement of goods require transport services that varies from mode to mode. The best suitable mode is required to be identified depending upon the nature of product that has to be moved. Like if coal or carbon has to be moved use the railways from the source to the production unit directly, so as to minimize losses, time & cost factor. Therefore, in order to identify the right transport system the following have to be considered:

- Impact of the transport system on the supply chain.
- Factors that determine the choice of transport mode.
 - Who are the customers to your product per se?
 - What are the environmental factors?
 - What is the product?
 - What is your company profile?
- Feedback and reporting both from within and the environment on the choice of transport, and rectify in case you went wrong the first time.
- Your foresight, flexibility & integration of available resources in planning stage will be one of the crucial factors that will dictate the choice of transport.

Activity 1

Visit a carrier company and document your understanding about the practicalities of employing these carriers.

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¹ Mohanty & Deshmukh (2004) in Essentials of Supply chain Management, chapter 7, pp. 118-119.

Considerations influencing transportation

- **Customer communications:** In order to obviate delays in transportation and handling of logistics both the suppliers and distributors are relying more and more on electronic transfer systems, IT & the Internet. This will help in considerable reduction in time delays and ensure better cooperation between the chains.
- **Market coverage:** Transportation costs influence the size of markets covered in a big way. The characteristics are: costs, flexibility, reliability and availability. The product per se will influence the economics of the decision. A low volume and high value product will be able to support higher costs, which means extended delivery distances and increase in delivery frequency.
- **Sourcing decisions:** The geographical dimension of the source markets can be influenced by low cost transportation system, i.e. 'reliable bulk freight services could extend the source markets,' says Mohanty & Deshmukh. Companies therefore have to consider a trade off between price and quality and the costs involved in delivering to the processing point, i.e. volume and cost of transportation.
- **Manufacturing operations:** Cost of transporting has a direct bearing on the location of the manufacturing market center. That is why, extraction based units are close to the source of raw materials and the products related to customer satisfaction are closer home, i.e. near to the customer hub center.
- **Pricing decision:** Transportation happens to be the important component of product costs. Therefore, selection of the appropriate transportation mode will have a direct bearing on the product costs per se, with more relevance to exports. Increase in transportation costs increases the product pricing.
- **Customer service decisions:** Both customer service policy and transportation decisions go hand in hand and hence one cannot be considered in isolation of the other. Moreover, the type of market will also dictate the decision and will vary considerably. Therefore, it is pertinent to overrule the cost factor while servicing the medical customers, since speed is more important than cost in selecting the transport mode.

Activity 2

Correlate the practical problems and factors influencing transportation of a company or a carrier.

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An effective selection system

Transporter selection can effectively be resolved by adhering to the five stages of selection framework:²

- Stage I: identification of those factors affecting the choice of transport selection.
- Stage II: categorize the significant factors and identify the potential risks.
- Stage III: determination of the distribution network depending upon the number and size of the depots.

- Stage IV: application of matrix analysis for selecting the right transport.
- Stage V: measure and monitor costs continuously.

Before we move further, let us see warehousing as a part of recapitulation what we have studied in Unit 4.

14.4 WAREHOUSING

This happens to be another important facet of logistics chain and works side-by-side with transportation. It is that segment of logistics function that deals with storage and handling of inventories starting from supplier receipt to consumption point. The management of this includes the maintenance of accurate and timely information relating to inventory status, location and disbursement. Factors influencing the warehousing decisions are:

- Type of distribution
- Value of the firm
- Quantity and potential for obsolescence
- Competitiveness
- Economic condition

Warehousing performs a variety of roles as mentioned below:

- **Material handling:** It consists of receiving, storing and shipping.
- **Storage:** This maximizes customer services by improving product and location positioning.
- **Transfer of information:** This ensures timely and accurate information on inventory status, space utilization, equipment and manpower availability and transport capacity.

In order to develop an effective warehousing strategy the following has to be addressed:

- Documentation of existing warehouses operations.
- Documentation of the storage facilities and put forth requirements over the planning horizon.
- Identify the shortfalls within the warehouses that are available including the deficiencies.
- Alternate warehousing plans to meet contingencies in strategy.
- Selection of the best recommendation.
- Update the warehouse strategic plan.

With that as a backdrop to our study let us see the design and management of Supply Chain Management, since logistics happens to be the key of SCM.

14.5 TOOLS & TECHNIQUES OF REDUCING COSTS

As a logistics manager one has to dwell considerably on the correct selection of the fleet, which will further aid in reducing costs and indirectly help in reducing the cost of the product to the end user. The following functions are the domain of the logistics manager:³

³ Deshmukh & Mohanty, pp. 124 in Essentials of SCM

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- Negotiating routes and rates
- Selecting route and fleet
- Evaluation of the carrier performance
- Analyze transport costs and services
- Operating company owned means of freight and transportation
- Filing loss and damage claims
- Auditing freight bills

The ultimate choice depends upon such factors as financial policy, customer service policy, the control required by the company and the competition intensity of the markets.

