

## **Chapter 2**

### **TRANSPORTATION – CRITICAL LINK IN THE ECONOMY**

#### **Chapter Objectives:**

After reading this chapter, you should be able to do the following:

1. Understand the importance of transportation to the economic vitality of countries or regions.
2. Appreciate the role and contributions of transportation systems to the economic development of countries or regions.
3. Understand how transportation impacts the social and political dimensions of an economy or region.
4. Appreciate the historical role of transportation from an economic, social and political perspective.
5. Discuss the impact that improved transportation has upon land values.
6. Understand how transportation affects the price of goods and services.
7. Appreciate the function and scope of transportation in advanced and developed economies.

#### **Chapter Overview**

As indicated in Chapter 1, transportation plays a vital role in the initial development of the economy of a country and this ability to sustain development depends upon continuing improvement of the total transportation system and the associated infrastructure. This chapter explores the role, contributions and importance of transportation systems to the economic political and social dimensions of a country or region. Special attention is paid to the impact of the improved transportation upon land values and the prices of goods and services.

#### **Introduction**

The benefits of improved transportation are easier to comprehend when they can be viewed them from a macro perspective which is one of the objectives of this chapter. We can more fully appreciate the overall significance and impact of improved transport if we take this more holistic view.

Transportation is a pervasive and extremely vital function in all industrialized economies. Transportation systems provide the necessary critical links between producers and consumers both domestically and globally. It has long been recognized that one of the critical ingredients for underdeveloped countries to improve economically is the need to invest in transportation infrastructure. This investment is frequently referred to as social capital, that is, society as a whole is the beneficiary of such investment because of the economic benefits associated with new businesses, higher wages, more jobs, etc.

Transportation is one of the requirements of a developed economy because it can bring order out of

chaos. The more complex life becomes and the more developed the economy, the more indispensable are the elements of transportation. Unfortunately, our transportation system is frequently taken for granted, and we do not consider the benefits that accrue to us.

### **Historical Significance**

The growth of civilizations is directly associated with the development of transportation systems. A transportation system can help create a social structure. Eventually a society develops, with somewhat unified political opinions, cultural ideals and educational methods. The United States continues to grow in tandem with its transportation networks.

### **Economic Significance**

Transportation systems have a major impact upon population patterns and urban economic development. The transportation services of a city are the “life support system” of the citizens. The transportation service adds value to the goods shipped and this topic deserves consideration. Transportation systems help determine the economic value of products. A simple model in the text describes how this is true.

### **Place Utility**

The reduction in transportation costs gives the commodity **place utility or place value**. In a less efficient system, the goods will have no value if they can not be sold at the market price. The more efficient method of transportation creates place utility; since the goods can now be sold at point B for a competitive price (as illustrated in the text).

Reductions in transportation costs permit market areas to purchase products from distant suppliers that might otherwise only be produced locally at a higher price. The reduction in transportation cost is actually greater for longer distances than for short ones because of the fixed charges. If a supplier can cover the transportation cost in his or her price range, an increase in the distance over which this given amount will cover the transport of goods will increase the market area of the product in an even greater ratio. Dionysius Lardner referred to this phenomenon as the **Law of Squares** in Transportation and Trade (also known as **Lardner’s Law**).

### **Time Utility**

The concept of **time utility** is closely aligned to that of place utility. The demand for a particular commodity may only exist during certain periods of time. If a product arrives in a market at a time when there is no demand for it, then it possesses no value.

### **Quantity Utility**

Transportation gives goods **quantity utility** through the assurance that the goods will arrive without damage in the right quantity. This utility has increased in importance in recent years with the high level of importance placed on minimizing safety stock inventories for both shippers and receivers. Transportation adds utility to goods because efficient transportation systems promote geographic

specialization, large-scale production, increased competition, increased market areas and increased land values.

## **Geographic Specialization**

The concept of **geographic specialization** assumes that each nation, state, or city produces products and services for its citizens with its capital, labor, and raw materials. The concept is closely aligned to the principle of **absolute or comparative advantage**. This principle assumes that an area will specialize in the production of goods for which it has the greatest advantage or the least comparative disadvantage.

