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Promoting Economic Development by Improving Transportation Infrastructure for Goods Movement

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Promoting Economic Development by Improving Transportation Infrastructure for Goods Movement

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August 2002

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EXECUTIVE SUMMARY

Trade is a crucial factor in today's economy. While global trade activities between countries and multinational firms are important, trade at domestic and local levels also contributes to regional economic development, resulting in local job and income growth.

For trade and related activities to take place successfully, goods movement must be as efficient as possible. One of the transportation system's main purposes is facilitating goods movement. There are a number of theories and empirical studies that aim to provide insights into how transportation infrastructure affects goods movement. The theories and studies reveal that transportation infrastructure affects four aspects of economic development:

- Production Costs
- Industrial Location
- Regional Productivity
- Cost of Interregional Trade

According to numerous published studies and reported empirical evidence, transportation infrastructure influences key economic factors at the industry, regional, and national levels. This study examined four main types of transportation infrastructure and the aspects of economic development they affect:

- Highways
- Ports
- Distribution Facilities
- Intermodal Connectors

Highways generally affect most aspects of regional economic development including productivity, production costs, and interregional trade. This is because most local economic activities depend on highways to transport both commodities and members of the labor force. Any improved highway system can allow regions to specialize in production of commodities they are most efficient in producing because the highway improvements can create higher potential for more profitable trading activities.

Ports and development of port facilities provide a way for a region to gain more competitive advantage over others by allowing resourceful methods for shipping items to and from distant regions. In addition to enhancing overall regional productivity, ports can reduce costs for targeted businesses shipping and receiving bulk cargoes by decreasing transportation costs. Such benefits encourage existing local businesses to stay and expand in the area and attract prospective employers to the area.

Distribution facilities can help raise overall regional productivity and lower targeted industries' production costs. A centralized warehouse or a trucking hub to serve a local area can improve overall regional productivity by reducing congestion, bottlenecks, and inefficiencies in local

transportation systems. A region with efficient distribution facilities can attract more prospective businesses by offering higher productivity and lower production costs in the region as compared with other regions.

Intermodal connectors provide effective ways of linking different modes of transportation. By connecting different modes within the overall system, intermodal connectors - such as access roads to ports, rail yards, or distribution facilities - allow more inexpensive ways to move commodities within, from, and to different regions. Cheaper transportation costs contribute to reduced production costs and higher productivity of the region. A region with a more efficient transportation system can attract industries and jobs as the region offers more competitive advantage in trading activities.

This report provides four case studies that link transportation planning for goods movement with economic development strategies:

(1) Monterey Bay Area, California
In the Monterey Bay Area of California, we performed a multimodal freight movement study. This study examined various modes of the local transportation system and the economic benefits stemming from improving the local transportation system. In addition to highway and intermodal connector improvements, a freight distribution facility was examined in this study for its potential economic benefits to agricultural industries in the Monterey region.

(2) Fresno County, California
This study examines relationships between highway improvements and positive effects they may bring to local industries. Many local businesses surveyed in the study responded that improving a main corridor in the study area is of utmost importance. Highway improvements are crucial in business location decisions, reducing production costs, and raising the overall productivity of the region.

(3) Eastern Southern California
What are the potential economic development impacts of a proposed bypass route in Eastern Southern California through the three counties of Imperial, Riverside, and San Bernardino? Facilitating goods movement by creating the bypass highway can improve the overall productivity of the region and encourage industries to locate in the area by providing easier access to efficient transportation systems. The study concluded that the bypass can provide a much less congested route for travelers, and attract more through-traffic in the region. Many traveler-serving businesses in the vicinity can capture potential economic benefits from increased travelers in the area.

(4) Putnam County, West Virginia
This study shows how port development strategies can benefit local economic development. The port and terminal developments assessed were found to improve goods movement and regional productivity. When a number of businesses can share terminal facilities, they can utilize economies of scale, reducing costs of transportation further. Higher productivity and

reduced production costs can encourage new businesses to locate in Putnam County and spur economic growth in the area.

In summary, trade activities play important roles in economic development, both in the global and the local context. Effective goods movement heavily depends on transportation infrastructure. By facilitating goods movement, transportation infrastructure can foster economic development. This report presents four common types of transportation infrastructure improvements, and how they affect economic development. Four case studies illustrate the links between transportation infrastructure planning at the local level and local economic development.

1. THE ECONOMIC IMPORTANCE OF TRADE

Overview

In recent decades, many schools of economic thought have held firmly to the belief that trade is the driving force of economic growth. At the regional, national, and international levels, opportunities for trade are often linked with prospects of access to new and larger markets, increased levels of production, increased employment, income growth, and in some cases increased tax revenue. A recent study by the World Trade Organization (WTO) finds trade to be a "strongly positive contributor" to economic growth. The study also finds that "openness to trade" is the reason why the standard of living in some developing countries is catching up with those in developed countries. [1]

According to the WTO, "There is strong evidence that trade boosts economic growth, and that economic growth means more jobs. It is also true that some jobs are lost even when trade is expanding." In some cases however, such losses simply amount to a redistribution of resources from one sector of the economy to another or from one trading partner to the other. This redistribution of resources within different sectors of an economy tends to facilitate the reallocation of resources from relatively less productive sectors to more productive opportunities in other sectors.[2]

Variation in benefits from trade can also be attributed to differences in climate, geography, technological capabilities, natural resources, and human resources. Due to these differences, most, if not all economies are not self-sufficient. Instead, they possess different comparative advantages in producing various goods and services. Trade thus affords each economy an opportunity to obtain goods and services that are uneconomical to produce internally. Closely associated with this scarcity problem is the fact that some economies are more efficient at producing certain goods relative to others. Rather than engage in direct production of all goods, countries are better off purchasing the desired goods from more efficient producers.

Growth Trends in International Trade

Pursuit of liberal trade policies in the aftermath of the Second World War contributed greatly to the explosion of trading activities amongst the major industrial countries. The United States and its major trading partners pursued trade policies that involved eliminating prohibitive tariffs, quotas, and regulations that hindered the free flow of goods and services across national borders. Trade expansion fuelled the post-war economic growth of many war-torn economies, particularly in Europe and East Asia. This new liberal trade policy was founded on the neoclassical economic theory that open economies tend to grow faster than closed economies.

In the 1960s and 1970s, through the pursuit of exported growth strategies, a handful of East Asian economies grew at unprecedented rates, reinforcing the global trend of expanding tade

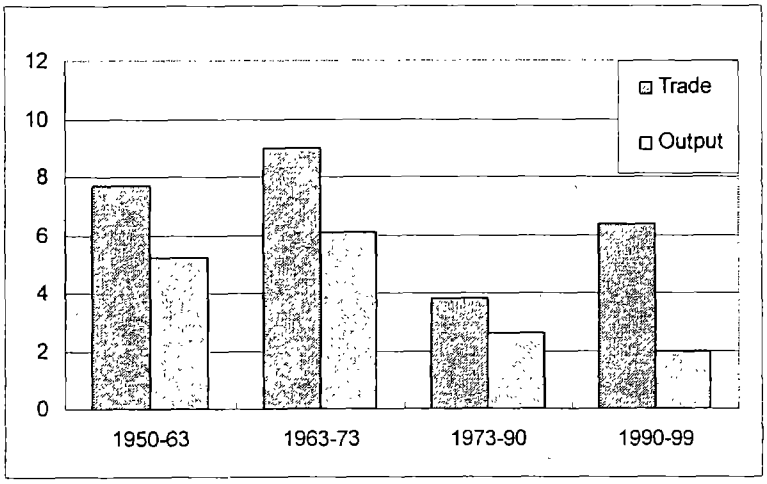
spurring economic growth. This strategy focused on the development of local industries that produced value-added manufactured goods for the export market.