Table 14.1 gives the characteristics of transport infrastructure in India.

Table 14.1: Transport Infrastructure of India

Transportation Types	Characteristics
Railways	62,000 Kms. of network, with 7000 stations, 3 gauges, 12 million passengers, 1 million tonnages of freight/day
Road	34,000 Kms. of primary roads (NH), 1,28,000 Kms. of State Highways, 27,00,000 Kms of miscellaneous roads and tracks and 30 million vehicles approximately.
Water	A coastline of 6000 Kms, with 11 major and 139 minor ports handling 230 million tonnages of cargo/day
Air	A massive cargo service with 6 International airports and 86 domestic ones, in addition there are a hoard of transport aircrafts of Indian air force catering to emergencies and natural calamities, which can effectively be pressed into service in contingencies.

Actually the entire selection process is a very complex one and should aim at identifying the right attributes required to implement the company's customer service policy. The main attributes are (Deshmukh & Mohanty):

- Current performance as regards delivery accuracy and reliability
- Responsibility acceptance to guarantee the service product offered
- Offering flexibility so as to respond to criticalities and emergencies
- Information for purpose of controlling
- Financial stability to ensure continuity of service and for up gradation of equipment
- Integration to the maximum into customer business, sharing confidence, problems and capabilities

What is therefore the significance of this choice factor? Actually, transport costs include all costs directly associated with the movement of product from one location to the other, therefore, to identify the choice of transport mode, it is mandatory to determine the impact of transport upon the overall supply chain. This could well be achieved by analyzing the existing transport cost, realization of the profit leverage effect and analysis of the impact of transport upon other elements of the distribution system.

14.6 TRANSPORTATION COSTS

Transport costs vary from less than 1 per cent (for machinery) to over 30 per cent (for food) of the recommended selling price of products, depending upon the nature of the product range and its market. However, the average transport costs is between 5 to 6 per cent of the recommended retail price of a product.⁴ With inflation transport costs also rise because the major components are the workforce (labor), fuel & maintenance, spares, drivers cost. Similarly, transport represents a direct cost added to the price of the product and any reduction in transport costs would lead to an increase in profit, with price remaining constant. The impact of reducing transport costs is as shown below:

Assumption: that a company X has a 10 per cent profit margin on sales turnover and with fixed prices.

- A cost reduction in transport expense of Rs. 1,00,000 is equivalent to increase in sales turnover of Rs. 1,00,000;
- If transport costs are estimated at 20% of total costs, in that case a 1 per cent reduction in transport costs will correspondingly give a 2 per cent increase in profits.

Transportation rates are almost linear with distances and not with volume, be it road, rail, water or air. We distinguish here the transportation costs associated with both an internal and external fleet. Transportation costs for company owned fleet is simple and is evolved by annual costs per truck, annual mileage, amount delivered and trucks effective capacity. All this information could be effectively utilized to calculate cost per mile per SKU. Whereas, incorporating transportation cost for external fleet is complicated, since; hiring of transport in India is different to that of USA. In India, transport rates are governed by respective RTO (Road Transport Office) of every state and differ from state to state. It ranges anything between Rs 5/- to 32/-, with different rates for commercial and private vehicles. For example, hiring of a private taxi in Kolkata/Delhi could be Rs 6/- but at Ooty it would be anything between 8 to 10 owing to the type of terrain in that region. Similarly, hiring of a full truck from West Bengal to Assam could be ranging from 14000/- to 25000/- depending upon the delivery point, lower Assam/Upper Assam. That is how it differs. In USA, the TL (truckload carriers) subdivides the country into zones, with every zone conforming to a state. Except for Florida or New York, which are partitioned into two zones. For example, to calculate TL cost from Chicago, Illinois, to Boston, Massachusetts, one needs to get the cost per mile for this pair and multiply it by distance from Chicago to Boston. An important property of the TL cost structure is that it is not symmetric; that is, it is typically more expensive to ship a full loaded truck from Illinois to New York than from New York to Illinois. In the LTL (less than truck load) industry, the rates are classified under class, exception and commodity. The class rates are standard rates that can be found for almost all products or commodities shipped. They are found with the help of classification tariff that provides each shipment a rating or class.

Once the rating is established, it is necessary to identify the rate basis number. This is the approximate distance between the load's origin and the destination. With commodity rating or class and the rate basis number the specific rate per hundred pounds can be obtained from a carrier tariff table or freight tariff table.