Geographic specialization is complemented by large-scale production or **economies of scale** which are the result of more efficient operations. The raw materials for production need to be transported to a manufacturing facility, and the finished products must be transported out of an area at reasonable costs to markets and consumers at acceptable prices. Geographic specialization assumes that the large-scale production of goods is demanded at distances away from the production site. Obviously, one area cannot rely upon its comparative advantage and large-scale production without the use of efficient transportation systems. The more efficient the transportation, the larger the potential market area and the possibility of increased scale economies.

Efficient transportation can also provide the consumer with the benefit of increased **market competition**. Transportation can increase the market area for a product; thus, goods must be produced in the most efficient fashion, or distant competitors will enter the market and capture market share.

Transportation improvements which enhance an area's economy also can increase the **value of land** that is adjacent to or served by the transport improvements. It is important to note that transportation may not always have a positive impact on land values. Noise and air pollution accompanying some networks can decrease adjacent land values.

## **Transportation Patterns**

Transportation patterns reflect the flow of people and commerce. The world's major water routes for transporting merchandise traditionally go to and from Europe, the United States, and the Far East (Japan, Korea, Hong Kong, and Taiwan).

In the United States, routes link the major metropolitan areas and represent the existing rail trunk line, interstate highway, and inland waterway patterns. The Canadian pattern links the major cities that are in a narrow population band along its border with the United States. Mexico's major commerce routes are strongly tied to its economic center, represented by Mexico City.

## **Gross Domestic Product (GDP)**

Transportation plays a major role in the overall economy of the United States and transportation accounts for about 10.5 percent of gross domestic product. **Passenger transportation** has been growing in relation to the GDP until recently. **Freight Transportation** which traditionally accounted for between eight and nine percent of GDP have decreased due to the more efficient use of transportation equipment and better network scheduling. It is interesting to note that overall transport

expenditures as a percentage of GDP are slightly less than food expenditures and more than education expenditures.

**Modal split** is a useful analytical tool for the study of transportation. The freight intercity modal split is dominated by railroads, with about 40 percent of the ton-miles in 2006 . Railroads typically move bulk, low-value commodities such as grain, coal, ore, and chemicals for longer distances which impacts their ton-miles share. In recent years, rail traffic by container, which transports relatively higher-value finished goods, has increased. The air mode, while highly visible, still handles less than one percent of the total ton-miles in the United States.

The total ton-miles of freight increased between 1980 and 2006, as shown in Table 1.2, but the economy has expanded at a faster rate than the demand for freight transportation. The increase in global trade is one of the reasons for this phenomenon. For example, in the past, a domestic steel firm usually purchased transportation service for inbound raw materials (ore, lime, coal) and the movement of the outbound finished goods to the customer. At the very minimum, this involved four different movements. Today the steel may be imported, requiring one domestic movement between the port and the customer. Thus, steel is being used in the economy, but fewer transportation moves are involved in making it available to the customer.

Good transportation spurs economic development by giving mobility and lower **landed cost** to production factors, which permits scale economies and increased efficiency. Good transportation enlarges the area that consumers and industries can draw on for resources and products. Good transportation expands the area to which a given plant or warehouse can distribute its products economically, and the resulting specialization and scale economies provide a wider choice of products for consumers at a lower cost.

## **Environmental Significance**

Transportation sometimes pollutes the environment and exploits natural resources, although many citizens feel that the overall benefits provided by transportation exceed these costs.

## **The Environment**

There has been growing concern over the impact of transportation on the environment in recent years, with particular emphasis on air quality (pollution), noise, and water quality. Increasing pressure from the environmentalists has resulted in legal restrictions that help govern the balance between a sound and efficient transportation system and a safe and clean environment. The term, **Green Supply Chains**, has become a part of our vocabulary. Transportation is an important part of all supply chains and will receive increasing attention in environmental analyses and discussions.. The major change which has occurred since the previous edition of this book was published is the growing acceptance by businesses and other organizations that they have an important role to play in helping to make improvements in this area. Perhaps, even more important a growing recognition that it does not have to be a “zero sum game.” In other words, reductions in an organization’s carbon foot print, for example, can be accomplished along with reductions in the cost of transportation operations with careful planning. Many companies are looking at their transportation operations from this “win-win” perspective.