Through governmental intervention, an enabling environment was created for the production and exportation of automobiles, electronics, textiles, semiconductors, and other goods that were regarded as nontraditional exports for these developing countries. As their exports increased, these countries experienced rapid increases in their income levels and living standards. While there are numerous other factors that have contributed to remarkable growth in these East Asian economies, international trade played a key role in their growth.

In the 1980s, coupled with the recognized importance of international trade, financial liberalization policies of the International Monetary Fund (IMF) and the World Bank ushered many of the less developed economies of the world into the new global free trade environment. For many years, however, some of the developing countries had implemented protectionist and import substitution trade policies, which, combined with other factors, constrained the economic growth in the long run.

Trade is widely considered to be one of the necessary components of any region's economic engine. However, there are many other determining factors that affect a developing economy's success and failure. Considering each of the determining factors and the liberalization of financial markets, international trade grew at a faster rate than production during the last five decades. The rate of growth in trade volume has consistently outperformed that of the overall output volume. Exhibit 1 shows this historical trend in international merchandise trade. When the world economy as a whole is observed, the historical trend as shown in Exhibit 1 illustrates the linkage between trade activities and growth in the overall economy.

Exhibit 1: World Merchandise Trade and Output, 1950 – 1999
(Average annual percentage change)



Source: The World Trade Organization (2000 Trade Statistics)

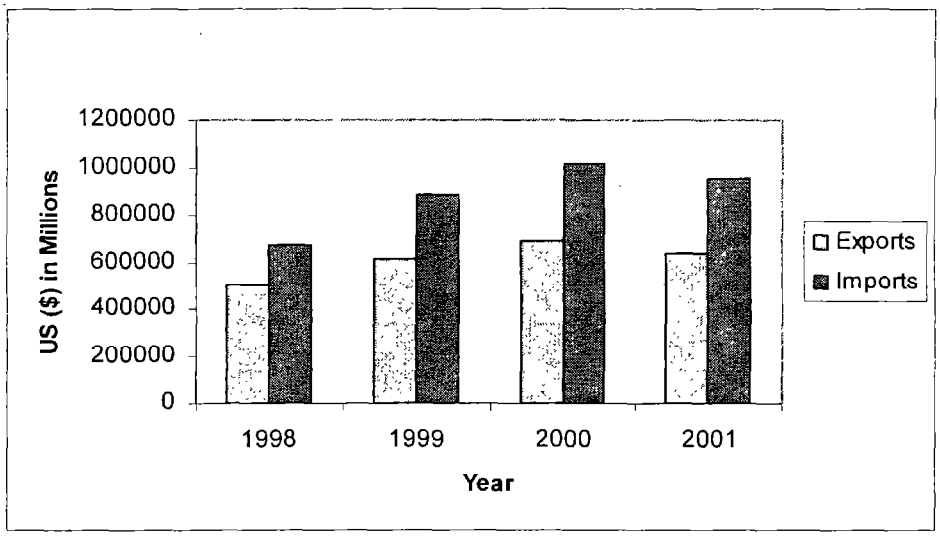
Merchandise trade grew at an annual average rate of approximately 7.8 percent during the period 1950 – 1963 while world output grew at an annual rate of 5.6 percent. This trend increased and continued through the early 1970s. There was a slump in merchandise trading during the period spanning from 1973 – 1990. The slump in international trade was due to the severe economic conditions of the 1970s and 1980s.[3] As economic conditions improved in the 1990s, world merchandize trade also improved.

Growth Trends in U.S. Trade

One of the key components of Gross Domestic Product (GDP) is net exports (the difference between exports and imports). According to basic economic theory, a positive net export level contributes directly to employment generation and economic growth, while a negative level of net exports is perceived to be inimical to economic growth. In basic accounting, it appears that a surplus correlates to an infusion of outside money and economic gain while a deficit does not.

There is a positive trend of growth in trade activities of manufactured goods in the United States. Exhibit 2 shows recent trends in trade of manufactured goods in the United States. The increased trend of the trade deficit in manufactured goods is clear. However, the total value of the traded goods shows 1998 – 2001 growth in both imports and exports signifying that there is an increasing trend of trading manufactured goods between the United States and other countries around the world.

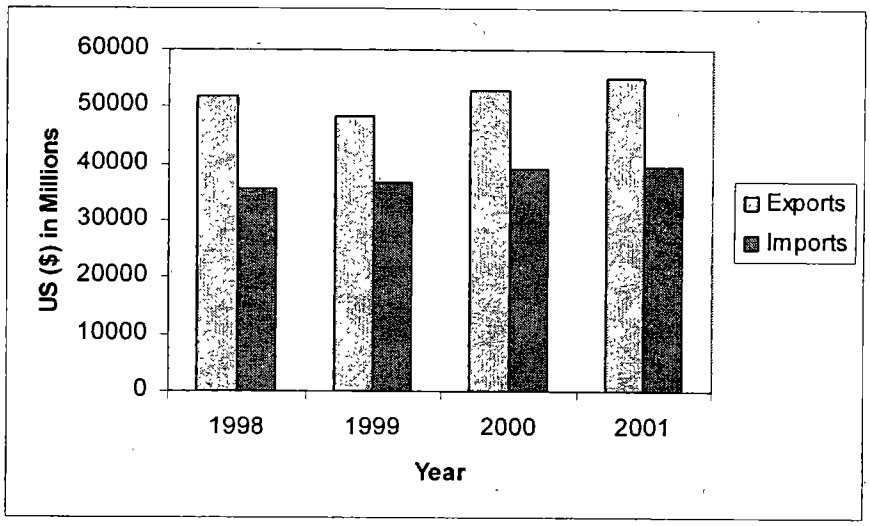
Exhibit 2: Trends in United States Trade - Manufactured Goods



Source: Trade and Industry Analysis Division, The Office of Trade and Economic Analysis (OTEA), United States Department of Commerce, 2002.

Exhibit 3 shows recent trends in agricultural products. While the United States exports of agricultural products have been exceeding imports over the years, the imports have been gradually climbing.

Exhibit 3: Trends in United States Trade - Agricultural Products



Source: Trade and Industry Analysis Division, The Office of Trade and Economic Analysis (OTEA), United States Department of Commerce, 2002.