In India, the rates are fixed and are reviewed every 3 months depending upon the petrol and diesel prices prevailing in the country at that point in time. A truck moving from Meghalaya to Delhi will charge lesser than from Delhi to Meghalaya, why? The primary reasons could be:

⁴ Deshmukh & Mohanty 2004, Essential of SCM, pp 124-125

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- Assam is a troubled state and incoming traffic to the state faces problems in entering the state, one has to cross Assam before entering Meghalaya.
- Certain parts of the state are hilly and rates are fluctuating.
- Return load for the trucker ex Meghalaya is more difficult visa vie Delhi.
- Most of the truckers moving towards Northeastern areas of the country charge for the return trip ab-initio.

Such aspects and rules are pre-mentioned in the contract documents and the companies and the trucker based on environment factors sign up for a minimum term of one year extendable to 2 years or more.

India is a very versatile country. One trucker could agree to take your load for 30 grand while the other for 45 at the same time, from and to the same place. Many other factors like reliability and reputation aspects are to be considered before hiring, we have seen this earlier on.

Supply chain systems

Transport is vital to the overall gambit of SCM operation and therefore cannot be considered in isolation. The entire transportation process is to be monitored, in order to gauge the exact location and state of the materials being transported. Transport, is the process, which transports materials between 2 or more stations, and therefore, the form of transport to be used should not only be responsive and compatible to the terminal stations, but also with the operating environment through which the product moves. In order to achieve the best, it is therefore mandatory that sufficient information be made available to enable the movement to be monitored by the producer, consumer, agencies, financial institutions and relevant groups.

Transport profile

Operating characteristics dictate the transport requirements of an organization. The transport requirement depends on the different and versatile nature of tasks that are to be performed. Therefore, to generalize, an organization, which doesn't have versatility and varieties in operating its transport for varied tasks, will operate much below the optimum level of efficiency.

Operational factors

Operational factors that determine the transport mode are:

- Environmental factors
- Characteristics of alternate transport modes
- Combination approach

We will see this with the help of a flow chart as shown in figure 14.2.

The various characteristics of alternative transportation mode are:¹

- Useful load: physical capability and maximum load as a percentage of gross weight.
- Density: cargo density, i.e. weight per cubic unit.
- Overheads: fixed costs as a percentage of total cost.
- Productivity: calculated in tonne-miles per direct man-hour.

It is very important to establish and determine the accurate operating characteristics of each available transport mode, so that suitability of matching these to the operating factors can be established. Each type of transport offers different characteristics and as a supply chain manager you have to understand the efficacy of these aspects:

¹ Deshmukh & Mohanty, Essentials of SCM, Transportation, pp 117-127

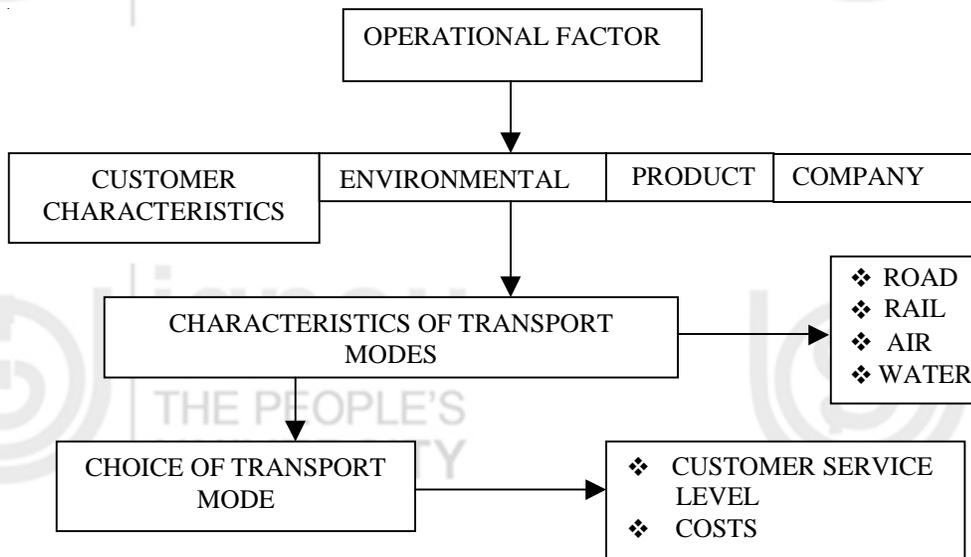


Figure 14.2: Operational Factors for Deciding the Transport Mode (Deshmukh and Mohanty, 2004)

- The 10-12 tonne truck (Punjab Body) offers the highest useful load.
- The cargo vessel offers the highest density.
- Freight trains have the highest overheads, though ODC clearance have to taken from the railways if the goods are not of standard specifications and are being transported in open BOM's/KF's.
- The cargo aircraft has the highest productivity.

