

TRANSPORTATION SYSTEMS — A COMPARATIVE ANALYSIS

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ABSTRACT

Human power, other animate energy and ultimately the technological advancement have geared the process of progress of civilization from time immemorial. Invention of wheel is a revolutionary footing in the arena of movement and transport to ease the development process. Road, Rail and Water in the earlier days and Air, Subway, Ropeway, Pipeline and Space Transport systems are the emblem of the modern civilization. “Technological Wonders” in transport system have been emerging with great speed and comfortability to cover distances safely and timely. Pollution free cheaper alternative modes and design may prove beneficial for the economy of a nation and global environment at large.

Key Words: *Transportation System, Comparative Analysis.*

INTRODUCTION

“Consciousness is only possible through change; change is only possible through movement” (Huxley, A. 1942). Invention of wheels which have originated either in Mesopotamia or Eurasia in the late Neolithic Age has paved the way of movement and thereby progress of civilization have gained momentum.

Life is movement. Man moves from time immemorial with their very inception. Movement is related to work, benefit, development and progress. Again, literacy, health, business, livelihood etc. are all connected with the transport and communication.

Movement, a one of the five themes of Geography (Rosenberg, M. 2013) involves in travel of people, goods and ideas from one place to another. This locational change may be of temporary or permanent and or in the scale of local, regional, state or international level.

Urbanization or the growth poles of advanced settlement seek links with all modes of transport for its proliferation. It acts as the supply line of its

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health and prosperity. Planned and purposeful link may outwit the regional imbalances and ease the supply lines of daily and all time needs.

Mere wooden structure and boat have transformed into fully mechanized multifunctional ultra modern ships and Steam Engine to Surface Rail, Tube Rail and Monorail to Bullet Train.

Flying machines of Wright brothers have helped to develop modern aeroplanes and ultimately will be coming very high speed supersonic hybrid aircraft. Again the ideas from fire arrows using gun powder have helped the advancement of space science through rocketry and so on.

Moreover, the linking strategies of major sea routes through erasing isthmus have cut short distances of thousands of kilometers. The opening of Suez Canal in 1869 i.e. the connecting sea link between the Europe and Asia and Panama Canal of 1914 i.e. the link between the Pacific and the Atlantic oceanic countries help to handle millions of vessels and billions of tons of cargo since these inception with a economy of trillions of dollars freight cost. Navigable straits such as Malacca, Hormuz etc. support in handling bulk of maritime trade.

OBJECTIVES

The study aims at

1. To present a comparative analysis of different modes of transport and to select best possible alternative.
2. To highlight various utilities of movement.
3. To make a coordination among these for greater developmental opportunities.

UTILITIES OF MOVEMENT

Movement, the innate and inherent activity certainly has multitude of importance and fulfil many objectives as follows

- Maintain connectivity for daily and timely need and exchange ideas, goods and services and to be a part of joy and sorrow.
- Overcome the distances be it the Euclidean, Transport or Logistical in nature.
- Defend the invasion of various types and time.
- Increase the extent of empire or make influence on other areas / region / country.
- Establish civilization from the remote past unto the modern world.
- Access better areas of food, shelter and business.

- Minimize or check the unrest be it the political, social or regional in character.
- Initiate or continue nomadic, pastoral, industrial, social or other economic activities.
- Access the physical, social, cultural, economic and medical opportunities.
- Leave the hostile environment in the event of onset of fire, disease, regional conflict, social turmoil, political unrest, tsunami, earthquake, flood, drought and other types of frequent or prolonged hazardous events.
- Keep healthy physical, mental and spiritual well being.
- Maintain function ability of organs.
- Active and responsive to any kinds of action and reaction.
- Imply and carry out order, request, command, wish and bonding.
- Aggregate or segregate something.
- Embrace ourselves in discipline and show performance.
- Helps to perform our duties.
- Encourage to adopt plans and strategies and to execute these and to be cooperative with the modernization & globalization.
- Judge and avail the market potentiality.
- Make a balance between want and supply.

TRANSPORT NETWORK DEVELOPMENT - A GLIMPSE IN HISTORY

Transport Network or the framework of routes is the advertent or inadvertent outcome of linking nodes to provide easy access to the people. Volume of traffic, number of connecting routes and vehicles often help to shape the types of transport network. Slopes and rounded logs were used to move objects.