Domestic Trade: Value, Products, and Trade

Trade is important not only in the global context, but also at the regional and local levels of the economy. Domestic trade activities seem crucial to the overall health and growth of the United States economy. By sector, wholesale and retail trade sectors account for approximately 16 percent of total United States GDP and 22 percent of total employment. While retail and wholesale trade only capture portions of all trade-related activities, it is worthwhile to note that the two industry sectors account for nearly 16 percent of total United States GDP. When services, transportation, and manufacturing activities associated with trade-related activities were counted, the significance of trade in the domestic economy would be even greater.

Domestic trade is a major source of economic activity in the United States. Economic benefits of domestic trade are also reflected in terms of total value of goods traded within the United States. According to the 1997 commodity flow survey that measured the exchange of goods among local regions in the United States, domestic trade involved at least 40 product groups. This trade was worth approximately $6.9 billion dollars in 1997. [4]

The economic benefits from domestic trade are not limited only to the value of the goods traded. Domestic trade activities generate additional economic activities that support production, storage, transportation, and transaction of the exchanged commodities. It is clear that trading

goods makes a substantial contribution to economic development in the United States that goes well beyond face values of the exchanged products.

As Table 1 shows, the value of the top 20 product groups traded in the United States has been growing substantially in recent years. For all goods traded in the United States the percent change in value from 1993 to 1997 was nearly 19%. As domestic trade contributes to employment and income generation in regions where it occurs, growth in trade activities generally implies growth in local and regional economic development.

Table 1. Top 20 Product Groups Ranked by Value

Rank	Product Group	Value($ mil) 1997	% Change (1993-1997)
	All commodities	$6,943,988	18.8
1	Electronic and other electrical equipment	869,675	69
2	Motorized and other vehicles (including parts)	570,981	14.5
3	Miscellaneous manufactured products	420,883	80.8
4	Machinery	417,103	8.4
5	Textiles, leather, and articles of textiles or leather	379,161	-15.5
6	Other prepared foodstuffs and fats and oils	346,379	-0.1
7	Base metal in primary or semifinished forms	285,690	97.5
8	Plastics and rubber	278,832	18.1
9	Printed products	260,327	46.1
10	Mixed freight	230,415	11.5
11	Articles of base metal	227,182	-20.7
12	Pharmaceutical products	224,448	37.3
13	Gasoline and aviation turbine fuel	217,051	6.8
14	Chemical products and preparations, n.e.c.	209,487	-2.5
15	Meat, fish, seafood, and their preparations	183,784	8.7
16	Basic chemicals	159,623	57.7
17	Precision instruments and apparatus	157,946	-4.9
18	Transportation equipment, n.e.c.	129,185	0.1
19	Wood products	126,426	15.8
20	Milled grain products and preparations, and bakery products	109,854	22.6

While the top-traded products by value in presented Table 1 are mainly manufactured goods, agricultural products usually produced in rural areas have been growing substantially as well. Table 2 shows the top 20 products ranked by percent change in value. It indicates that significant growth occurred in trading of agricultural commodities during the period between 1993 and 1997. For example, trade in fertilizers used in agricultural production grew approximately 60% between 1993 and 1997.

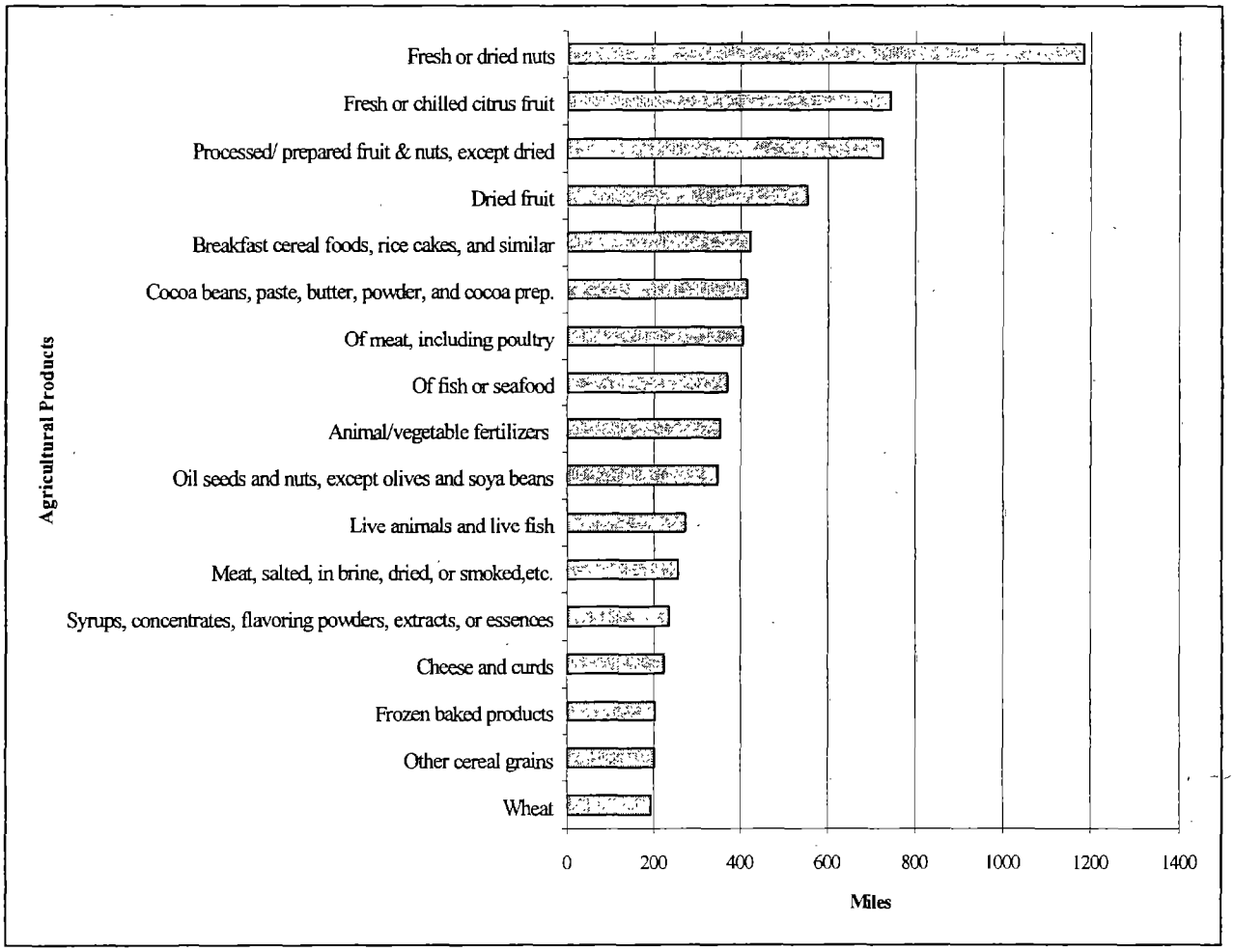
Table 2. Top 20 Product Groups Ranked by Percent Change in Value