Each of these transport modes has their peculiar characteristics that affect the preparation of the product before movement, e.g. movement by sea will require better packaging than those by air, mainly in the international and intercontinental traffic utilizing multi modal transport.

Channelisation - Multi-modal Transport Operations

The choice of transport mode is not only a choice between type of transport, but between a system or a process of transportation, between manufacturer or seller and customer or buyer. It involves separate sectors i.e. between production line to go-downs/warehouses, material handling interfaces at each terminal facility and the documentation process to support the product. The complete market channel has to be defined and each sector demarcated and analyzed separately for transport requirements, in coordination with customer characteristics, volume, and the operating environment through which the operation is carried out. Each of the sector would require separate transport mode, to be precise. Let us understand the type of channel with Figure 14.3.

If that were so, then what are the factors to be considered when analyzing the transport requirement of each sector? What should be the basic guidelines? They are (essentials of SCM, Deshmukh & Mohanty):

- Control, ownership, finances, security to include documentation and product and responsive information system
- Movement of product, handling, requirement of stocks at each levels, packaging, and safety standards
- Market factors
- Labor

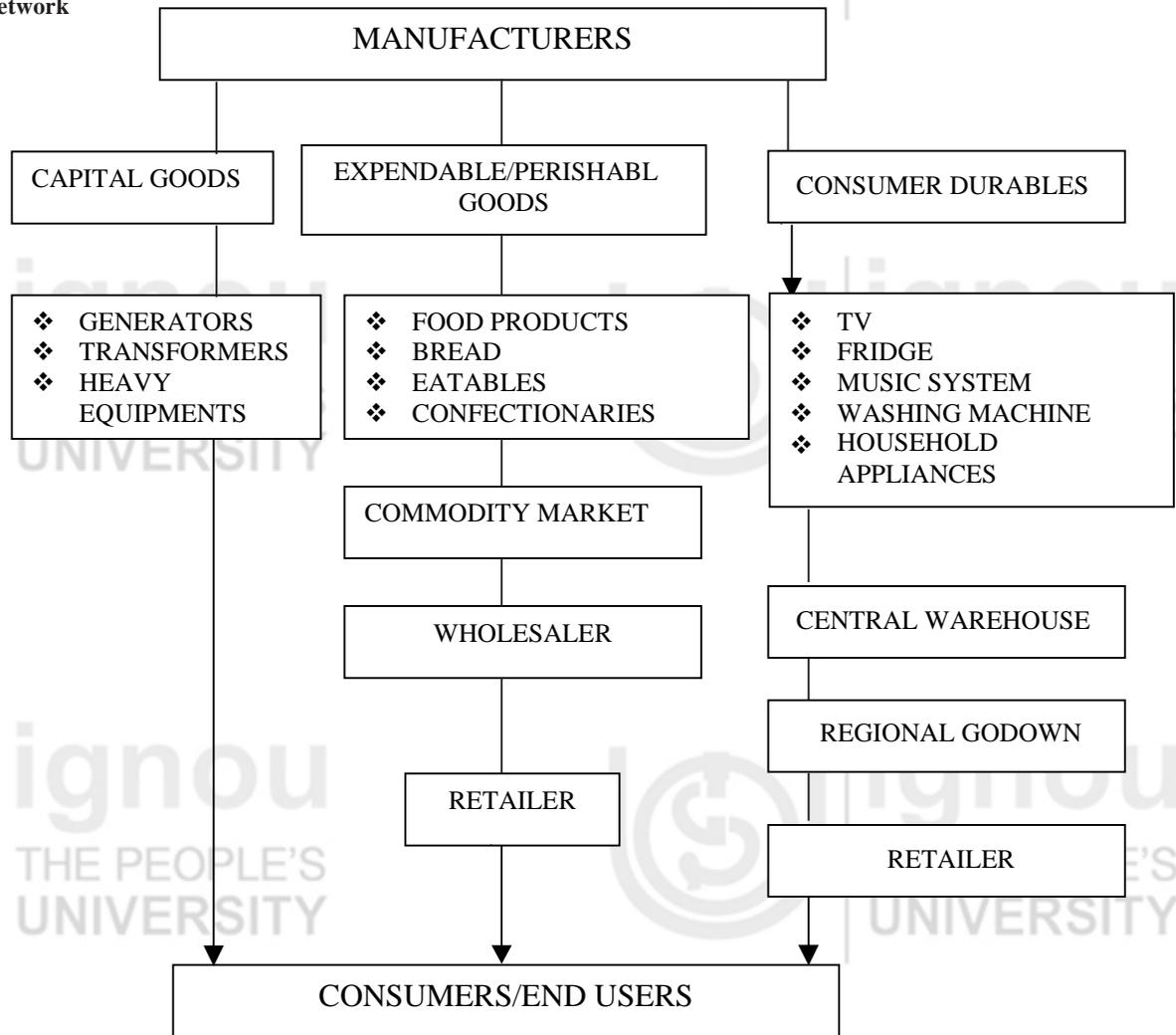
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Fig 14.3: Depicting the Types of Channel

- Training
- Turnover of both goods and manpower
- Risk factors, competitiveness, and profit potential
- Environmental realities.

