Industry Clusters, Supply Chains, and the Freight Economy

Center for Transportation Studies Annual Conference
Lee Munnich
November 3, 2016
Transportation Policy and Economic Competitiveness (TPEC)

• Ensure Minnesota is at the forefront of transportation in support of economic competitiveness.
• Provide academically-based research and insight on industry clusters, finance, technology, and other key areas.
TPEC Three-Part Focus

• **Financing.** Funding of the surface transportation system will continue to be a critical issue at all levels for the foreseeable future.

• **Industry Clusters.** There is a large and increasing amount of research identifying a strong link between transportation and economic competitiveness.

• **Technology.** Major changes in technology are imminent and will require major changes in public policy.
Cluster Linkages and Economic Diversification

Minnesota, 2014

Source: US Cluster Mapping Website http://www.clustermapping.us/
Cluster Linkages and Economic Diversification

Minnesota, 2014

Source: US Cluster Mapping Website http://www.clustermapping.us/
Cluster Linkages and Economic Diversification

Minnesota, 2014

Source: US Cluster Mapping Website http://www.clustermapping.us/
Cluster Linkages and Economic Diversification

Minnesota, 2014

Source: US Cluster Mapping Website http://www.clustermapping.us/
Cluster Linkages and Economic Diversification

Minnesota, 2014

Source: US Cluster Mapping Website http://www.clustermapping.us/
Cluster Linkages and Economic Diversification

Minnesota, 2014

Source: US Cluster Mapping Website http://www.clustermapping.us/
Cluster Linkages and Economic Diversification

Minnesota, 2014

Source: US Cluster Mapping Website http://www.clustermapping.us/
Cluster Linkages and Economic Diversification

Minnesota, 2014

Source: US Cluster Mapping Website http://www.clustermapping.us/
http://freighteconomyatlas.org/
Analytical Process

**Identify industry clusters:**
- Apply cluster analysis to land use

**Locate commodity freight flow concentrations:**
- Using hotspots analysis, identify local freight-intensive routes

**Identify state freight-intensive corridors through flow concentrations:**
- Utilizing the data on commodity flows augmented with the LQ function at the state-level

**Identify regional freight corridors:**
- Utilizing the data on commodity flows augmented with the LQ function at the regional-level
- FHWA criteria applied to identify regional freight corridors
  (i.e. highways segments with at least 8,500 trucks per day, highway parallel to rail lines with high volume, & rail and waterways with more than 50 million ton of bulk cargo)

**Identify national freight flows network (U.S. supply chain):**
- Utilizing the data on commodity flows augmented with the LQ function nation-wide

**Analyze the economic impact of industry clusters and commodity flows**
- Apply freight transportation intensity function – a ratio of total ton-miles to Gross State Product & Gross Domestic Product to show the actual freight activity required to produce one unit of goods and services at either state- or national-level (acquired from BTS)
Analytical methods: Clusters and Hotspots

Clusters analysis:
- Identifying industry clusters through land-use
  - metropolitan areas, statistical areas, and local municipalities

Hotspot analysis:
- Locating freight-intensive corridors by freight flows
  - state, regional, and national

Note: This analysis identifies Minnesota industry clusters through land use by commodity code

Location of Minnesota Intermodal Facilities & Warehousing/transportation industry cluster

Concentration of Minnesota Average Annual Daily Truck Traffic
Analytical methods: LQ of commodity flows

National maps and analysis:
LQ of commodity flows

Regional maps and analysis:
LQ of commodity flows
A story map is a strategy of using a graphical organizer to provide a narrative of elements on a topic or a description of a series of events through a story-telling application. An example story map of the transport of agricultural products originating in Minnesota distributed across the Great Northern Corridor is provided below.
Case Study: Medical Devices and Health Sciences

• Medtronic: Show the supply chain for pacemakers made by Medtronic
  • Method-
    – Identify supply chain through online information
    – Create visualization representation
    – Visualize the analysis
• Started in a Twin Cities’ garage in the 1940s
• Headquarters in Dublin, Ireland
• Pacemaker, first major product
• Product Groups:
  – Cardiac/Vascular
  – Restorative Therapies
  – Minimally Invasive Therapies
  – Diabetes
• Ships to 155 different countries, 80 distribution centers globally, and 70 manufacturing plants
Transport, logistics, & Supply Chain

- State licensing has a significant impact on medical device distribution, manufacturing, and trade
- Lithium battery restrictions
- Uses a variety of transportation options depending on size and cost of product
- Memphis, the critical supply chain juncture
Medtronic Supply Chain

- [Link](http://agis.maps.arcgis.com/apps/MapJournal/index.html?appid=a5c6eb42346640378858c7beaa8cce67)
Title: "Midwest Supply Chain Optimization Atlas"

Objective:
To enhance the understanding of transportation infrastructure constraints to supply chain performance in the Midwest and consideration of alternatives to achieve supply chain optimization.

States: Minnesota, Iowa, Illinois, Missouri, Wisconsin, Nebraska

Platform: Esri GIS Platform hosted on National Freight Economy Atlas provided by TPEC/CGU
What is Supply Chain Network Optimization?

- Commonly used by private companies to design and optimize global supply chains to improve services and/or reduce costs
- Applying same practices to optimization of state and local freight networks to:
  - Lower the cost of transportation for businesses
  - Increase transportation responsiveness and predictability
  - Incentivize business expansion
- Identify commercial freight road networks that are irrelevant
- Reduce road freight / truck traffic
- Improve transportation network resiliency
Comparing Base Year Domestic Freight Flows

Data Source: FAF 3.5, Federal Highway Administration
Midwestern states much more rail dependent than the coasts

GDP share specialization in rail transportation is much higher in Midwestern states
TPEC Quetica Collaboration

1. Determine data to be used in Atlas and means/format for analysis.
2. Analyze Midwest supply chain constraints.
3. Create maps and case study story maps of constraints.
4. Provide selective analysis and visualization of constraints and alternatives for optimization.
Questions?