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Chapter 2
TRANSPORTATION AND 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 the United States and countries or regions and why transportation is probably our most important industry.

2. Appreciate the role and contributions of transportation systems to the economic development of countries or regions.

3. Understand how transportation of goods and people 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 and economic development.

6. Understand how transportation affects the price of goods, services and market areas.

7. Appreciate the function and scope of transportation in advanced and developed economies.

Chapter Overview

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. 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 and where they can be sold and consumed. An efficient and effective transportation system is essential for businesses to produce and sell products and services. 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, and the social benefits associated with mobility, improved educational systems, and communication. Even developed countries like the United States need to continually evaluate the adequacy of their transportation infrastructure to insure that the system needs of the economy.

Transportation is one of the requirements of a developed economy because it can bring order out of chaos. It reaches and touches every phase and facet of our well-being. Viewed in totality from a historical, economic, social, and political perspective, it is the most important industry in the world. Without transportation, you could not operate a retail store or win a war. The more complex society becomes and the more developed the economy, the more indispensable is the transportation system.

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Unfortunately, the transportation system is frequently taken for granted, and the benefits that accrue to the economy from the transportation system are not fully appreciated. Therefore, it would be appropriate at this point to discuss the many benefits of improved transportation. This chapter will investigate the historical, economic, environmental, social, and political impact of a well-designed and improved transportation system.

Historical Significance

The growth of civilizations is directly associated with the development of transportation systems. A transportation system can help create a social structure and a political system with more unified political opinions, cultural ideals and educational methods. The economies of the world tend to grow in tandem with their transportation networks. Transportation has also played a major role historically and still does currently in National Defense. As we look to the future, the transportations systems of the world will be economically, socially and politically challenged.

Economic Significance

Transportation touches the lives of all U.S. citizens and citizens in other areas of the world. It affects their economic well-being, their safety, their access to other people and places, and the quality of their environment. When the transportation system does not function well, it is a source of great personal frustration and perhaps economic loss. But when the transportation system performs well, it provides opportunity and rewards for everyone. Understanding the basic fundamentals of transportation economics will provide important insights into the role of transportation in the economic viability of a country, and also the businesses and other organizations that provide the output, revenue, and income that really drives an economy.

Transport Measurement Units

Transport demand is essentially a request to move a given weight or amount of cargo or freight a specific distance between two points. The demand for transportation is usually measure in weight-distance units for freight and passenger distance units for people. For freight, the usual demand metric is the ton-mile and for people the metric is the passenger-mile. Both measurements are two dimensional which can present some challenges for modal comparisons, but they are the best measures of the macro importance of freight and passenger movements or macro demand for comparison or modal split purposes.

The freight intercity modal split is dominated by trucks, with about 77 percent of the tons moved in 2013. Railroads declined in relative share after World War II but have increased in share since 1990 because of fuel prices and other factors. Motor carriers have also increased their relative share of the total ton-mile market after 1980, but their share has remained relatively stable since 2000. 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 more visible, still handles less than 1 percent of the total ton-miles in the United States.

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As stated previously, transportation can spur economic development by providing mobility and lower landed cost to production factors which in turn can provide economies of scale and increased efficiency. The overall importance and significance of improved transportation needs to be understood and appreciated.

Demand Elasticity

Demand elasticity refers to the sensitivity of customers to changes in price. If demand is elastic or sensitive to changes in price, a decrease in price or rates will increase demand or sales of a product or service, but an increase in price will have the opposite effect on demand or sales. Conversely, if demand is not sensitive to price changes, it is described as inelastic. On an aggregate basis, the demand for transportation is usually inelastic since freight costs are usually a small percentage of total landed cost. However, in specific market areas between specific shipping points where there is intermodal competition, the demand for each of the carriers competing for the traffic tend to be elastic or sensitive to price changes. This phenomenon is not unusual even for the demand for products. It should be noted that changes in service levels of carriers, especially transit time and reliability, can impact demand even when there is no change in rates because the improved service level impacts inventory holding cost and other logistics costs.

Freight Transport Demand

The demand for freight transportation is usually dependent on the demand for a product in another location which can be described as a derived demand or secondary demand. Derived demand is not unique to transport since the demand for many raw materials and product parts are dependent upon the demand for a finished product. Figure 2-1 illustrates the basic nature of derived demand. Value of the service is an important consideration for product demand which considers the impact of transportation costs and service on the demand for the product in a market area since it impacts landed costs. If the landed cost for a product is lower than the landed cost of other sources, it will impact the demand for the product and, consequently, the demand for the related transportation service (see Figures 2-2 and 2-3). The landed cost also impacts the extent of the market area (potential sales) for a product.