Therefore, in order to maximize the usage of transport being offered, the transport companies should be able to match and synchronize the market requirements, which will then have a major influence on the choice of transport mode.

Specialization is created by the impact of channel costs, which are incurred either before or after transportation, where the introduction of specialization reduces the mechanical handling costs, packaging costs and related expenditures mainly during terminal activities.

The very objective, by which the transport mode could be chosen, depends upon whether the company is using revenue or capital to buy the transport. In case of revenue, minimum cost throughout the transport operation should be the objective, and in case of capital, maximum tax return upon capital should be the objective, since this give maximum return.

In certain case, both revenue and capital expenditure will be included in the operation. In such cases, the combination of the minimum expenditure and maximum after tax revenue could be calculated by determining the net cash flow after tax for the life of the capital asset. The criteria for choice will then become the maximum discounted

return or minimum discounted cost in terms of net cash flow, calculated with a discount rate equivalent to the cost of capital.⁶

- Revenue expenditures incurred during utilization of particular mode, as in packaging and labour should be considered along with:
- Capital expenditure incurred in utilization of a particular mode as in mechanical equipment at the terminals.
- Associated risks with any capital asset with a life of over 2 years, where the asset would require changes and modification.

In spite of determining a method of assessment, the correct decision can only be taken, once the degree to which the calculations are taken have been considered in detail.

14.7 METHOD OF SELECTION

The selection procedure for the transport mode could vary from the simple decision either to identify one feasible method of distribution or to follow the competitor's procedures, to the complex decision that calculates the cost incurred and produces an optimum solution. The three potential methods are:⁷

- **Judgment:** Identification of the important factors affecting the transport problem by the transport manager, and the transport mode from a list of alternatives available, so that the important features of the transport requirements are met. The shortcomings are tremendous in such a process, since; transport is considered as a service rather than a distribution system.
- **Cost trade-off:** It is where the impact of transport is calculated in relation to immediate terminal objectives and activities, and the total cost of distribution system is optimized. This particular approach acknowledges the existence of trade-off within the numerous alternative approaches in an attempt to assess the situation to minimize total costs.
- **Distribution models:** This identifies and explains the interrelationships between the components of the distribution system at various levels of daily, weekly or monthly demands. These models could be built to examine the impact of alternative transport modes and methods, as either the demand changes or the components in the system change.

Therefore, in order to carry out a systematic selection of the transporter a framework consisting of the following stages is recommended: (Figure 14.4)

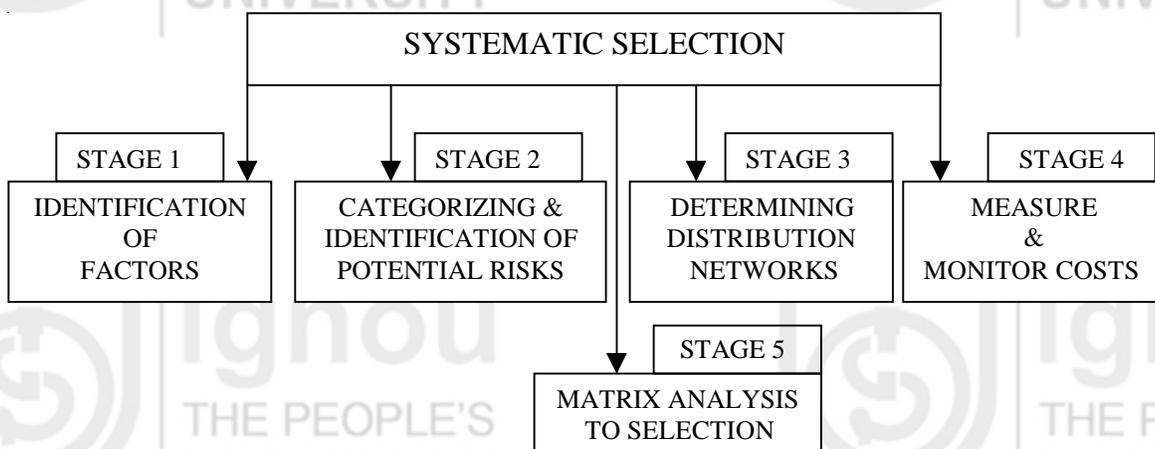


Figure 14.4: The Selection System

⁶ Deshmukh & Mohanty in Essentials of SCM, p 129

⁷ Deshmukh & Mohanty in Essentials of SCM, pp 130

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- Stage 1: identifying the factors affecting the choice of transport selection
- Stage 2: categorizing the significant factors and identifying the potential risks
- Stage 3: determining the distribution network in terms of number and size of depots
- Stage 4: applying the matrix analysis to select the most appropriate transport method
- Stage 5: measuring and monitoring cost factors.