There is already a growing challenge in the 21st century to ensure efficient transportation facilities and mobility by maintaining the present system and developing alternatives to meet the growing needs of individuals and organizations.

### **Air Quality and Acid Rain**

Pollution is an external side effect of transportation because of the widespread use of internal combustion engines. Transportation is a major contributor to air pollution. Reductions have taken place in motor vehicle emission rates because of governmental requirements, but economic and population growth makes it a persistent problem especially on a global basis. Essentially, **acid rain** is a pollution-related phenomenon that causes falling rain to be much more acidic than normal because of the addition of sulfur dioxide, nitrogen oxides, and volatile organic compounds to the atmosphere causes acid rain. The acid deposits have an adverse impact on aquatic systems, crops, forests, human health, and visibility. An important issue facing the United States and the rest of the world is the so-called “greenhouse effect” and the related climate changes. **Ozone reduction** in the stratosphere is a big concern and we can expect worldwide concern and the development of protocols to reduce the risks in this area.

### **Maritime and Water Quality**

The protection of the marine environment from the adverse effects of oil spills, garbage dumping from ships, hazardous material losses, and so on is a growing concern shared by many federal and state agencies.

### **Noise**

Another type of pollution is noise, which can emit from many sources, including airplanes and motor vehicles. Noise emissions are governed by the Noise Control Act of 1972, which allows the setting of operational standards for aircraft and trucks and even rail equipment operated by interstate carriers.

### **Safety**

One of the more disturbing by-products of transportation is injury and loss of life. In 2006, a total of 44,912 persons lost their lives in the United States while engaged in transport. Approximately 95 percent of those fatalities occurred in highway vehicles.

Train accidents, oil spills, and the threat of gaseous explosions while in transit have increased. With an increasing variety of products being shipped and an increasing volume of transportation, these problems require greater attention.

### **Social Significance**

A well developed transportation system also contributes improved health and education delivery systems and effective communications among regions of a country. Overall, transportation plays a major social role in our economy that is not always fully appreciated nor understood by the citizenry.

## Political Significance

The origin and maintenance of transportation systems are dependent on the government as its intervention is needed to design feasible routes, cover the expense of building public highways, and develop harbors and waterways. The government is responsible for aiding all passenger and freight transportation systems in which the costs cannot be covered reasonably by a central group of users. One outgrowth of regulation is the **common carrier**. The common carrier has a duty to render service without discrimination based upon set rates for specific commodities. The government's role as a regulator of transportation services may entail certain drawbacks for the public. The government's right of **eminent domain** may require individuals to move and sell their land, even though they might not wish to do so. Although families might be displaced, the government's role is to act in the best interest of the public by designing routes that help the citizens of the nation efficiently conduct their business and meet their social needs. Closely connected with transportation's political role is its function as a provider for national defense. Although it is accurate to say that the American transportation system has been shaped by economic factors, political and military developments have also played important roles.

## Overview of Modern Transportation

The transportation system influences many aspects of our life. For example, the location of transportation facilities has effects on the surrounding communities. Railroads and superhighways can divide towns and neighborhoods, and the location of highway interchanges can determine the location of manufacturing, retailing, and distribution operations. Factors can be identified correlating network changes to changes in neighborhood characteristics. Regional shopping centers, higher-income commuter enclaves, and resort, vacation, and amusement districts can grow as the result of available transportation networks, and the appropriate combination of economic and social factors.

Market area decisions are dominated by the ability of the transporter to get the product to market at a low cost. Decisions about whether to purchase parts, raw materials, supplies, or finished goods for resale must reflect transport costs and decisions about where plants, warehouses, offices, and stores should be located all take transportation requirements into consideration. Lastly, pricing decisions are strongly affected by the transportation system. Overall, **transportation interacts** with three groups of our society: users, providers, and the government. Thus, transportation decisions makers are expected to consider all aspects of society in one form or another. The role of the user is to make decisions that will maximize the relevant consumer- oriented goals.