Initiated by Mauryan Empire in 3rd Century BCE, Grand Trunk Road was constructed and extended by “Sher Shah Suri” in the Medieval Period and was later improved by the British in 19th Century. It runs hundreds of kilometers from Chittagong to Kabul. This road presently known as “Sher Shah Suri Marg” has been serving directly and indirectly to hundreds of cities.

In the words of famous author Rudyard Kipling (1901),

“And truly the Grand Trunk

Road is a wonderful

*spectacle. It runs straight,
bearing without crowding
India's traffic for fifteen
hundred miles – such a river of
life as nowhere else exists
in the World.”*

Colonial rulers had improved the then existing road network to pave the connectivity for the sake of rule and to widen their business spheres. In post independence periods, various projects were undertaken to increase the accessibility. Expressways, national highways, state highways, district roads and rural roads as a result now-a-days gain a total length of nearly 50 lakh kilometers carrying about 80% of passenger and 70% of total freights.

VARIOUS LINKING MODES AND ADVANTAGES AND DISADVANTAGES

Roadways

Road ways are the prime ways of transport of linking cities and any types of developmental activities as follows

- It is useful in point to point transport of goods, traffic and services.
- In short distance transfer, it has highest feasibility and cost effectiveness.
- It may overcome rugged terrain which other mode of transport cannot.
- Road ways often act as feeders and are able to link with any types of transport network.
- Nations generally have lion's share of handling bulk of goods through this mode of transport.
- In terms of availability, importance, flexibility, network and numbers it ranks first in the world.

Nonetheless, it is not full proof in all respect such as

- It involves high maintenance cost.
- It relies mostly on fuel oil whose cost is increasing day by day.
- Bulk transport is not economic in long run.
- Tyres and other accessories are precious.
- Outlaw activities often hampers the flow of vehicles.
- Fog and other hazardous events may disrupt this service system.

Railways

Railways are often considered as the significant mode of transport. It has several advantages, such as

- Six types of gauges provide wide flexibility of setting of lines. Plain land and longer routes are fitted with broad gauge or standard gauge. Less distance routes are fitted with metre gauge. Inhospitable but managed strips are mostly suited with narrow gauge. Lower gauges involve less installation and maintenance cost.
- Bulky goods can easily be transported over long distances through railways.
- In spite of its high installation cost, maintenance cost is low.
- It is one of the safest and fastest modes of transport.
- It is the reliable mode in supply of goods and services in emergencies.
- Extra wagon may be added to cope with the extra load.
- The process of industrialization, the sine-qua-non of a country's economic development gains pace with the railways.
- It is less accident prone as it is confined with its own tracks only.
- A number of rules facilitate the smooth flow of traffic and commodities by railways.
- Railways can generate huge amount of direct or indirect permanent or temporary employment.

Railways also face many types of shortcomings as here in under

- It incurs high initial/installation cost.
- Loose and unconsolidated sedimented base often restrict the setting up of railways.
- It fails to develop door to door connectivity.
- Inhospitable and hazardous terrain and sub-zero climate zone is mostly unsuitable for railway development.
- Limited speed is a major setback in tropical countries.
- Uneconomic to establish over short distances.
- Transport of perishable items is prone to delayed damage.
- Forested tracts often cause loss of wild life by accidents.
- Non-availability of wagons and compartments may squeeze the services.

- Indian Railways are yet to fulfil the motto of ‘Safety Security and Punctuality’.

Metro / Underground Railway

Subway / Underground /Tube/Metro Railway is a boon to this busy and crowded world. At present there are nearly 184 Metro Systems functioning worldwide. It has huge advantages as follows

- Reliable and faster mode of transport.
- Punctuality may be maintained through this mode.
- Least disturbed by weather variation.
- Zero disturbance at ground surface.
- Able to clear huge traffic in busy hours.

The major problems of this mode are

- Involves highest installation cost.
- Problems in lateral expansion.
- Earthquake cause a grave danger to this system.

Waterways

Waterways, the primitive mode of transport are advantageous in several ways

- It is the cheapest mode of transport in maritime location (Figure 1).
- Zero maintenance cost in the areas of ocean transport.
- Highly economic in shipment of bulky goods.
- International trade and commerce are almost solely dependent on waterways.
- Accidental risk is minimum in this transport system.
- ‘Natural Road’ favours all types of water / marine vehicles.