Rank	Product Group	Value($ mil) 97	% Change (1993-1997)
	All commodities	$6,943,988	18.8
1	Monumental or building stone	2,726	169
2	Gravel and crushed stone	11,508	103.7
3	Base metal in primary or semifinished forms	285,690	97.5
4	Miscellaneous manufactured products	420,883	80.8
5	Electronic and other electrical equipment	869,675	69
6	Commodity unknown	36,527	66.5
7	Natural sands	4,279	65
8	Metallic ores and concentrates	12,605	63.6
9	Fertilizers	27,334	60.3
10	Basic chemicals	159,623	57.7
11	Printed products	260,327	46.1
12	Waste and scrap	32,714	44.9
13	Pharmaceutical products	224,448	37.3
14	Cereal grains	59,642	32.9
15	Fuel oils	94,309	31.4
16	Milled grain products and preparations, and bakery products	109,854	22.6
17	Nonmetallic mineral products	109,197	20.4
18	Nonmetallic minerals n.e.c.	11,329	18.4
19	Other agricultural products	102,344	18.3
20	Plastics and rubber	278,832	18.1

Exhibit 4 shows 20 agricultural products ranked by average miles traveled. On average, most agricultural commodities travel more than 100 miles. This is an important aspect of agricultural commodity trade. The tendency shows that the geographic range of the market for most agricultural products extends substantially far beyond local markets. In the local economic development context, Exhibit 4 suggests that there is no reason why producers of tradable agricultural commodities should only sell their goods in the local markets. Furthermore, the data indicates that potential markets exist outside of the local markets. Therefore, facilitating long-distance transportation of agricultural products outside of the local markets can benefit the local economy.

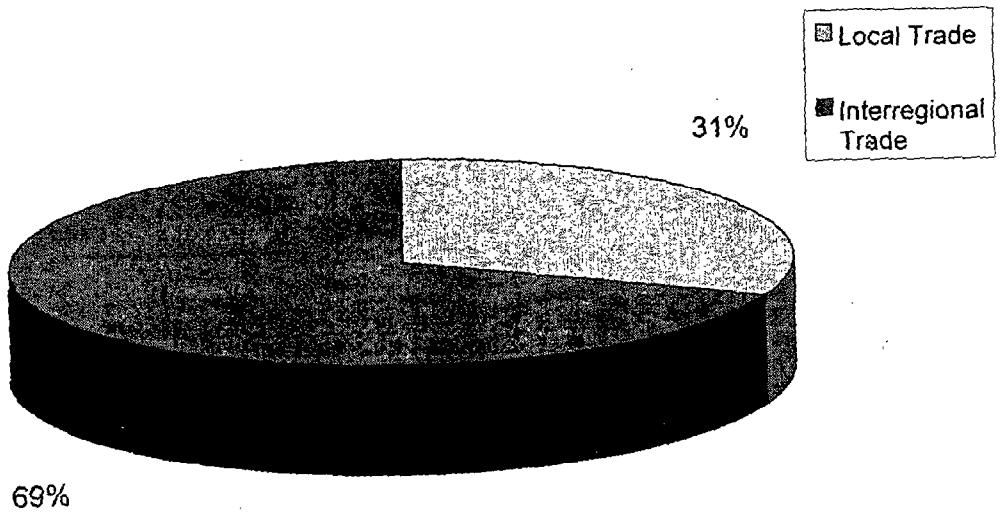
Out of 41 major agricultural commodity groups examined, ten groups are reported to trade within 100 miles. Notable commodities that are traded within 100 miles are milk and cream, logs for lumber and pulp, vegetables, and perishable baked goods. For more detailed information on the agricultural products and their average miles traveled, please see Appendix A of this report.

Exhibit 4. Agricultural Products by Average Miles Traveled



Based on the 1997 Commodity Flow Survey, there is more dollar value in long-distance trade than in local trade. Exhibit 5 shows that the long-distance trade represents more than twice as much in value as the local trade.[5]

Exhibit 5: Commodity Trade – Distribution of Value



2. ECONOMIC DEVELOPMENT AND TRANSPORTATION INFRASTRUCTURE: LITERATURE OVERVIEW

A substantial number of theories and empirical studies shed light on the relationship between economic development and transportation infrastructure. This chapter reviews these theories and empirical studies with the aim of providing insights into how improving transportation infrastructure contributes to goods movement and trade.

Overview of the Issues

There are widely recognized relationships between transportation infrastructure and four key aspects of economic development:

- Production Costs
- Industrial Location
- Regional Productivity
- Cost of Interregional Trade

Transportation Infrastructure and Production Costs

The literature indicates that transportation infrastructure directly influences the cost of production for industries in a region. As the cost of inputs used by industries to produce goods contain transportation costs, reduction in transportation costs due to improved transportation infrastructure tends to reduce industry production costs.

Two principal reasons account for the reduction in transport costs resulting from improved transportation infrastructure. First, improvements in transportation infrastructure reduce the time for moving inputs and consequently reduce the labor hours and costs associated with moving goods. Second, improvements in transportation infrastructure reduce maintenance cost of vehicles involved in goods movement. This reduction in maintenance costs results from the efficient use of goods-moving vehicles and translates into reduced costs for transportation and other factors of production.

Again, standard economic theory explains the relationship between transportation infrastructure improvements to industry production costs. Standard theory asserts that if transportation service is considered a factor of production, improvements in transportation infrastructure that reduce transportation costs will decrease the cost of production for industries using the infrastructure.[6]

The reduction in the cost of production generates economic development benefits for a region in a number of ways. One important benefit is that reduced production costs enhance regional competitive advantage and allow regions to attract industries. Another benefit is that the cost savings resulting from reduced production costs directly enhance proprietary income, which can

contribute to regional economic development through investment in equipment or products of the regional economy.

Transportation Costs and Industrial Location

The relationship between transportation infrastructure and industrial location is another important dimension of the link between transportation infrastructure and economic development. The literature shows that transportation infrastructure influences the location of industries and other types of production that rely on transportation infrastructure. Industries that need to move their products to distant markets as well as receive inputs from distant regions will consider transportation infrastructure conditions as a part of the consideration on the cost of transport. Further, the literature explains that different transportation costs among regions influence the regional location of production plants, which are not geographically tied to fixed inputs such as in mining industries or in other natural-resource extraction industries.

A principal argument for this relationship between transportation infrastructure and the location of goods production is that the cost of transportation is an important factor in selecting industry locations. Since industries need to ship their outputs to different regions and need to receive production inputs from different regions, issues of access to adequate, affordable transportation systems become important when considering sites for manufacturing plants.

The regional science literature concerned with location of economic activities provides this insight on the relationship between transportation infrastructure and industrial location. The basic logic is that the cost of transportation reduces net profit and therefore the cost of shipment from the site of production to site of the market is an important factor affecting the choice of location. Not every region can produce commodities that must be transported. Hence, the decision to produce in one location depends on the cost of transporting products to the market location.[7]

The location of industries in a region contributes to economic development by increasing direct and indirect employment. The use of local labor by the new industry increases regional employment directly. The increase in the demand for local products and services as a result of the newly established industry contributes indirectly to regional employment growth. Hence, regions where adequate and appropriate transportation infrastructure exists or transport costs are relatively low will attract industries that rely on transportation services. As these activities contribute to employment and economic growth in a region, transportation infrastructure contributes to regional economic development.