14.8 A TRANSPORTATION DECISION

Determining an organization's transport requirement will be based on the following underlying considerations, (Figure 14.5)

- The available depots, their sizes including movement requirements of raw materials to manufacturing units and finished products to the warehouses and on to the consumers.
- The best choice of mode available depending on the distance involved.
- Product characteristics that will further dictate the type of transport mode to be employed.
- The choice of equipment in terms of type of transport for each requirement.
- The financial option that could be employed in terms of individual type of equipment.
- The operation needs in terms of usage of the equipment for maximum utilization and minimum operational costs.

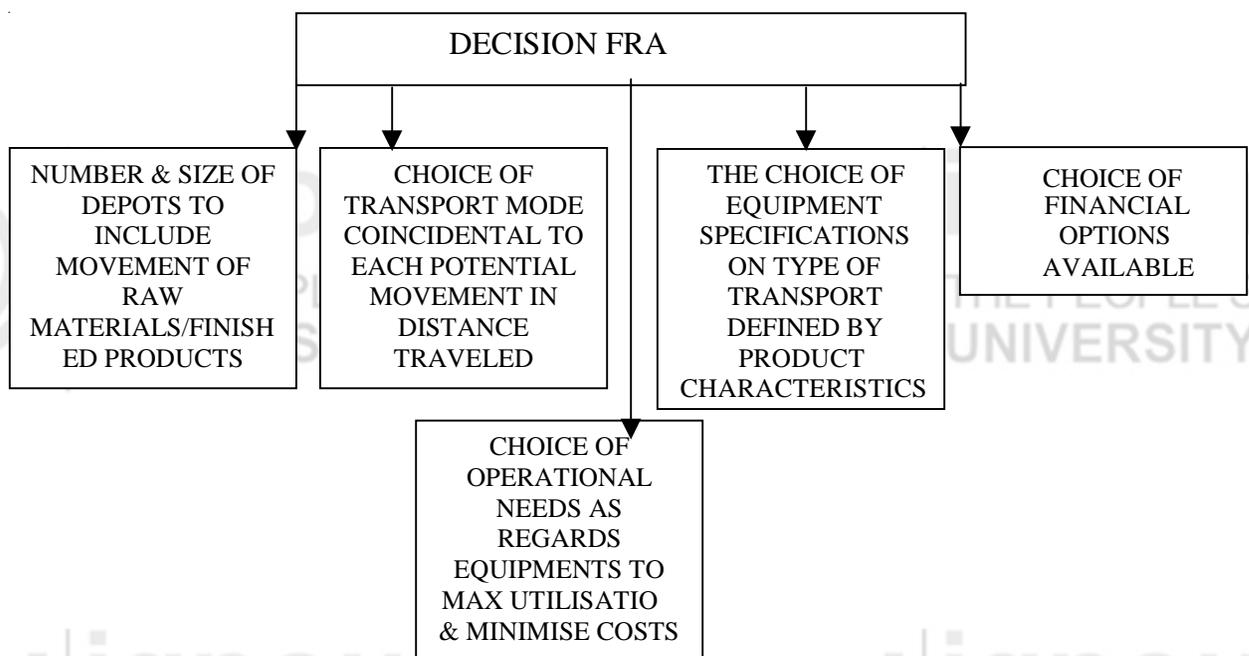


Figure 14.5 : Decision Framework

We have to understand that transportation operations cannot be seen in isolation, and hence warehousing and depot locations are equally important to understand the choice of transport selection process.

The total number and sizes of depots and warehouses will also have a direct bearing on transport operations of all companies across the board. Let us see these in more details.

14.9 NUMBER & SIZE OF DEPOTS

Depots/warehouses and storehouses define the distribution network of a manufacturing company. More the numbers, larger is the distribution networks. The network of depots will be defined by the numbers, size and location which, when combined, minimize the cost between ex-factory delivery and local distribution depot delivery for each order, (Deshmukh & Mohanty). Essentially, the distribution depots provide the resources to balance the cost to achieve optimum ex-factory loads and optimum local delivery loads. Once this is defined, it is possible to classify the transport operational requirements into tasks, as under:

- Management of raw materials of factories
- Inter-factory movements
- Delivery to warehouses
- Delivery to third-party transport facilities
- Delivery to satellite depots
- Delivery to consumers based on normal, priority or emergent.