## Overview of Transportation Trends

The transportation industry is in a continuing state of change. It is intertwined with the social, political, and economic forces in a society and economy. Since deregulation in the late 1970s and early 1980s carriers have organized, priced, sold their services, and managed operations based on this new environment.

## The Transportation Market

- Customized services and equipment to meet specific shipper/receiver needs
- Increased concern about equipment utilization
- Increased global commerce with longer shipping distances
- International transactions made faster and easier with improved information technology

- Shift from heavy industrial, production-oriented transportation to fast, service-demanding finished goods transportation
- Transportation becoming more integrated with production, sourcing, labor, distribution, and marketing factors in a supply chain context.
- Greater marketing orientation by carriers
- Higher fuel charges causing shifts in modal split
- More international transportation

### **Transportation Supply**

- Increased use of third-party services
- Consolidation in air, rail, and motor modes
- Increased use of public transportation in urban and suburban areas
- Integration of modes via joint ownership or special arrangements
- Continued technological advances in most modes
- Less private carriage use for reasons of cost savings; still present where special services are involved
- More international alliances of carrier
- More concern with security and terrorism

### **Operations and Management**

- Operations in closer link with marketing and sales of the carrier
- Leasing of containers, aircraft, terminal facilities, and other assets on increase
- Information-driven organization and structures
- Decision making and accountability being pushed lower in the organization

### **Government Policies and Regulation**

- Increased noneconomic regulation (environmental, substance abuse, safety and security)
- Government funding not keeping up with the deterioration of transportation infrastructure
- Increased concern about the financial viability of some modes of transportation, e.g., air transport.

In the 21st century, our transportation system faces significant challenges and problems because of global competition, governmental budget constraints, and increased demand from special interest groups such as senior citizens and especially, the threat of terrorism.. The patterns of trade that help to drive transportation are changing more quickly and becoming more complex because of the dynamic global environment that we now live in and the changing economic base in the United States and the increased competitiveness or previously undeveloped countries such as China.

### **Study Questions**

1. Help the Chairman of the Joint Transportation Task Force (discussed in the beginning of this chapter) by providing a rationale for spending money from the stimulus package to improve and maintain the

transportation infrastructure. In other words, why should the investment be made in improved transport systems?

*Investing in an improved transportation system would have an overall impact on multiple sectors of society. With transportation acting as a key ingredient to economic stimulation, improved infrastructure would improve businesses ability to produce and sell products and services. It would ensure more efficient versatility in transportation opportunities, providing flexibility to determine best routes and costs. Having the right products in the right place at the right time enables companies to maximize their revenue opportunities by adding extra value to their process. Transportation also plays an influential political role in national defense by providing the flexibility to move domestically and international in an efficient manner. This is most prominently reflected throughout the transportation of military supplies. Improved infrastructure reassures that our national defense is able to attain the supplies they need in a timely matter in order to protect our country. Furthermore, improved infrastructure is necessary for the world to continue their push towards a more environmentally friendly society. When companies can save costs on transportation, they are able to invest in areas that reduce their environmental impacts. Finally improved transport system results in social benefits. Socially, good transportation system can enhance health and welfare of a population. Though it not a significant problem in the United States, having the ability to transport food and life necessities throughout the country in an efficient manner can influence poverty and famine levels. Well developed transportation also contributes improved health and education delivery systems and effective communications among regions of a country.*

2. “Transportation is the most important economic factor for economic development”. Defend this statement.

*Transportation systems provide the necessary critical links between producers and consumers both domestically and globally. The citizens of industrialized countries are dependent upon transportation systems to move products from distant locations where they are produced to markets where they are needed, can be sold and consumed. It has long been recognized that one of the critical ingredients for underdeveloped countries to improve economically is the need to invest in transportation infrastructure. This investment is frequently referred to as social capital, that is, society as a whole is the beneficiary of such investment because of the economic benefits associated with new businesses, higher wages, more jobs, etc.*

3. Why were the opening of the Erie Canal, the building of the transcontinental railroads and the building of the National System of Interstate and Defense Highways after World War II so important to the U.S?