Waterways also face some drawbacks, such as

- Slow speed is the major constraints of waterways.
- Unsuitable for perishable items.
- Internal waterways involve high maintenance cost for dredging activities.
- Icebergs, seamounts and abandoned iron structures may be dangerous to river / ocean going vessels.
- Oil spill from oil tankers often cause havoc to the aquatic / marine ecosystem.

- High dependent on weather conditions. Fog, tsunamis, cyclones etc. often may be disastrous.
- Maritime piracy often causes huge anxiety among the victim nations.
- Throwing / dumping of metallic or non metallic garbage may be dangerous to aquatic biota.

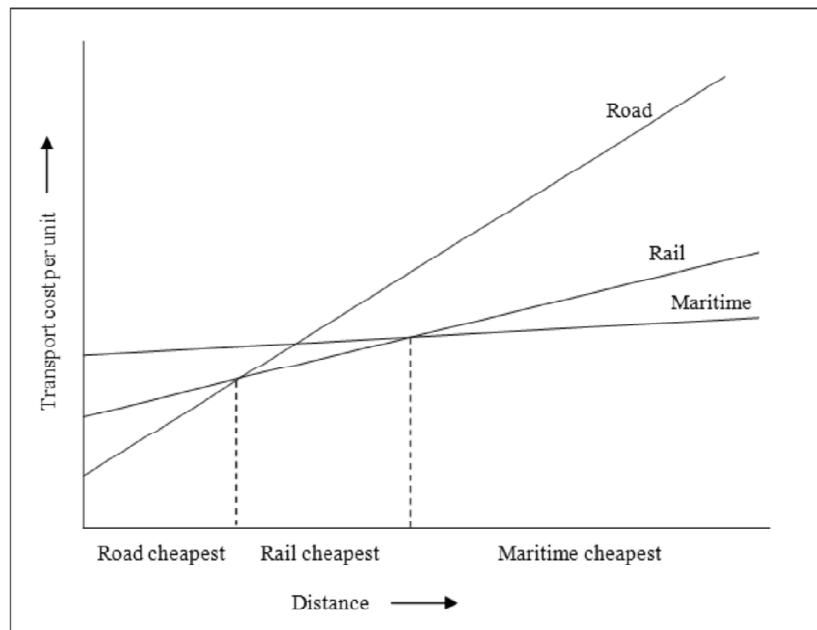


Figure 1: Comparative analysis of transport cost in different modes of transport

Airways

Airways are the only and indispensable mode of transport over long distances. It has manifold utilities

- The quickest mode of transport.
- Physiographic barrier is immaterial to develop such network.
- Busy schedule will be maintained through this mode of transport.
- Emergent situation may be mitigated by this transport system.
- Aeroplanes can fly one continent to another without any halt in between to avoid excess tariff.
- Very useful mode of transport for trade and commerce of light weight items such as electronic goods, medicines etc.
- It is highly essential without which the modern world will not be able to move further.

Airways also face many kinds of lacunae. These are

- The costliest mode of conventional transport.
- High accidental risk be it the technical or manmade in nature.
- Rough weather may delay the flight and often cause disastrous fate.
- Hijacking problem is common in these days of terrorist activities.
- Airways have to follow specific international rules.
- Often the debate among the pilot and co pilot in the cockpit may be fatal.
- Pilots should be technically sound, physically fit, mentally alert and morally correct.

Ropeways

Ropeways having hanging 'car' on cable or cage structure transport goods and passengers over inhospitable terrain. It has many advantages as

- Efficient mode to overcome urban traffic congestion.
- Minimum or nil disturbance on the ground surface.
- Able to overcome riverine, marine, snowy field, forested tract, open mines, gorges and other types of inaccessible terrain conditions.
- Less labour intensive, safe and energy efficient mode of transport.
- Jerk free mode.
- Gravity driven ropeways are highly economic.

Ropeway has several limitations (such) as

- Slow mode of transport.
- Unable to handle huge load at a time.
- Inefficient to unload in other intermediate position.

Pipelines

Pipeline transport is a unique mode of transportation of liquid and gaseous substances and transformed solids over long distances. It may be fitted in surface or subsurface areas from the source to the collection or distribution centres. It has following favouring and disfavouring aspects as follows

- Efficient and reliable mode of transport in carrying liquids and gases.
- Can be developed in any terrain conditions.
- Minimum or no obstruction development in the surface.