A decision matrix approach helps in identifying the most appropriate transport option from the substantial range available. This approach uses the following steps:

- Selection of initial decisions required based upon known alternatives; like, choice of transport mode, choice of equipment specification, choice of financial options and operational needs.
- To select two options (factors) so that a matrix can be formulated using one in vertical axis and the other on horizontal.
- Selection of basic alternatives, which adequately cover the conditions, imposed by the vertical and horizontal axes.
- Determination of organization needs by analysis of the important factors generated to produce the matrix and use of the matrix to select the options required.
- Selection of the resources required by considering the results of the matrix analysis plus other factors of importance.
- The combination of the matrix solutions to provide an effective and efficient profile, which identifies the transport tasks and appropriate resources for the tasks.

This approach will require imagination to develop the selection of the initial decisions, to determine the important factors to use for the vertical and horizontal axes on the matrix, and to construct the matrix. Yet, the majority of the question could be answered by a combination of brainstorming, analysis and categorization of important factors, which affect the choice of transport selection.

Choice of mode

One of the ways to identify the appropriate choice of transport mode is to select the most significant attributes affecting the decision. These could be the size of the order (cubic meters or weight) and the distance to be traveled in miles from the concerned supplying depots and related factors. Let us see this with an illustration.

Let the attributes be $x_1, x_2,$ and x_3 etc. The weight of these attributes be denoted by $w_1, w_2,$ and w_3 etc. Let the transport alternatives be denoted by $X_1, X_2,$ and X_3 etc, with each of the alternatives scaled from 0 to 10 for each of the attributes. Compute the aggregate score for each of these alternatives ($w_1 s_{11} + w_2 s_{12} \dots$ etc). Select that alternative which has got the maximum score (figure 14.6). This form of analysis will help in identifying when each transport mode is appropriate.

Scores for alternatives

Attributes	weights	A1	A2	A3
x_1	w_1	s_{11}	s_{21}	s_{31}
x_2	w_2	s_{12}	s_{22}	s_{32}
x_3	w_3	s_{13}	s_{23}	s_{33}
x_4	w_4	s_{14}	s_{24}	s_{34}
Aggregate score		S_1	S_2	S_3

Figure 14.6 : Decision Matrix

Alternatively, an elaborate framework such as Analytic Hierarchy Process (AHP) can be applied to rank the transport alternatives on a set of tangible/intangible attributes. Therefore, in order to test the efficacy of this selection process, at the macro level certain measures have to be instituted based on ratio including cost per ton or cost per cubic meter, and cost per delivery. Actually a target has to be established for each transport activity in order to determine the actual area where the difference occur, and at the same time monitor these aspects as part of effective decision making processes.

14.10 FLEET SIZING & CONFIGURATION

Fleet sizing objective is to employ through ownership, hire, lease and or rental the fewest possible trucks to manage the company's load profile/shipping requirements. This decision is akin to the decision of how much inventory is to be made available to the consumers/customers. In fleet sizing, increased availability yields fewer lost sales, shorter customer cycle times, improved customer services but higher fleet costs. Fleet sizing projections should be developed a few times during the year and at any time when a major shift in demand pattern occurs. In certain cases, the cost of vehicle shortages can be estimated and a cost of shortages versus cost of ownership analysis can be made to determine the optimal fleet size. Fleet size can be regulated and minimized by:⁸

- Utilizing standard size pallets and transport containers.
- Vigorously monitoring fleet utilization levels annually.
- Maintaining total fleet visibility, including loading times, unloading, transit times and maintenance times.
- Choosing low-use periods to conduct routine maintenance.
- Monitoring and charging for demurrage for fleet detention by suppliers, customers and carriers.
- Utilizing alternative coverage means during super peak periods to avoid carrying the burden of an oversized fleet.

⁸ EH Frazelle, in Supply Chain Strategy, pp 210-211

Therefore, it can be seen that whatever be the fleet size, the company has to use it judiciously and constantly monitor its progress for optimum utilization of the available resources and at the same time cut down costs of maintenance and time lag.

Fleet maintenance is one means of reducing the ownership cost of the fleet by delaying potential replacements and improving customer service through improved reliability.

14.11 ROUTING AND SCHEDULING

India is one of the best examples of routing and re-scheduling, wherein such activities are optioned in the shortest possible time. Roadblocks, damages to bridges and roads owing to natural calamities are the major reasons for such re-routing. We can plan our travel plans well in advance but then criticalities are criticalities and one has to accept such contingencies. Everything doesn't happen as planned and therefore every company should gear for alternative arrangements involving alternate routes, modes and schedules in case the movement of the shipment is emergent.