Service Components of Freight Demand

As indicated above, service demands affect the cost of the service provided and the landed cost. The transportation service characteristics that are usually most important and discussed in this chapter and the modal chapters include transit time, reliability, accessibility, capability, and security:

TRANSIT TIME can impact the inventory levels held by sellers and buyers. Usually, the longer the transit time the higher the inventory levels required and the higher the related inventory carrying costs and potential stock out costs.

RELIABILITY refers to the consistency of the expected transit time of carriers. It impacts safety stock levels and stock out costs. Safety stock increases the level of inventory required and consequently, inventory holding cost. Sock out cost is the cost of not meeting customer demand which can be the profit on the sale of the product or the longer run cost associated with losing the customer.

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ACCESSIBILTY refers to the ability of a carrier to move freight between a specific origin and destination. If the carrier cannot provide that direct service it will affect inventory cost with longer transit times and higher total transportation costs usually associated with additional transportation services (pick up and/or delivery charges). The motor carrier usually has the advantage in providing direct point-to-point service and is frequently the complementary service required by other carriers for complete point to point service.

CAPABILITY usually refers to the ability of the carrier to provide effective service for specific products and/or to meet the special service characteristics of the freight and market needs. Typically, this is the first step in evaluating the potential for using a particular mode of transportation for a movement and in many instances is intuitive, e.g., livestock cannot be moved via pipeline.

SECURITY is concerned with the safety of the freight while it is in-transit or what is commonly referred to as loss and damage. Security also impacts inventory or safety stock and stock out costs.

Value of Goods

Transportation plays a role in determining the value of goods or products. Figure 2-4 illustrates this concept and is a useful method for explaining the concept to students.

Place Utility

The reduction in transportation costs gives a commodity with additional **place utility or place value**. In a less efficient system, the goods will have no value if they could 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 more distant suppliers that might otherwise only be produced and sold 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 p. 49**).

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

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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.

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.

Gross Domestic Product (GDP)

Transportation plays a major role in the overall economy of the United States and transportation accounts for about 9.0 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 expenditure

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. The synergy between the transportation system and the environment is being increasingly investigated by both environmentalists and by transportation planners at all governmental levels. In fact, increasing pressure from environmentalists has resulted in legal restrictions that help govern the balance between a sound and

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efficient transportation system and a safe and clean environment. The term **sustainability** 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 that has occurred is the 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 is a growing recognition that it does not have to be a "zero sum game." In other words, reductions in an organization's carbon footprint, 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.

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 2014, a total of 34,641 persons lost their lives in the United States while engaged in transport. Approximately 78 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. Government intervention is needed to design feasible routes, cover the expense of building public highways, and

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develop harbors and waterways. 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.

Closely connected with transportation's political role is its function as a provider for national defense. Today, our transportation system enhances our lifestyles and protects us from foreign enemies. The ability to transport troops acts as both a weapon and a deterrent in this age of energy shortages and global conflicts. The conflicts in Central America, Africa, and the Middle East place even greater emphasis on the importance of transportation in protecting our distant vital interests.

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. Transportation policy incorporates more than economics—the expected benefits of the system extend beyond the economic realm.

SUMMARY

- Transportation is a pervasive and very important part of all developed economies and is a key ingredient for underdeveloped countries to progress to economic development and independence.

- The history of the United States is replete with evidence of the close correlation of advances in transportation technology with our advancing economic development, from the Erie Canal to our modern highways and air systems.

- Transportation systems are the lifelines of cities and the surrounding suburbs. Tons of products are moved into cities every day to promote the health and welfare of its citizens. In addition, products which are produced in the cities are moved out for shipment elsewhere.

- Transportation contributes to the value of goods by providing time and place utility. That is, effective and efficient transportation moves products to points where there is a demand for the product and at a time when it is needed.

- Geographic and labor specialization are important cornerstones of industrialized countries, and transportation provides one of the necessary ingredients for this to occur.

- The more efficient the transportation system, the greater the possibility of scale economies and increased market areas.

- Improved transportation in an area will usually increase land values because of the improved accessibility to raw materials and markets.

- The flow and patterns for commerce influence transportation infrastructure patterns of developing countries.

- Transportation expenditures for freight and passengers are an important part of the gross domestic product in the United States.