*A transportation system can help create a social structure. People traveling or living within the bounds of a particular transportation network share ideas and experiences. Eventually a society develops, with somewhat unified political opinions, cultural ideals and educational methods. The highway system was envisioned as being a system of superhighways connecting the states and their major centers within the states which could enhance our ability to defend against enemy attack. The expenditures on air transport infrastructure are based primarily on military and political consideration as opposed to economic benefits, but the economic benefits usually outweigh the political and military benefits over the longer run*

4. Why are highways serving major metropolitan areas sometimes described as their lifelines?

*Transportation systems have a major impact upon population patterns and urban economic development. A city would not be able to survive without its transportation system. Even the suburban areas surrounding the city are dependent on the transportation systems. Transportation services add value to the goods shipped.*

5. Explain the nature and importance of time and place utility, and how they contribute to the value of a product.

*The reduction in transportation costs between points A and B gives the commodity place utility. The more efficient method of transportation creates place utility; since the goods can now be sold at point B for a competitive price. Reductions in transportation costs permit market areas to purchase products from distant suppliers that might otherwise only be produced locally at a higher price. Time utility is closely aligned to that of place utility. The demand for a particular commodity may only exist during certain periods of time. If a product arrives in a market at a time when there is no demand for it, then it possesses no value. Effective transportation can create time utility by ensuring that products are at the proper locations when needed. The increased emphasis upon just-in-time and scheduled deliveries as well as lean inventories has heightened the importance of time utility especially for high value products and emergency shipments. The efficiency of a new system enables the producer located at Point A to expand their market area to include B which is a value-add service.*

6. Adam Smith stated the specialization of labor was limited by the extent of the market and that transportation helps to expand the market. Explain this statement.

*The concept of geographic specialization assumes that each nation, state, or city produces products and services for its citizens with its capital, labor, and raw materials. Since most areas cannot produce all of the needed products for its citizens, transportation is necessary to exchange (buy and sell) the goods that can be produced more efficiently at another location in return for different goods produced locally. Gain from the specialization of goods will be mutually advantageous when the cost ratios of producing two commodities are different in different areas. The development of specialization usually leads to lower prices, an increased availability of goods, and a higher standard of living. However, without the use of efficient transportation networks, the advantages of scale economies, production efficiencies, and specialization could be lost. The raw materials for production need to be transported to a manufacturing*

*facility, and the finished products must be transported out of an area at reasonable costs to markets and consumers at acceptable prices. Otherwise, the goods have no value. Without transportation, local entrepreneurs could produce goods inefficiently and charge high prices for their consumption. Transportation can increase the market area for a product.*

7. What is the relationship between improved transportation and land values?

*Transportation improvements which enhance an area's economy can increase the value of land that is adjacent to or served by the transport improvements because the land becomes more accessible and potentially more useful. Suburban centers provide excellent examples. The value of the land in these areas has increased to reflect the advantageous life-styles that the new or improved transportation systems have made possible. The land values within the city are obviously also enhanced by the economic development. It is important to note that transportation may not always have a positive impact on land values. Noise and air pollution accompanying some networks can decrease adjacent land values.*

8. "Transportation patterns reflect the flow of people and commerce." Explain that statement and its significance for transportation systems.

*Transportation has a catalytic effect on a society in that it stimulates commerce and movement. The reverse is true also. The demand for commerce and movement will cause transportation to be developed. Routes have an east-west pattern between the developed nations and a north-south pattern between the developed nations primarily in the Northern Hemisphere and developing nations in Africa and South America. These routes closely approximate major air cargo and passenger routes of the world. In the United States, these routes link the major metropolitan areas and represent the existing rail trunk line, interstate highway, and inland waterway patterns. Mexico's major commerce routes are strongly tied to its economic center. The railroad mainlines and early highway development created an economic and social orientation to this pattern.*

9. While improved transportation systems provide economic benefits, there may be some associated environmental costs. What are the major environmental costs associated with transportation and what is their potential negative impacts?