Delay in delivery due to routing problems increase costs of goods manifold. Therefore, to tide over this the company has to plan these activities well in advance with detailed coordination and judicious and realistic planning. India is a versatile country with equally versatile terrain and climatic condition. Companies have to gear itself to such changing scenarios and terrain since the very inception. Efficient versus inefficient routing can save tremendous amount of money in fuel, labor, and capital expenditures and significantly enhance customer satisfaction. The objective should be to minimize:

- Total route costs
- Number of routes
- Distance traveled
- Route time

The constraints are:

- Customer requirements and time available
- Balancing of the route for the driver, to minimize overtaking
- Maximum route time
- Vehicle capacity
- Start & stop points enroute
- Infrastructure constraints.

Routing problems are some of the most difficult criticalities encountered, and cannot actually be solved optimally.

14.12 FUTURISTIC DIRECTION IN TRANSPORTATION

One salient aspect that we all have to understand that with e-services our lead time to delivery has reduced considerably, but somehow the movement of the product and raw materials perforce cannot move through e-services and have to restrict movement to roads, rail, air and waterways. Yes, the order can be placed through e-services in a faster mode and so can payment be but the products cannot be physically moved through the net. A truck, rail wagon or a ship or the cargo aircraft has to move it from the place of origin to the consumer's destination.

Distribution Network Planning

Transportation too, has improved considerably with the advent of technology and mechanical developments within a short span. Certain programs and organizations help in coordinating transportation in a better way and as time passes they are bound to improve transportation in a big way. They can be clubbed under as follows:

- **Carrier relationship management:** Speedy movements across the globe have also given rise to lack of coordination and planning resulting in criticalities too. However, through carrier relationship management programs we can bind the transporters and those working with it under one roof/enterprise. These programs are designed to formalize communication, partnering, negotiating, and performance monitoring aspects of carrier management. At the heart of most carrier relationship management programs is a set of guidelines for selecting core carriers, the minority of carriers who carry a majority of the enterprise's weight, cube and shipments.⁹
- **Corporate traffic councils:** These help in bringing together all personnel working in the area of transportation within an enterprise. The traffic council sets corporate transportation policy and explores opportunities for leveraging transportation spending across the corporation.
- **Training and certification:** Corporations should aim at making and maintain transportation as a value added activity. For this everyone should be in one plane and therefore, such training activities are carried out to get all under one platform.
- **Driver quality:** Improvements in drivers with better working environment and better wages will help in a big way to improve the driver's capability and capacity in the long run.
- **Joint Procurement:** Significant cost reduction can be carried out if the purchase and negotiation of transportation services is consolidated across both inbound/outbound transportation activities within a business unit, across units and even with non-competitors.
- **Logistics compliance & security officer:** Forming the chief logistics security officer will enable a company to cope with global logistics law and to anticipate security lapses within the logistics network.

14.13 SUMMARY

We have in this unit discussed on transportation mix, techniques of cost reduction, modes of transportation, multimode transport operations, carrier selection etc. It is evident that transportation is one of the important facets of logistics and equally important in the process of SCM, because they impact the customer services and other areas of cost. These decisions are prominent within the purview of company logistics decisions due to the factor of trade off potential that exists between alternative modes of transportation and other logistics functions within the firm. Therefore, an understanding of costs and benefits of alternative transport modes, together with an in-depth evaluation of overall corporate implications is mandatory. Transportation costs will always have a direct bearing on the product costs, i.e. increased transport costs will have risen prices and vice versa. Therefore, appropriate selection of the right transport mode is necessary for optimum customer satisfaction and a balanced logistics system of the firm.

14.14 SELF ASSESSMENT QUESTIONS

- 1) Explain transportation mix with relevant examples.
- 2) What are the various techniques of cost reduction?

⁹ EH Frazelle, in Supply Chain Strategy, pp 220-222

- 3) Explain MTO in detail with specific examples from those outside the unit.
- 4) Explain the procedure of transport and carrier selection. Why is it carried out and what are the major characteristics?
- 5) Why is fleet sizing necessary? Elucidate with relevant examples.
- 6) What is routing and scheduling? Explain in the Indian context.
- 7) What are the different constraints of routing?
- 8) Suggest a futuristic transport profile for a growing company.

Transportation Mix

14.15 REFERENCES AND SUGGESTED FURTHER READINGS

- 1) Frazelle, E.H., *Supply Chain Strategy*, McGraw-Hill, New York.
- 2) Deshmukh & Mohanty (2004), *Essentials of SCM*, Jaico Publishing House, Mumbai.
- 3) Handfield, R. B. and Nichols, E. L. (1999) *Introduction to Supply Chain Management*, Prentice Hall, New Jersey.
- 4) Waters Donald (2003), *Logistics: An Introduction to SCM*, Palgrave McMillan (Indian Edition), NY.