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- While transportation provides many benefits, it can also contribute to environmental problems including pollution, poor air quality, acid rain, and global climate changes.

Study Questions

1. There is much discussion on the local, state and federal levels about the need to repair and improve the Interstate Highway System. Provide rationale for meeting this need.

Investing in an improved transportation system would have an overall positive 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. The opening of the Erie Canal and the building of the transcontinental railroads in the 19th century were described as significant milestones for economic development in the United States. Explain their importance individually and collectively.

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The Erie anal provided a link from the East Coast, specifically New York to the Upper Great Lakes Region which provided access to the Mid-West which was a bonanza for the manufactures of the East to have access to those market areas and a pipeline Mid-West agriculture and mineral resources. While the Erie Canal was a "man-made" public works, it was built at a very low cost, mostly with prison labor, and the tolls were minimal. The success of the Erie canal spurred interest in other Canal but as pointed out in the text none of them were as successful as the Erie Canal and the railroads soon provided a more efficient and effective alternative to canals. The transcontinental railroad had essentially the same impact connecting the eastern manufacturers with markets for their products and a supply of food and other resources for the more densely populated Easter Seaboard. It was a classic win-win but had some "bumps and bruises" with political and individual greed leading to excesses. The Transcontinental rail system had a much larger impact when completed in 1866 than the Erie Canal, but both were monumental stepping stones for the Economic development and growth of the United States along with social and political impact of connecting the citizenry of the country.

4. The highways and other metropolitan transportation services are frequently described as the lifelines of the metropolitan area. Do you agree with this statement? Why or why not?

Transportation systems have a major impact upon population patterns and urban economic development. A city would not be able to survive without its internal transportation system and the connecting transportation system to external markets and producers. Even the suburban areas surrounding the city are dependent on the transportation systems. Transportation services add value to the goods shipped from the urban areas to markets and provide the economic livelihood of the urban areas. On the other hand, the urban areas need food and other supplies to sustain the population of the urban area. The cities could not exist without the efficiency of transportation systems into the city and outbound from the city.

5. Compare and contrast time and place utility, and explain how they contribute to the value of products what is the importance of time and place utility in our global economy?

Place utility is created when a product is moved from a point where it is produced to a point where there is demand for the product and the buyer is willing to pay a price that covers the landed cost of the product and sufficient profit for the producer. The more efficient the method of transportation the greater the potential market area and the greater place utility. Reductions in transportation cost permit market areas to purchase products from distant suppliers that might otherwise only be produced locally at a higher price. Time utility is aligned with 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 arrive WHERE (place utility) and WHEN (time utility) they are 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. Time and Place utility are even more important for global supply chains which face many challenges and more uncertainty because of the greater distances.

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 the meaning and importance of this statement.

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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 and increased productivity (read greater output). If there is insufficient demand for the increased output, the producer will have excess supply which will have no value. The availability of efficient transportation networks to move the products/output to other geographical markets justifies the specialization and the advantages of scale economies. In other words, without the transportation system the production efficiencies from specialization would 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.

7. Economists often point to the impact of improved transportation on land values and related economic development. What is the nature and significance of the transportation impact?

Transportation improvements can enhance an area's economy and 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. Another good example is along the major interstate highway systems the pass through remote, undeveloped areas. However, when you reach an interchange area you usually see evidence of commercial establishments such as hotels, restaurants, service stations, shopping centers and even industrial activity. The land at those interchanges greatly increased in value when the highway was developed and the interchange established.

The Erie Canal and the transcontinental railroads mentioned previously had a major impact on land values in areas contiguous to these transportation systems. This was particularly true of the transcontinental railroad which opened up the Western States as market areas and the source of many agriculture and mineral products.

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

Noise, air quality, and pollution are most frequently mentioned as potential negative impacts form transportation systems. If these impacts are too negative, they can negate the economic benefits of the improved transportation. Sustainability and Green systems are frequently mentioned terms today and there is no question that transportation and related supply chain activities have a major impact here. There is much effort underway to reduce the carbon footprint of transportation and supply chain related activities through reduced truck miles, less packaging materials, etc. While not usually considered as an environmental factor, transportation safety is also an issue and can be a negative impact of modern transportation systems

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Transportation systems can pollute the environment and exploit 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.

9. Improved transportation systems can also have social and political significance. Why are these important considerations for evaluating existing and/or proposed additions to the transportation?

