

Productivity

The Connection Between Transportation Performance and the Economy

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Productivity is not a new buzzword but is now in vogue. Productivity is important for transportation operators and is a primary driver of regional and national economic development. An increasing number of state departments of transportation (DOTs) want to consider productivity impacts in prioritizing programs and projects.

Productivity can be defined as the ratio of output produced per unit of input. For instance, freight operators consider fleet productivity in terms of ton-miles moved per truck, or daily deliveries made per driver. Transit operators consider passenger miles served per vehicle. Transportation systems that are faster, safer, and more reliable—and pickup and delivery systems that are more efficient—can increase productivity ratios. These systems can make better use of available resources and spur greater competitiveness and profitability for transportation service operators.

The same concepts apply to the nation's economy, for which productivity can mean more output per worker or more value added per dollar of business investment. By expanding access to labor markets, supplier markets, and customer markets, transportation infrastructure enables greater productivity for producers of goods and services, as well as for transportation providers.

Transportation's Effects

National Cooperative Highway Research Program (NCHRP) Report 786, *Assessing Productivity Impacts of Transportation Investments*, examines the sources of productivity and notes that transportation can have several effects that include the following (1):

- ◆ Increasing the scale of customer markets that can be served from a single location, enabling fixed costs to be spread over a larger revenue base;

From the warehouse to shipping routes, efficient infrastructure and transportation systems can enhance productivity.



PHOTO: ALEEN SKRYW, FLICKR

Crowds of commuters and travelers pass through Penn Station in New York daily. Transportation expands access to labor markets, specialized materials and services, and more.

- ◆ Expanding labor markets and the ability of businesses to access workers with diverse and specialized skills, enabling a better matching of worker skills to business needs;
- ◆ Expanding access to suppliers of highly specialized input materials and services;
- ◆ Enabling new and more efficient manufacturing, distribution, and business operation technologies; and
- ◆ Enabling clusters of businesses that can gain from the shared use of common resources.

Supply Chain Clusters

Supply chain technology has advanced with improvements in transportation. Fast and reliable truck freight movement via Interstate highways has allowed producers in a range of industries to adopt just-in-time delivery and lean manufacturing processes, which

increase productivity by reducing or eliminating the costly warehousing of parts and materials.

This has led to the development of supply chain clusters along highway corridors. For example, the automotive cluster in the Southern United States brings together car assembly plants and parts suppliers along 150-mile lengths of four highway corridors: I-65, I-75, I-81, and I-85.

The geographic span of these clusters reflects the area from which a same-day, round-trip truck pickup and delivery can be made along uncongested highway routes. The dispersion of assembly plants and suppliers within these areas reflects the cost advantages of spreading out in more rural areas with reduced costs for land and labor.

Improved highway access also has enabled large-scale, centralized logistics and distribution technologies. The completion of I-81, for example, allowed long-distance, north-south truck movements to avoid the congested I-95 corridor. That, in turn, enabled the emergence of centralized warehouses in Eastern Pennsylvania to serve the Greater New York City region, as well as other nearby metropolitan areas.

Technology-Led Industries

Effective road and transit systems for passenger transportation in urban areas also have increased labor productivity by expanding the scale of labor markets. This particularly benefits the research and development (R&D), professional services, and high-tech industries, which seek larger labor markets with a greater choice of workers who have diverse and specialized skill sets.

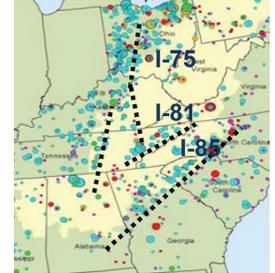


IMAGE: EDR GROUP/APPALACHIAN REGIONAL COMMISSION, SOURCES OF REGIONAL GROWTH IN NON-METROPOLITAN APPALACHIA

Auto supply chain corridors in the Southeastern United States.



PHOTO: VIRGINIA DOT

Running from New York to Tennessee, I-81 provides an alternative north-south freight route to I-95.

The Denver Tech Center along the I-25 corridor in Colorado is home to several major businesses and corporations.

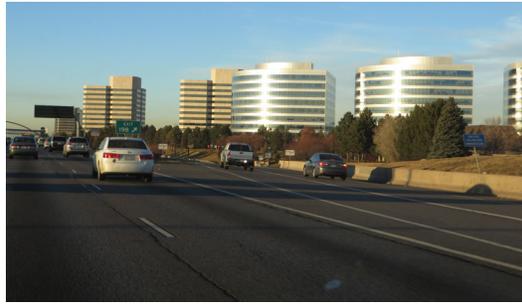


PHOTO: KEN LUND, FICKER

High-tech clusters associated with computer equipment, for instance, have tended to develop in metropolitan areas with a leading R&D university and a relatively large, educated labor market accessible by a highway. Several notable computer technology clusters started as highway-oriented developments—such as the 128 Technology Corridor along Route 128–I-95 in Massachusetts, Silicon Valley along US-101 in California, and Research Triangle Park along NC-147 at I-40 in North Carolina. More recent centers, such as the Denver Tech Center along I-25 in Colorado and the I-270 Corridor in Maryland, have continued the pattern.

Transit's Roles

A recent American Public Transportation Association study of the relationship between transportation and high-tech clusters found two emerging trends that involve transit services (2). One is the operation of bus services sponsored by private industry, supplementing public transit plans for services to relieve congestion in the highway-oriented clusters of technology businesses.