Transportation Infrastructure and Regional Productivity

Regions with adequate transportation infrastructure, such as good road networks, airport infrastructure, and access to port facilities, tend to have a higher level of productivity than those with inadequate transportation infrastructure.

One reason for this positive relationship is that transportation infrastructure influences regional productivity through the facilitation of efficient movement of goods and labor used in production. Hence, improved transportation infrastructure can enhance the efficiency of goods and labor movement for production. The reduction in time and effort required to produce goods translates directly into increased regional productivity.

The reason for the positive relationship between transportation infrastructure and regional productivity is grounded in standard economic theory related to the link between capital stock and productivity.[8] In brief, this theory states that in any given region or industry, the better the capital stock, the more productive are economic activities that use or depend on that capital stock. The application of this theory to transportation infrastructure and economic development interrelationships usually considers transportation infrastructure as a type of physical capital.

As regions with high productivity tend to be attractive to industries, transportation infrastructure also tends to influence regional income and regional economic development through its effect on long-term regional productivity. One result of this effect on economic development is that employment and economic growth tend to rise over time in a region that invests significantly in transportation infrastructure. Another result is that the quantity of goods produced and the level of income earned tend to rise rapidly over relatively short periods of time in regions with growing productivity.

Cost of Interregional Trade

Extensions of the literature on industrial location and transportation infrastructure provide interesting links between transport costs and regional distribution of production and interregional trade (Krugman, 1991; Fujita, Krugman, et al; 1999). This relatively recent literature on the interrelationship between transport cost, production, and trade emphasizes transport costs and the geography of production as the important determinants of interregional trade and regional economic growth.

Transportation costs and economies of scale in the geographic concentration of production influence interregional trade patterns according to the literature on industrial location and transportation infrastructure. This explains why regions with low costs of production and transportation are likely to dominate the production of goods and increase the geographic concentration of goods production. This concentration can generate economies of scale and reinforce the further concentration of goods production in the region. This theory suggests that a region can increase its advantage in trade by lowering the transportation costs for interregional goods movement.

The central argument in this literature on transport costs, geography of economic production, and interregional trade is that there are advantages to producing goods in a few locations. Given the need to supply a large number of markets from these few locations of production, the cost of transport from a location of production to market areas becomes important in determining the production locations. This consideration ultimately determines the regions that export particular commodities. As exports influence economic growth, transport costs influence economic

development in a region. Moreover, transport costs affect the geography of production and interregional trade by encouraging production in certain locations and discouraging it in others.

Further, this extension of the industrial location literature explains that initial conditions in regions play vital roles in establishing the geography of production and thereby the pattern of interregional trade. Because there are increasing returns to scale, initial conditions that lead to the development of particular industries, especially manufacturing, in one region will tend to reinforce the production of those particular goods in that region. This tendency helps the region in the production of those particular goods as long as transport costs remain relatively low. As a result, there will be a pattern of trade in which particular goods flow from this region of initial production to other regions to satisfy demand.

The concentration of production in a region generates many regional economic development benefits. One regional economic development benefit of the concentration of production is that regions can dominate interregional trade of the commodities whose production is concentrated within the particular region. This domination of interregional trade allows the region to rapidly expand employment and generate substantial economic growth by supplying products to many regions. For instance, the concentration of computer chip production in Silicon Valley in the 1990s led to the rapid economic growth of Silicon Valley and surrounding areas as the region supplied computer chips and software to substantial number of regions within the United States and other major countries.

Another major economic development benefit of the geographic concentration of production is that such concentration attracts other industries and activities that rely on the products whose production is concentrated. When there are economic benefits to locating near suppliers, some industries may move to the regions offering these benefits. The attraction of new industries contributes to the rapid increase in employment and economic growth in regions with concentrated industries.

Results of Empirical Studies

Many studies on the United States economy as well as regional economies in the United States have examined various aspects and extensions of the theories discussed in the previous section.[9] In general, these studies find supportive evidence for links between economic development and transportation infrastructure. This section reviews the empirical studies on the links between transportation infrastructure and the previously described aspects of economic development:

- Production Costs
- Industrial Location
- Regional Productivity
- Cost of Interregional Trade

Most studies examining the relationship between transportation infrastructure and productivity using U.S. data find a positive significant relationship between transportation infrastructure and productivity at the national, state, regional, and industry levels.[10] As productivity increases

usually translate into increases in real employment, income, and real wages, there are also studies that consider these issues. Again, the results of these studies generally indicate a positive significant relationship between transportation infrastructure and growth in regional output, employment, and income (Luce, 1994; Garcia-Mila et al., 1992; Crihfield and Panggabean, 1995; Singletary et al., 1995).

The evidence for the empirical links between transportation infrastructure and cost of production is also very strong in a number of studies at national, regional, and industry levels (Morrison and Schwartz, 1996; Nadiri and Mamuneas, 1994; Holleyman, 1996; RESI, 1998). These studies suggest an inverse relationship between transportation infrastructure and the cost of production at national, regional, and industry levels for different measures and types of transportation infrastructure.

Empirical studies on transportation infrastructure, interregional distribution of production and the location of industries interrelationships also find supportive evidence. These studies indicate that transportation infrastructure improvements affect the regional distribution of employment in a way that favors the region in which the improvement occurs (Boarnet, 1996). The evidence further indicates that the net regional output resulting from interregional redistribution of employment due to transportation infrastructure improvements is positive.

Implications of Research for Goods Movement and Trade

The literature on transportation infrastructure and economic development offers a number of important implications for goods movement and trade. First, insights on the positive relationship between transportation infrastructure and regional productivity suggest that transportation infrastructure improvements are vital aspects of any economic development strategy aimed at elevating regional productivity. The positive relationship between transportation infrastructure and regional productivity indicates that an economic development strategy that ignores or neglects developing adequate transportation infrastructure fails to use an effective instrument for pursuing its objectives. The literature also indicates that a neglect of transportation infrastructure is a neglect of economic development.

Second, the literature suggests that one way the public sector can help to reduce production costs for businesses is to ensure that transportation infrastructure adequately facilitates shipment of goods to and from industries within the region and goods coming from or going to other regions. Facilitating the distribution of goods movement within the region can improve regional productivity and enhance the region's role in interregional trade.

Third, the evidence indicating that transportation infrastructure affects the location of industries implies that a development strategy involving attraction of new industries to a region must ensure that regional transportation infrastructure is adequate for the targeted industries. Industries' ability to gain access to supply routes must be evaluated in accordance with existing transportation infrastructure and the potential location of manufacturing plants and distribution centers.

Finally, the evidence indicating that transport costs affect the geography of production and the pattern of interregional goods movement suggests that the development of adequate transportation infrastructure for interregional goods movement is vital to strengthening the competitive position of the region as a center for interregional trade. Failure to lower transport costs to competitive levels affects not only shipping industries, but also the ability of a region to sustain trade.