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. Information technology has enhanced the opportunities to communicate and help unify a nation, but transportation also plays a role in bringing people together and exposing them to products and services from other regions of the country which helps reduce regional social and political barriers.

10. The service considerations of carriers are considered by some shippers to be as important as or even more important than the freight rate. Discuss the various service characteristics for freight demand. Do you agree with the statement? Why or why not?

There in question that service characteristics of carriers have become much more important to shippers over the course of the last thirty years as they have recognized the cost trade-offs for improved service such as lower inventory costs, reduced warehousing cost, lower loss and damage, lower landed cost, fewer stock outs and better customer service. In effect, the freight rate had to be evaluated along with the service provided to determine the best alternative. Three modes of transportation usually have an advantage in terms of the lowest line-haul rates between two points—rail, water carrier and pipeline but general thinking, they are at a disadvantage with respect to service. Whereas, the motor carrier and air carrier have some advantage for service, but their rates are higher than the other three, especially the air carrier. As the value of the products increase, the importance of the service characteristics increases because the trade-offs are greater for inventory cost, warehousing, customer service, etc. When he product values are low, e.g., coal, crude oil, agricultural products, etc., the freight rate gets the most attention.

Case Questions

Case 2.1 Highways Galore

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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 pf 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 an 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.*
- *The 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, this reflects an increased number of transportation units on the roadways in which congestion throughout existing routes will be reduced with more efficient roadways.*
- *Beneficial to general public as a general transportation resource and overall economic development.*
- *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 Transportation and Economic Activity

Also unique to these two cities was their manufacturing specialization: steel in Pittsburgh and automobiles in Detroit. Using the information contained in this chapter:

1. Explain what role transportation played in the development of these two cities.

2. Discuss what factors would lead to their manufacturing specialization.

3. Identify any other benefits to a city or geography that manufacturing specialization would create.

• Pittsburgh manufactured steel (place and time utility).

• Detroit manufactured automobiles and therefore needed a supply of steel.

• Transportation characteristics such as transit time, reliability, accessibility, and capability all made Pittsburgh a cornerstone in providing steel to Detroit's auto plants.

• Geography also played a large role – proximity of Pittsburgh to Detroit.

• Coal plays a large roll in steel production, and PA had coal.

• Canals, Rivers, Railroads, and Lake Erie all played roles in the manufacturing specialization as Pittsburgh could fairly easily ship steel to Detroit via those modes

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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 https://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/

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CHAPTER 2

TRANSPORTATION AND THE ECONOMY

Transportation: A Global Supply Chain Perspective (9e)
Novack, Gibson, Suzuki, and Coyle