The other trend is the emergence of a new generation of inner-city technology clusters for creative software, social media, and biotechnology R&D companies. The inner-city areas offer transit service, which appeals to many young technology workers who prefer nonautomobile environments.

Kendall Square in Cambridge, Massachusetts, is an emerging transit-friendly, urban technology cluster.



PHOTO: EDR GHOUPA, THE ROLE OF TRANSIT IN SUPPORT OF HIGH-GROWTH BUSINESS CLUSTERS

Kendall Square in Cambridge, Massachusetts; Midtown–SoMa (or South of Market) in San Francisco, California; and Midtown South in New York City are examples of emerging urban technology clusters. In these transit-friendly environments, software and Internet media firms can maximize their productivity by expanding their scale of operation, their access to qualified workers, and their access to R&D centers.

Intermodal Connectivity

Intermodal connectivity is another source of increased productivity. Rail, air, and marine terminals provide ways for businesses to reach beyond the regional supplier and customer markets served by road-based modes to access national and international markets. This can encourage operations at a larger scale, reducing the unit costs of production and increasing the efficiency of centralized distribution systems.

At the regional level, new logistics parks have emerged across the country near air and rail intermodal centers. At the national level, a recent project report from the Airport Cooperative Research Program documented the contributions of air system connectivity to national economic growth in North America (3).

Multiple modal terminal facilities also can be linked for greater productivity. In British Columbia, Canada, for example, the multimodal Greater Vancouver Gateway Transportation Plan has linked road, rail, air, and marine facilities. According to Bob Wilds, Director of the Greater Vancouver Gateway Council, the plan “brought together industry and public agencies [that] understood the need to maintain the region’s competitiveness as a global gateway.”

Slowdowns and Bottlenecks

Infrastructure that once enabled productivity growth, however, may not automatically maintain the same levels of performance over time. Aging facilities and increasing congestion can undermine transportation performance with slowdowns and bottleneck delays. These problems can occur on roads, transit stops, rail terminals, airports, and seaports and apply equally to freight and passenger transportation services. Slowdowns and bottleneck delays reduce the productivity of commuters, transportation workers, vehicles, and equipment.

The effects of slowdowns and bottlenecks can be more extensive. Besides adding cost for transportation service operators and inconvenience for individual travelers, delays also can lead to greater impacts on the economy. For instance, reliability drops as congestion grows, so that freight shippers and receivers incur more overtime costs as workers wait at loading docks for delayed pickups and deliveries.



A busy Metro platform in downtown Washington, D.C. Efficient transit flows prevent highway bottlenecks, which can reduce the effective size of the labor market for businesses, as well as the range of suppliers and customers.

When delivery reliability falls, manufacturers increase warehouse stocks for parts and materials to avoid shortages, shutdowns, and added operating costs. Wholesalers and retailers respond in a similar manner to avoid a loss of sales because of delays in product arrivals. To allow more time for drivers to reach destinations, trucking companies may pad the delivery schedules, moving the pickup times earlier, hiring more drivers, and acquiring more vehicles to make the same number of deliveries in a day.

Slowdowns and bottlenecks also can reduce the effective size of the labor markets from which businesses can draw workers and can reduce the range of suppliers and customers for businesses. When this happens, some businesses move from centralized distribution facilities to establish satellite centers. Consequently, the unit costs of products go up, and the competitiveness of operating in these locations goes down, with negative effects on jobs and pay rates.

Transportation Agencies' Role

Recognition is growing that transportation facilities can have impacts on accessibility, reliability, and

intermodal connectivity, and that these lead to economic impacts far greater than the costs to vehicle operators. Some transportation facilities may play a more critical role than others in supporting regional economic productivity and competitiveness.

A growing number of state DOTs and some metropolitan planning organizations now are adopting prioritization criteria and planning methods that recognize productivity effects. Some have adopted rating systems that give weight to factors supporting economic productivity—such as enhancing truck routes, intermodal facilities, access to global gateways, or connectivity to markets and key economic corridors. Others have incorporated economic impact models such as REMI or TREDIS that assess the productivity impacts of projects.

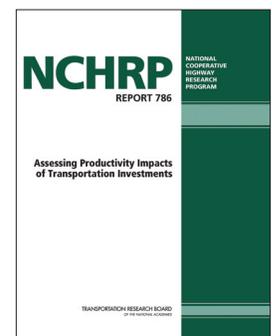
NCHRP Report 786 describes a variety of tools that agencies can use to calculate productivity impacts directly. Better and more effective transportation investment decisions can be made when the wider impacts are considered; the economy—including businesses and consumers—is likely to be better off as a consequence.

References

1. *NCHRP Report 786: Assessing Productivity Impacts of Transportation Investments*. Transportation Research Board of the National Academies, Washington, D.C., 2014. http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_786.pdf.
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3. *ACRP Report 132: The Role of U.S. Airports in the National Economy*. Transportation Research Board of the National Academies, Washington, D.C., 2015. http://onlinepubs.trb.org/Onlinepubs/acrp/acrp_rpt_132.pdf.



The new Port Mann Bridge in British Columbia, Canada, was part of the Greater Vancouver Gateway Transportation Plan.



NCHRP Report 786, *Assessing Productivity Impacts of Transportation Investments*, is available from the TRB online bookstore, <https://www.mytrb.org/Store/Product.aspx?ID=7322>; to view the book online, go to <http://www.trb.org/Publications/Blurbs/171356.aspx>.