- Solids may also be transported by converting it into sludge or slurry form.
- This mode can be developed in surface, subsurface or underwater environment.
- Longer distance may be covered through this mode.
- Oil, natural gas, bio-fuels, water, milk, liquor, nitrogen, oxygen, hydrogen, ammonia etc. may be transported through pipeline.
- Involves little maintenance and lower transportation cost.
- Subsurface pipeline is highly safe and hazard free means of transportation.
- Only pollution free mode of transport.
- Security checking is not essential as in the other modes of transport.
- It may be laid from one continent to another.

In spite of those huge advantages this mode of transport is not free from difficulties, such as

- High installation cost.
- Any unrest between the connecting nations may disrupt this transport system.
- Leakage, fire, earthquake etc. may cause havoc to this system.
- Geo-political factors play a crucial role across international boundaries.
- Specific limit to the carrying capacity.
- Lack of permission of the neighboring nations often obstacles the development of this mode.

INTEGRATED TRANSPORTATION SYSTEM

Different locations usually support different types of transport system (Figure 2). But, integration, coordination and management within modes and time of transport are highly advantageous in production and distribution activities for the sake of supply and demand conditions. Functional and geographical integration may ease the problems of delay and geographic separation, although intermodal activities and modern improvement in transportation may prove highly beneficial to outwit this problem.

Linking megacities by various modes of transport and effective coordination between the rail, road, air and waterways and fit with the best and cost-effective mode to the collection and distribution centres may prove highly beneficial. A Terminal that can accommodate several modes of transportation may be highly helpful for integration.

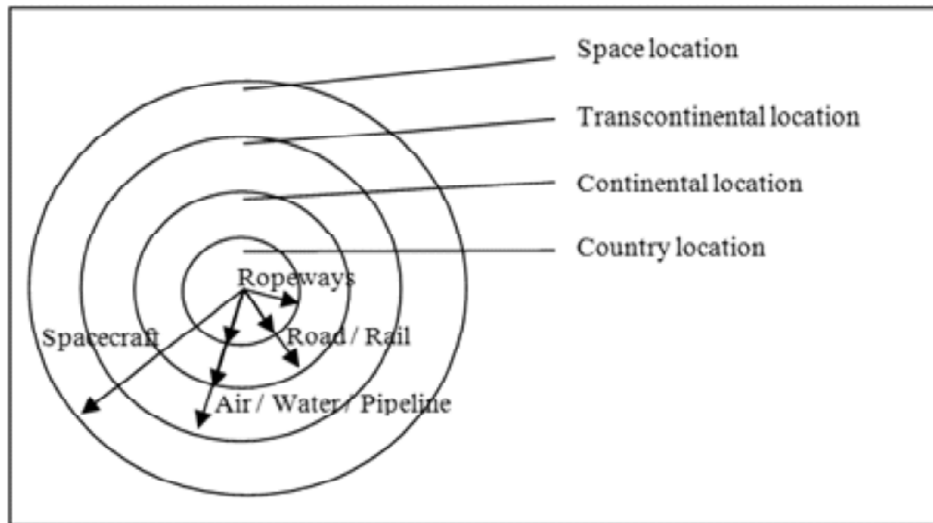


Figure 2: Locational specificity and suited transport system

SPACE TRANSPORT – A DEVELOPED AND DEVELOPING ENDEAVOUR

The inquisitiveness and establishment challenge of supremacy have lifted the Human Race in space from 1960s by their costliest and even deadliest endeavour. After landing of men in moon in 1969, they have developed a lot by setting Space Station, reusable Space Ship and human landing mission in Mars. The beginning of commercial ‘Suborbital-Tourism Race’ to keep foot in space by private agencies is now under progress. Privately managed Missions are targeting commercial mining of asteroids for precious metal and reproduce rocket fuel from “Water Ice” in moon.

“Fifty years in the future, I would hope that millions of people have had the opportunity to travel to space, and that thousands of people live there.....,” “I think outposts on the moon and Mars are entirely possible, with tourism to the lunar surface an expensive but possible activity” – (Whitesides, G. T., 2013).

CONCLUSION

Transport Sectors have been facing serious challenges in developing energy efficient, eco-friendly, cheaper, safer and faster mode of opportunity. Alternative energy sources, Anti Collision Device, Satellite Based Railway Navigation System, Elevated tracks, Auto Mode System of Aeroplane etc. are all directed to the safety, comfortability and timely arrival and supply of systems and services. GPS, Spacecraft, International Space Station etc. are looking towards more and more advance modes of transportation.

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