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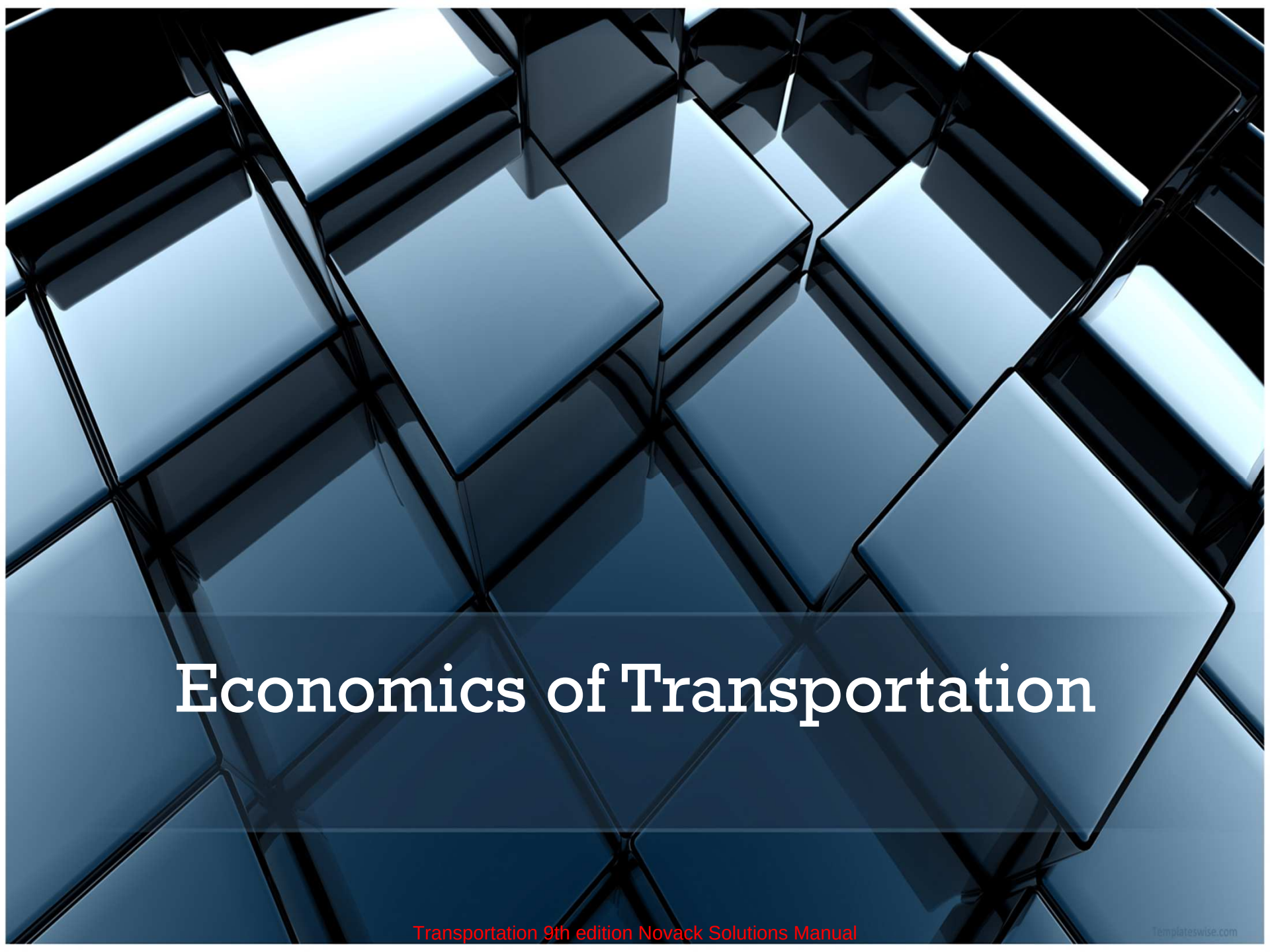


Discussion Outline

- Economics of transportation
- Transport measurement units
- Significance of transportation from a historical, environmental, social, and political perspective

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Economics of Transportation (1)

- Transportation demand = a request to move a given weight or amount of cargo a specific distance between two specific points
- Demand for transportation
  - Transportation helps to bridge the supply and demand gap inherent to mass-production.
  - Goods need to be transported nationally and globally.
  - Measured in ton-miles
- Passenger demand
  - Transportation bridges the supply and demand gap for people between locations.
  - People need to be mobile for work, recreation, shopping, and to access services.
  - Measured in passenger-miles

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Economic Significance: Freight Transportation

- A geographical area specializes in the mass production of particular goods and/or services.
- Transportation bridges the supply and demand gap inherent in the mass production–oriented approach.
- Transportation lowers "landed cost" to production factors.

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Economic Significance: Passenger Transportation

* Workforce mobility
* Growth of suburban areas
* Increased land and property values
* Tourism

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Measurement Units

TABLE 2-2 Passenger Miles: 2011–2014 (millions)

	AIR	RAIL	BUS	LIGHT DUTY VEHICLES
2011	575,613	37,562	292,716	3,650,223
2012	580,501	37,878	313,357	3,669,278
2013	589,692	39,116	321,539	3,688,161
2014	607,772	39,288	339,177	3,731,888

Source: U.S. Department of Transportation, Bureau of Transportation Statistics, 2017, Washington, DC.

TABLE 2-3 U.S. Tons of Freight (millions)

YEAR	AIR	TRUCK	RAIL	WATER	PIPELINE
2007	13	12,778	1,900	950	1,493
2013	15	13,955	1,858	808	1,539
2040	53	18,786	2,770	1,070	1,740

Source: U.S. Department of Transportation, Bureau of Transportation Statistics, *Freight Facts and Figures 2015*, Table 2-3.