3. FOUR TYPES OF TRANSPORTATION INFRASTRUCTURE IMPROVEMENTS: ECONOMIC DEVELOPMENT EFFECTS

The theories and evidence reviewed on transportation infrastructure and economic development interrelationships in the previous section indicate that the transportation infrastructure affects different aspects of economic development. It is also illustrated in the theories and evidence reviewed that transportation infrastructure may influence key economic factors at the industry, regional, and national levels. This chapter discusses four types of transportation infrastructure and the aspects of economic development they affect.

Highways

Highways usually affect most aspects of regional economic development including productivity, production costs, and interregional trade. This happens because most economic activities either depend on or use highways in the transport of goods involved in trade.

Highways affect regional productivity by connecting different regions to each other and allowing the exchange of goods and services to occur among them. The facilitation of trade allows regions to specialize in those goods that they are most efficient in producing.

In cases where highway infrastructure improvements differ across regions, they influence regional differences in transportation costs. Differences in transport costs influence long-term regional distribution of production and thereby interregional trade patterns. When industries in different regions relocate to benefit from higher productivity and lower transportation costs, changes in trade patterns and regional distribution of production can take place.

In instances where a highway improvement changes road networks to accommodate larger trucks and traffic volumes, the improved highway system leads to improved efficiency in the interregional movement of goods. Such an improvement also allows a region to accommodate production that relies on larger trucks to move its products and inputs. This can foster regional productivity growth and provide cost reduction benefits to most industries and households that use the new road networks.

Ports

Sea and inland ports give regions access to foreign trade and are usually a low-cost means for shipping bulky items to and from distant regions. Improvements that increase the efficiency of ports will therefore benefit interregional trade in goods and contribute to employment growth and regional productivity. These efficiencies impact productivity by enhancing the movement of large volumes of goods to distant regions and extending the market reach of industries and regions using the port facilities.

Regions with ports also benefit by offering transshipment services to land-locked regions. In effect, a region with well-developed port facilities can sell port services to other regions. Hence, improvements in port services can increase a region's competitive advantage in attracting businesses from other regions.

Like sea and inland ports, airports influence many important aspects of regional economic development and facilitate the fast delivery of important products and services. Courier services and many professional services benefit from an airport. Airports offering low fares attract business to a region and contribute to employment, income, and productivity growth in that region. Efficient and reliable airport services reduce delivery times and enhance the productivity of regions and firms. The availability of efficient and reliable airport services can influence a firm to locate in a region.

Airports contribute to a region's ability to attract and sustain specific industries. For example, tourism in some regions relies on access to airports to attract tourists from foreign and distant regions. Moreover, industries that rely on fast and reliable transportation service must operate from regions with adequate airport services. Research centers and law firms, for example, that often ship products overnight usually operate in regions with reliable and efficient airport services. Finally, as an airport can serve many cities and regions, it often influences a large geographic area. The benefits of airports therefore are regionally diffused and not limited to just the region in which they are located.

Distribution Facilities

Distribution facilities improve overall regional productivity. When distribution facilities reduce congestion they allow a region's economy to function efficiently. Goods flow more freely and people take less time to undertake work-related travel in regions where distribution facilities remove significant large truck traffic from dense travel routes.

Distribution facilities can also reduce production cost for industries that use them. Distribution facilities that allow industries to consolidate shipments in one location reduce logistical costs for industries by increasing economies of scale in distribution.

Distribution facilities can affect the geography of production by attracting production close to where they are located. When industries or warehouses develop near distribution centers they affect the geography of production. By clustering in a single location, productivity increases as a result of efficiency in interindustry transactions.

Intermodal Connectors

Intermodal connectors, namely access roads to ports and connectors linking roads to each other perform a valuable function in the transportation network. Without them, the transport network is incomplete and cannot to facilitate efficient transfer of goods and people.

Given their importance in the transportation network, they affect all aspects of economic development that other transportation infrastructure affects. Intermodal connectors allow the transportation network to operate as it should.

Access roads to ports are intermodal connectors that allow regions to access port services and thereby reduce industry production costs for firms that use them. When they allow improved access to ports by large trucks, they promote economies of scale in goods movement, which reduces costs for shipping industries. When they serve as links in the transportation network, they promote efficiency in goods movement and increase regional productivity.

4. PRACTICAL CASE STUDIES LINKING ECONOMIC DEVELOPMENT STRATEGIES WITH TRANSPORTATION PLANNING FOR GOODS MOVEMENT

In selecting "good practice" case studies linking transportation planning for goods movement with economic development strategies, we followed a simple guideline that focused on projects and studies that were directly connected to promoting economic development. In this regard, only projects that had the specific aim of supporting local industries, economic development, or removing major barriers for goods movement were examined as potential cases.

This guiding principle for limiting potential case studies to those with direct links to economic development promotion is consistent with the main objective of this report. First, the main purpose of this study is to describe and demonstrate examples of ways in which transportation infrastructure improvements contribute to economic development by supporting trade activities. Therefore, it is reasonable to focus on studies that illustrate direct associations with economic development and transportation infrastructure.

Secondly, transportation improvements can serve various economic and social functions such as relieving traffic congestion, improving safety, or changing impacts of air pollution. However, the net effect of different types of transportation improvements on goods movement is not generally clear. Relative impacts stemming from transportation improvements may differ significantly depending on existing transportation infrastructure conditions. It may be possible to observe more pronounced impacts of transportation improvements in the economy where the existing transportation system poses serious barriers to efficient goods movement. Hence, we put emphasis on regions and economies with severe economic underdevelopment as well as those areas with major impediments to goods movement.

More specifically, the following general aspects of transportation studies were considered to serve as guiding variables in selecting good practice examples:

- Size of the study area
    - Regional
    - Statewide
    - County or multicounty
    - Subcounty
- Mode of transportation
- Commodities produced by local and regional economy

The broad categories noted above should only be considered as general aspects in examining case studies. We recognize that there may be other sets of criteria for examining case studies in the areas of public transportation investment and goods movement. However, for the purpose of this project, these general aspects of case studies were used to consider and select four good practice examples.

For this report, we draw on four previous projects that show examples of economic development strategies through facilitation of goods movement. Three studies examined regions in California and the fourth in West Virginia.

(1) Monterey Bay Area, California
In the Monterey Bay Area of California, Jack Faucett Associates (JFA) performed a multimodal freight movement study. One part of the project included presentation of a set of recommendations for alternatives to meeting the freight transportation needs of the agricultural industries in the region, including the establishment of a freight distribution center.

(2) Fresno County, California
In Fresno County, California, JFA conducted a study of the relationship between transportation and economic development. JFA examined links between highway improvements and the positive effects they may bring to local industries. Highway improvements are important in business location decisions, reducing production costs, and raising the overall productivity of the region

(3) Eastern Southern California
In Eastern Southern California, Coachella Valley region, JFA recently performed a study examining the potential economic development impacts of a proposed bypass route in Eastern Southern California through the three counties including Imperial, Riverside, and San Bernardino. Facilitating goods movement by creating the bypass highway can improve the overall productivity of the region and encourage industries to locate in the area by providing easier access to efficient transportation systems. The study concluded that the bypass can provide a much less congested route for travelers, and attract more through-traffic in the region. Many traveler-serving businesses in the vicinity can capture potential economic benefits from increased travelers in the area.