*Transportation sometimes pollutes the environment and exploits natural resources. The debate of the overall benefits provided by transportation exceed the costs continues. The environmental challenge of the future will be to accurately assess the relationship between industrial and consumer benefits compared to and their construction and external, societal costs associated with transportation improvements. Green Supply Chains, the balance between a sound and efficient transportation system and a safe and clean environment have become part of our vocabulary. Pollution from internal combustion engines, acid rain which contains more pollutants from industrial and commercial processes as well as vehicle emissions, oil spills, and ship generated garbage all have and will continue to have adverse effects on the environment.*

10. “Improved transportation systems can also have social and political significance.” Explain.

*A good transportation system can enhance the health and welfare of a population, offer educational opportunities and effective communications among regions of a country. Adequate transportation is needed to create national unity; the transportation network permits the leaders of government to travel rapidly to and communicate with the people they govern.*

## Case Questions

### Case 2.1 Opportunity Knocks

1. You have recently been hired by HOG, Inc. and Mr. Edwards has asked you to develop a set of discussion points that would point out the economic and perhaps, social benefits from a new highway link in central Pennsylvania.

#### Discussion Points

- *Can reduce travel time, which will increase business cycle time, and save transportation costs. By saving costs in transportation, companies would be able to invest the money in alternative areas that could improve their business from a efficiency and/or environmental standpoint.*
- *PA emphasizes on dairy and agricultural products that rely on freshness and therefore benefit from more efficient routes of transportation to get to their necessary locations.*
- *Federal Highway Administration has estimated that total freight volume moved in the U.S. is expected to triple by 2035, therefore needing a better route for transporting products. Also, reflects an increased number of transportation units on the roadways in which congestions throughout existing routes will be reduced with more efficient roadways.*
- *Beneficial to general public as a general transportation resource.*
- *Penn State would have an easier connection to their branch campuses to develop more research opportunities, and improve the overall quality of the university reflecting.*

### Case 2.2 The Green Team

1. You have been asked by the Green Team to critique their pilot program pointing out strengths and weaknesses as well as the addition of new initiatives for them to consider.

#### Strengths

- *“Green friendly”*
- *More efficient for each individual location*
- *Ensure availability of product by baking bread on site and reducing chance of stockouts*
- *Reduce long run costs in transportation*
- *Build stronger supplier relationships*

Weaknesses

- *Reduce expertise and specialization*
- *Require more time a labor to bake on site.*
- *Entirely new process therefore have a lot of details to be determined*
- *Repetitive processes – same procedure occuring at multiple facilities.*
- *Increased fixed costs for necessary equipment at multiple facilities.*
- *Limits suppliers by location by procuring locally.*

***Suggested Internet project***

Have the student research current U.S. freight expenditure by mode. In addition, find statistics for accident rates and fatalities in the U.S. for each mode.

Have the student locate current total ton-miles by mode for freight and rank the modes from highest ton-miles to lowest.

Some addresses are:

United States Department of Transportation    <http://www.dot.gov/DOTagencies.htm>

Federal Highway Administration    <http://www.fhwa.dot.gov/>

Federal Motor Carrier Safety Administration    <http://www.fmcsa.dot.gov/>

Federal Railroad Administration    <http://www.fra.dot.gov/>

National Highway Traffic Safety Administration    <http://www.nhtsa.dot.gov/>

Maritime Administration    <http://www.marad.dot.gov/>

Pipelines and Hazardous Materials Safety Administration    <http://www.phmsa.dot.gov/>

Research and Innovative Technology Administration    <http://www.rita.dot.gov/>

National Transportation Library    <http://ntl.bts.gov/>

Bureau of Transportation Statistics    <http://www.bts.gov/>

Transportation Safety Institute    <http://www.tsi.dot.gov/>