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Demand Elasticity

The Sensitivity of Customers to Changes in Price

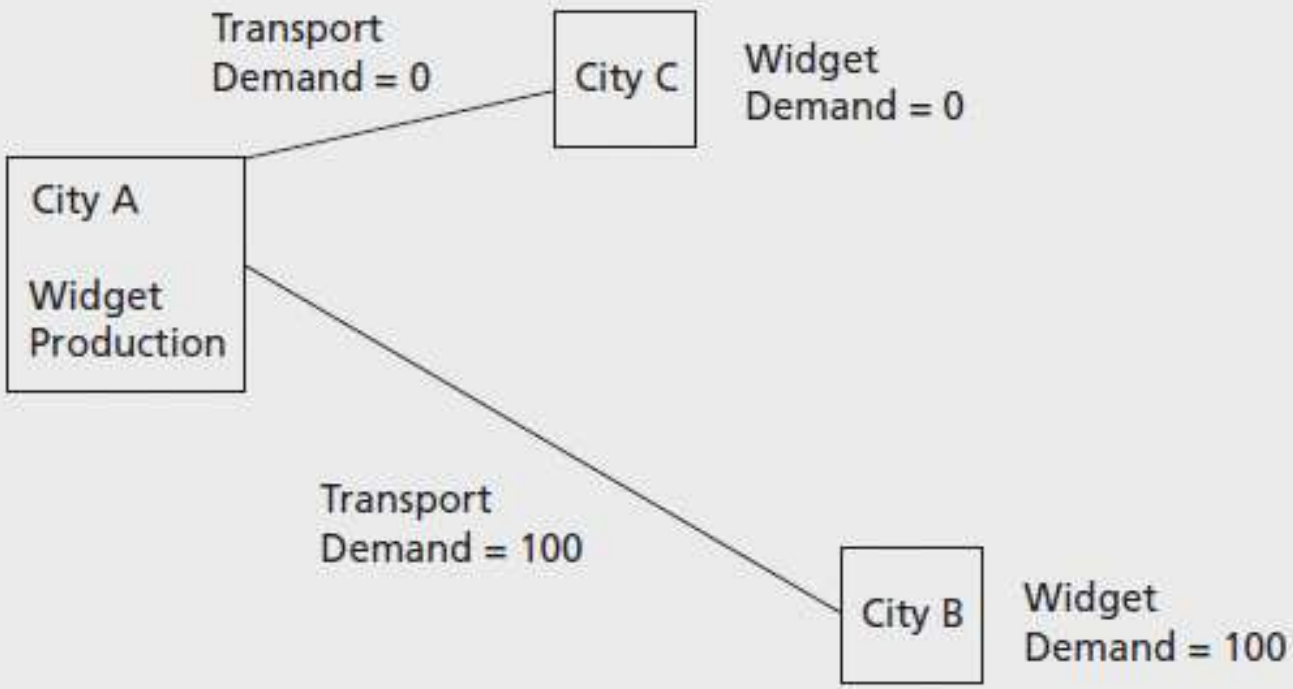
- Aggregate demand for transportation is *price inelastic.* Freight rate reductions will not proportionally increase the aggregate demand for freight transportation.
- Demand for specific modes of transportation or specific carriers is generally *price elastic and service elastic.*
- Reductions in rates charged usually result in greater than proportional increased demand. Decreasing service levels similarly result in greater than proportional decreased demand.

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Derived Demand for Freight Transportation

FIGURE 2-1 Derived Demand for Freight Transportation



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Value of Transportation Service

The Impact of Transportation Costs and Service on the Demand for the Product

* Landed cost determines the extent of the market
* Landed costs at buyer facility =

  Production cost of overseas supplier

  + Overseas warehouse & transport costs

  + Export tariffs

  + International freight transportation costs

  + Import duties

  + Buyer warehouse & transport costs

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Landed Cost Determines the Extent of the Market (and Equation)

FIGURE 2-3 Extent of Market Area



LC(P) = LC(20)

Production Cost (P) + Transportation Cost (P) = Production Cost (S) + Transportation Cost (S)

$\$50 + \$0.60(x) = \$50 + \$0.50(200 - x)$

$\$0.60(x) + \$0.50(x) = \$50 + \$100 - \$50$

$\$1.10(x) = \$100$

x = 90.9 miles from P

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Service Components of Freight Demand