(4) Putnam County, West Virginia
For the Army Corps of Engineers, JFA conducted a Port Commodity Market Study of a potential port site along the Kanawha River in Putnam County, West Virginia. When a number of businesses can share terminal facilities, they can utilize economies of scale, reducing costs of transportation further. Higher productivity and reduced production costs can encourage new businesses to locate in Putnam County and spur economic growth in the area.

Table 3 provides a summary of the four studies considered in the report in terms of various aspects of transportation and economics studies. All four examples presented here are studies conducted at multicounty, county, or smaller geographical level. All four studies examined existing conditions and limitations that represent severe impediments to goods movement in their respective study areas. Another similarity between the four selected studies is that when socioeconomic variables were examined, the study areas were generally rural. All four projects identify links between transportation improvement projects and planning, and their positive effects on the local economy. More detailed discussions the four selected cases are provided in the following paragraphs.

Table 3. Four Selected Cases and General Aspects of Transportation and Economic Studies

General Aspects of Transportation and Economic Studies		Monterey, CA	Fresno, CA	Coachella Valley, CA	Putnam County, WV
Size	Regional				x
	Statewide				x
	County or multicounty	x	x	x	x
	Subcounty		x		
Modes of Transportation	Roads	x	x	x	
	Rail				
	Water				x
	Air				
	Intermodal	x			x
Commodities Produced	Agricultural goods	x	x		x
	Manufactured		x		x
	Mining and other raw materials				x
	Unknown			x	x

Monterey Bay Area, California

JFA conducted a multimodal freight movement study, with emphasis on agribusiness products, in the Salinas and Pajaro Valleys, in the Monterey and Santa Cruz Counties for the Association of Monterey Bay Area Governments (AMBAG). AMBAG, as the metropolitan planning organization, is responsible for federal transportation planning in Monterey and Santa Cruz Counties. Agribusinesses in the region are vital parts of the local economy, and can draw benefits from transportation improvements that remove or mitigate existing limitations and constraints in the local freight transportation system. The study assessed local, intraregional and interregional freight movement needs, summarized existing conditions (existing freight movement, facilities, and services), and forecasted regional demand for agricultural and related freight movement through 2015.

One of the projects suggested as a solution to area freight transportation deficiencies was a freight logistics center. The center included a centralized information function, on-site parking for trucks, a truck stop, and various other truck-servicing businesses. JFA made a preliminary assessment of the costs and benefits of such a distribution facility. The recommendations for improving the Monterey region's transportation infrastructure were designed to improve upon existing conditions and limitations that form barriers to efficient agricultural goods movement in

the region. The distribution facility serving agricultural industries in the region can enhance regional productivity and reduce costs for many agricultural producers. Also affected can be business location decisions of existing and prospective businesses when such a distribution facility is in place and alleviating various transportation inefficiencies.

Although the main aspect of transportation infrastructure improvements examined in the study was a distribution facility that was to improve overall regional productivity, highway and intermodal aspects of transportation infrastructure improvements were also considered. Bottlenecks and inefficiencies in the system were also identified along with problems associated with availability and reliability of freight service, freight rates, competitive problems in the carrier industry, and shipment delays. JFA evaluated potential system improvements that could include roadway capacity expansion, interchange upgrading, intermodal facilities, or agricultural industrial park/center concepts. As highway and intermodal aspects of transportation infrastructure improvements provide necessary boosts to the region's productivity and transportation systems' overall efficiency, they can also reduce production costs and encourage businesses to stay in or relocate to the region.

Improvements of highways, intermodal connectors, and creation of a new freight distribution facility can increase the Monterey region's overall productivity by aiding agricultural producers and associated businesses, which are vital to the region's economy. The transportation infrastructure improvements discussed in this case also can reduce production costs and affect industrial locations of many important businesses in the region.

Fresno County, California

JFA conducted a study of the relationship between transportation and economic development in Fresno County's Manning Avenue corridor for the Federal Highway Administration's Economic Development Corridors Initiative. This study (1) increased the knowledge about the relationship between highway investment and economic development to improve federal transportation policies and funding strategies and (2) provided technical assistance to local communities and agencies within the corridor area and in the rest of Fresno County. JFA developed a sketch-planning tool for the study analysis that was also provided to local stakeholders. This sketch-planning tool forecasts the transportation, economic, and fiscal impacts of economic development projects or scenarios.

Through a targeted local employer survey in the Manning Avenue corridor, JFA confirmed the hypothesis that the capacity and condition of highways matter in business decision making. Improved road conditions not only affect the efficient and safe transport of business supplies and products, but also impact the attractiveness of an area in terms of the expansion of existing businesses, and presumably the establishment of new businesses by prospective employers as well.

Given the importance of transportation facilities in local and regional economic development, JFA analyzed the capacity of Manning Avenue to accommodate the corridor's employment growth, as projected by the County, for the years 2002 through 2020. Currently there is a

bottleneck, or segment of generally unacceptable traffic, along Manning Avenue in the City of Reedley. Based on the local employer survey results, JFA assumed that new employers would find unacceptable traffic conditions, such as the bottleneck, a constraint to economic development, and consequently would seek other areas in Fresno County, or the surrounding region, for business establishment.

JFA analyzed the potential of planned improvements to reduce existing bottlenecks in the Corridor and found that traffic in the year 2020, even with the planned improvements, would be considered unacceptable during the peak travel hour. By 2020, this traffic congestion could place 30% to 47% of the projected office and industry (or primary) jobs at risk. Not gaining these "at risk" jobs would have significant economic and fiscal impacts on the local economy. In 2020, the absence of these jobs from the local corridor economy would translate to the loss of approximately $58.8 million in potential income for local residents. The reduction in potential income also has significant impacts on local tax revenues: approximately $1 million per year in potential sales tax and property revenue and $ 0.9 million per year in potential property tax revenue for the year 2020.

The Fresno County Manning Avenue Corridor Study demonstrates the potentially significant economic and fiscal impacts of highway capacity on economic development. The study suggests that highway investment can support economic development by promoting an acceptable level of traffic service along major transportation corridors.

Coachella Valley Area, Eastern Southern California

JFA completed a study examining the potential economic development impacts of a proposed bypass route in Eastern Southern California through the three counties of Imperial, Riverside, and San Bernardino. The study also examined highway improvements as a type of transportation infrastructure improvements. The route would allow trucks and passenger vehicles traveling through southeastern California and points north of the Los Angeles basin to bypass the Coachella Valley and Los Angeles areas, thereby reducing air pollution and congestion impacts throughout the region. The purpose of this study is to estimate usage of the bypass route and the corresponding economic development impacts on the corridor. The study also considers any loss in economic development along competing routes.