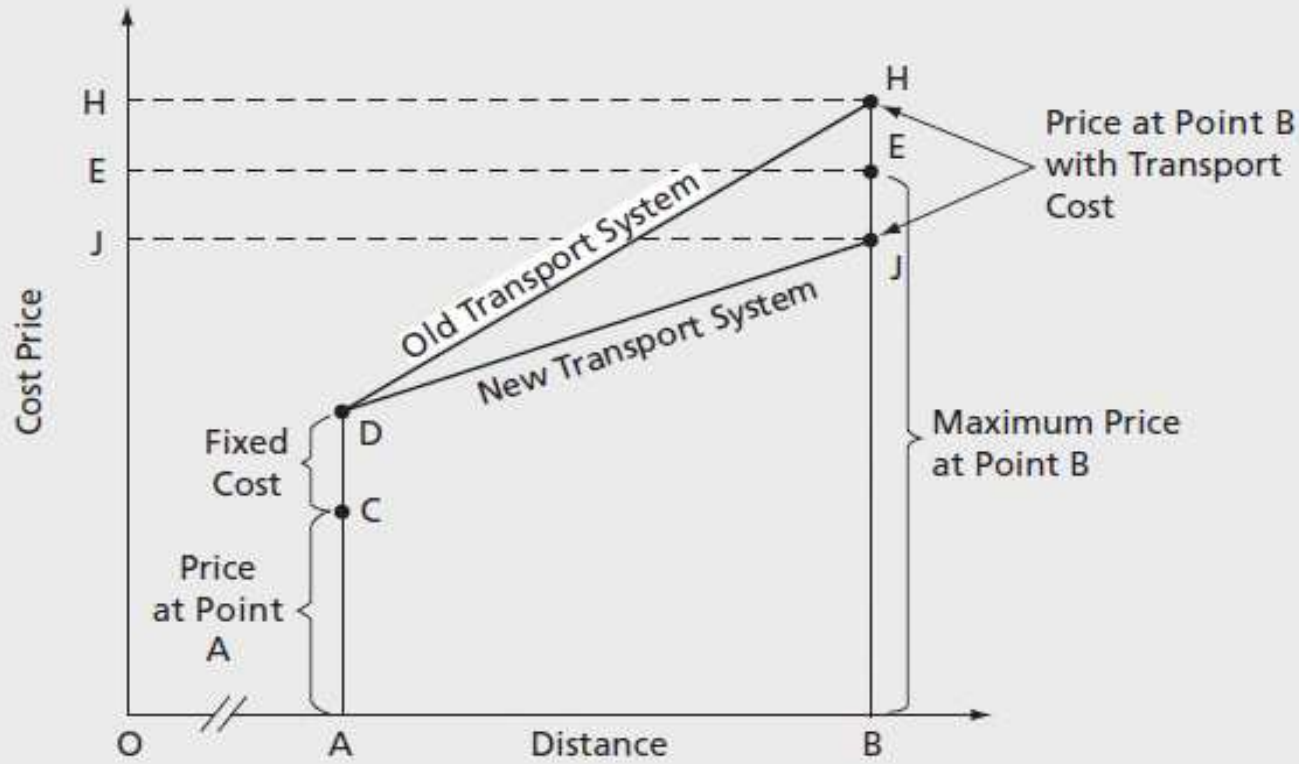
TABLE 2-4 Service Components of Freight Demand

SERVICE COMPONENT	USER IMPLICATION
Transit Time	Inventory, Stock Out Costs
Reliability	Inventory, Stock Out Costs
Accessibility	Transit Time, Transportation Cost
Capability	Meets Products' Unique Physical and Marketing Requirements
Security	Inventory, Stock Out Costs

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Landed Cost Impact on Value of Goods