Transportation infrastructure improvements such as the bypass route can aid goods movement by providing more efficient access to transportation facilities by a number of industries within and outside the study region. Due to factors like the North American Free Trade Agreement (NAFTA), trade between the United States and Mexico is expected to increase significantly in coming years. This will generate more truck traffic between Mexican border areas and other parts of California. Efficient goods movement by improving highways would not only help increase the overall productivity of the region, but also encourage business location decisions. As the bypass route is designed to provide better access to numerous market areas for many industries, the study region can attract potential employers that can take advantage of effective transportation systems.

Another potential benefit of the proposed bypass route is added revenues to local traveler-serving industries. It is expected that many traveler-serving businesses will benefit from increased traffic diverted to the proposed bypass.

This type of transportation infrastructure improvements can impact the region in several positive ways. By providing more efficient ways for goods movement, the proposed bypass can increase overall productivity of the study region and surrounding areas. The highway improvements can also benefit existing local businesses that serve travelers who drive through the region. After the proposed bypass is constructed, it may attract new businesses seeking less-congested highway routes to the area, spurring economic growth in the region.

Putnam County, West Virginia

The Huntington District of the United States Army Corps of Engineers with the West Virginia Public Port Authority commissioned the Port Master Plan for the Buffalo Putnam County Port District. It is a guideline for the development, marketing, and operation of a potential port site on the Kanawha River in Putnam County, West Virginia.

The study focused on the development of public port/industrial park concepts along Kanawha River with potential for economic development in the region. While the focus was on Putnam County and potential sites for port terminals, neighboring counties such as Kanawha, Mason and Cabell counties, West Virginia were examined. JFA also considered economic and commodity variables for the Ohio River System and the state of West Virginia in the study. The study evaluated the competitive advantages for certain commodities associated with access to river shipping. The evaluations include commodity forecasts including origin-destination patterns, costs of transport by competing modes, and economic development benefits for the region.

Developing a port or improving port facilities can benefit goods movement and contribute to employment growth and higher regional productivity. These improvements impact productivity by enhancing the movement of large volumes of goods to distant regions and extending the market reach of industries and regions using the port facilities. The concept of an industrial park associated with the port facility focuses on developing new business rather than competing with existing terminal operators. The notion of a public river terminal being a part of a riverfront industrial park focuses on attracting jobs and adding to the local tax base by providing industrial sites and enticing industries to occupy those sites.

Another aspect of the port improvements includes a publicly owned river terminal that would be a business attraction, providing access to an efficient mode of transportation for appropriate industries identified in the study. Intermodal connectors as part of port improvements allow businesses to access port services and thereby reduce industry production costs for the businesses in the region. In addition, a large facility with numerous tenants spreads the risk and costs of investments in piers, cranes, and other equipment. Similar economies of scale are generated in foreign trade zone creation, environmental compliance, and selected site development and administrative costs.

Economic and financial feasibility measures for the Buffalo port site fare well under various scenarios examined in the study. The estimates indicate that the creation of a public port can provide benefits to the region, state, and nation that exceed costs by significant margin. The study results reflect that public ports can provide a worthwhile investment in situations where transportation infrastructure can be jointly utilized by a number of tenant facilities allowing shared costs.

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APPENDIX A

Agricultural Products by Average Miles Traveled

Rank	Commodity	Value ($ Mil)	Average Miles
1	Fresh or dried nuts	1,838	1183
2	Fresh or chilled citrus fruit	3,389	743
3	Processed/ prepared fruit & nuts, except dried	11,298	725
4	Dried fruit	1,370	553
5	Breakfast cereal foods, rice cakes, and similar	5,536	422
6	Cocoa beans, paste, butter, powder, and cocoa prep.	972	414
7	Of meat, including poultry	3,378	405
8	Of fish or seafood	1,439	368
9	Animal/vegetable fertilizers	1,529	353
10	Oil seeds and nuts, except olives and soya beans	3,825	348
11	Live animals and live fish	6,173	272
12	Meat, salted, in brine, dried, or smoked,etc.	12,971	256
13	Syrups, concentrates, flavoring powders, extracts, or essences	11,689	235
14	Cheese and curds	27,907	223
15	Frozen baked products	11,655	202
16	Other cereal grains	11,642	201
17	Wheat	16,650	193
18	Coffee, tea, and spices, except unprocessed coffee and unfermented tea	13,512	183
19	Inedible flours, meals, and pellets of meat, fish, or seafood, and greaves	2,514	177
20	Wine and other fermented beverages	16,207	170
21	Flours and meals of oil seeds, except of mustard	4,068	162
22	Fresh or chilled edible fruit, except citrus	13,927	160
23	Wheat flour, groats, and meal	7,324	151
24	Juices, except those fortified with vitamins or minerals, but including...	11,007	151
25	Fresh-cut flowers	4,110	144
26	Frozen vegetables and vegetable preparations	16,713	130
27	Fresh, chilled, or frozen, except poultry	100,438	128
28	Insecticides, rodenticides, fungicides, herbicides, anti-sprouting products	26,909	125
29	Fish, except live, and seafood, except preparations	25,124	114
30	Fresh, chilled, or frozen poultry	40,434	108
31	Bran, sharps, and other residues of cereals or leguminous plants	1,311	101
32	Perishable or dry baked products	41,040	92
33	Corn, except sweet	31,350	85
34	Soya beans	27,864	76
35	Fresh or chilled potatoes (Irish potatoes), except sweet	5,876	73
36	Fresh or chilled vegetables, except potatoes (Irish potatoes)	20,347	70
37	Processed or prepared vegetables, except frozen, dried, or milled	32,320	67
38	Other, including complete feeds, premixes, bird seed, fish food, and feed...	33,396	65
39	Logs for lumber	9,136	57
40	Logs for pulping (pulpwood)	2,976	56
41	Milk and cream	22,288	49

ENDNOTES

[1] Ben-David and Winters (2000) provides discussions on roles and importance of trade in economic growth.
[2] Ibid.
[3] The quadrupling of oil prices by members of the Organization of Petroleum Exporting Countries (OPEC) and ensuing global economic recession of the 1970s contributed to severe economic conditions in. The Mexican led financial crisis, high inflation and high United States interest rates contributed to difficult economic conditions in the 1980s.
[4] The number of commodities is based on the 2-digit Standard Industrial Classification (SIC).
[5] Local trade as used in this section is trading taking place at an average distance of less than 50 miles.
[6] For a study based on this view, see Nadiri and Mumuneas (1994)
[7] Note that Von Thunen (1826) discusses the location of the production of agricultural goods while Alfred Weber (1929) discussions relates to manufacturing industries
[8] Many researchers have taken this view. A few notable ones include Aschauer (1989), Munnell (1990) and Morrison and Schwartz (1996)
[9] Drennan (1999) provides an up-to-date survey of studies on transportation infrastructure and economic development in the US.
[10] For examples of national, state and regional studies, see Aschauer (1989), Munnel (1990), Tatom (1993) and Holtz-Eakin (1994). A few studies at the industry level are also available (Seitz, 1993 and Fernald, 1999).

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