FIGURE 2-4 Landed Cost with Old and New Transport Systems



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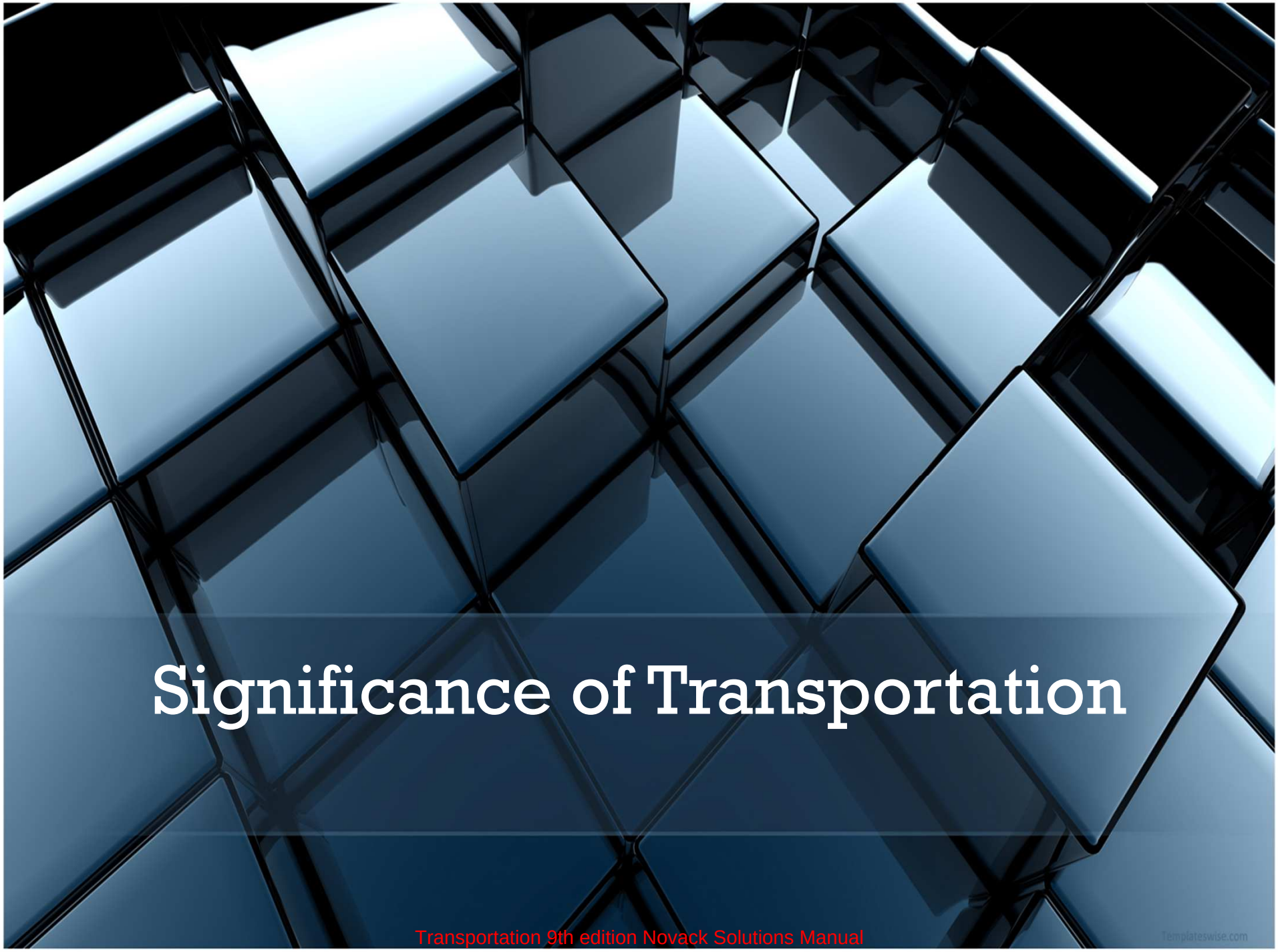


Utilities of Transportation

* Place utility
* Time utility
* Quantity utility
* Cost utility
* Land values

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Transportation Importance to GDP

TABLE 2-5 U.S. Gross Domestic Product by Major Societal Function 2015

FUNCTION	PERCENT OF GDP
Housing	19.0%
Health Care	16.0%
Transportation-related	9.0%
Food	10.0%
Education	7.0%
Other	39.0%

TABLE 2-6 Average Household Expenditures, 2015

CATEGORY	PERCENT OF HOUSEHOLD EXPENDITURES
Housing	33.0%
Transportation	17.0%
Personal Insurance and pensions	11.0%
Food	13.0%
Health Care	8.0%
Apparel and Services	3.0%
Other	15.0%

Source: U.S. Department of Transportation, Bureau of Transportation Statistics, *Pocket Guide to Transportation—2017*, Washington, DC, p. 52.

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Beyond Economic Significance

Environmental (social cost)

- Pollution: Air, noise, water
- Sustainability
- Safety: Injury, loss of life, hazards accidents (e.g. oil spills, gaseous explosion)
- Energy: Fossil fuels

Social

- Health & welfare
- Education delivery system
- Social interaction
- Lifestyle

Political

- National unity
- National defense
- Humanitarian aid
- Government intervention: Governance, system maintenance & development

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Historical Significance

- Ancient civilizations
- United States secession from Great Britain
- Westward expansion of the United States
- National defense
  - National System of Interstate and Defense Highways
  - Air transport infrastructure

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Summary

- Transportation expenditures are an important part of the history and gross domestic product of the United States.
- Transportation is needed for transportation of goods and people.
- Transportation contributes to the value of goods by providing various utilities that enhance the possibility of scale economies and increased market areas.
- While transportation provides many benefits, including social and political significance, it creates social costs due to the impacts on environment.

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