

Minnesota Medical Device Industry Cluster: Development, Linkages, and Transportation

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Introduction

Minnesota's medical device industry cluster is not only one of the biggest driving economic forces in the state, it is also a leader in global medical device arena. For this reason, the Transportation Policy and Economic Competitiveness (TPEC) program at University of Minnesota has undertaken a multi-phased analysis of the medical device industry, with particular attention to transportation implications. This analysis has featured both quantitative (e.g., spatial) analysis as well as qualitative (e.g., interviews) analysis. These analyses have addressed economic competitiveness, economic development, transportation implications, and research and data needs. These issues as well as transportation policy implications are summarized below.

Economic Competitiveness

Minnesota enjoys a strong "export economy" due to the success of numerous companies that are household names—Target, Best Buy, Medtronic, Mayo Clinic. According to Minnesota Department of Employment and Economic Development (DEED), in 2018, Minnesota's exports were estimated at a value of \$22.7 billion—ranking 20th in the nation. Compared to 2017, it was a 10 percent increase, setting a state record high in exports. In addition, the 10 percent increase in export value in 2018 compared to 2017 was 2 percent higher than the national average of 8 percent (*I*)

As regards to the Medtronic and Mayo Clinic's presence in Minnesota, many other medical health care businesses have led the way to Minnesota to having one of the strongest medical device industry clusters (MDIC) in the country. Minnesota has established itself as one of the forerunners in the field. Out of the \$22.7 billion in annual exports in 2018, the medical device and pharmaceutical industry made up almost 23 percent of Minnesota's total export value according to DEED. The medical device industry in Minnesota also saw an increase in exports compared to 2017, with business relationships expanding beyond state borders to major global markets in Europe and Asia. In 2018, optics and medical devices made up the second largest proportion of Minnesota's exports in value. The category "Others" was ranked the top product to contribute to the state's export value. However, this category includes a large range of miscellaneous goods.

It is without a doubt that Minnesota's reputation as home to many well-established healthcare facilities plays an integral role in making Minnesota the headquarters for medical device companies. To better understand how the medical device industry in Minnesota compares to the nation, in 2016, Minnesota had the fourth largest—after California, Indiana, and Florida—labor force in medical device sector out of the 50 states. Moreover, observations by key actors of the medical device industry suggest there is plenty of room for further MDIC growth.

Exporting goods beyond the international borders, Minnesota's medical device industry is known globally. Demand for certain devices may change over time, but medical device companies are continuously inventing better medical devices to meet the needs of the global market. Furthermore,

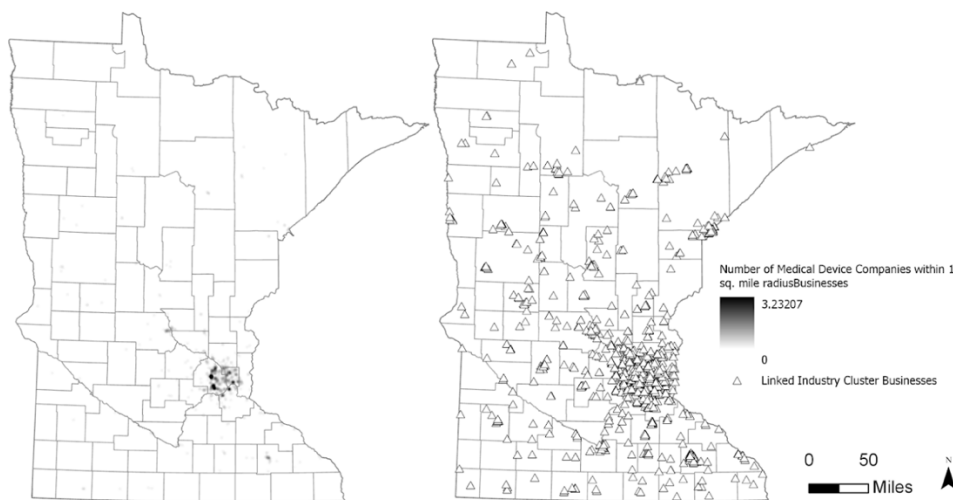
economic competitiveness goes well beyond regional boundaries. Therefore, it is crucial to understand the impact transportation infrastructure –not just ground transport but all other modes of transportation— has on maintaining growth and encouraging the advancement of the medical device industry and its MDIC in Minnesota.

Economic Development

According to ReferenceUSA, there were only 21 medical device companies that were recorded in 1983 in its database. Today, 36 years later, there are 234 medical device companies. Although the number of medical device companies recorded in ReferenceUSA does not reflect the true number of medical device companies operating in Minnesota, it does reflect significant growth within the industry over time (2). While most of the medical device companies’ headquarters and facilities are concentrated within the Minneapolis-St. Paul seven-county metro region, which includes Hennepin, Ramsey, Carver, Scott, Washington, Anoka, and Dakota County, the medical device industry’s success has benefited those outside of the metro region throughout Greater Minnesota. Suppliers who provide parts to medical device companies are often located outside of the seven-county metro region. As these suppliers rely on doing business with medical device companies, the success of the medical device industry in seven-county metro area ultimately fosters the growth of other “linked” industries that are located throughout the state.

Figure 1 summarizes the results of the study’s spatial analysis of the medical device businesses, and the nine identified linked industries: biopharmaceuticals, distribution & e-commerce, jewelry, recreational goods, electrical wiring, plastics, IT, production technology, and downstream metals. While medical device companies were highly concentrated in the Minneapolis-St. Paul seven-county metro region, the linked industries that support the medical device industry cluster are dispersed across the state in the 80 counties of Greater Minnesota (2).

Figure 1. Minnesota’s medical device businesses are concentrated in the MSP metro area while businesses in linked industries are more broadly distributed throughout the state



Economic developments in certain areas were very much induced by the presence of major corporate headquarters and medical device manufacturing plants in Minnesota. Through success and growth, the medical device companies and other private MDIC companies can be used as an attraction for regional growth and development. Conversations with local municipals that host corporate headquarters proved that they like to keep a close relationship with the companies. Local municipals make a lot of effort to keep business within their jurisdiction by accommodating and addressing the needs of the companies to prevent them from relocating.

One common challenge companies shared was finding skilled laborers. The medical device industry is a specialized industry that needs a variety of talent. It needs workers who are specialized in product design, engineering, marketing, supply chain, etc. Competing against other businesses in the industry nationwide and globally, medical device companies find it difficult to compete against the biggest companies located on the East and West coasts when it comes to recruiting. To successfully recruit talent, medical device companies in Minnesota are matching East and West coast salaries to attract talent.

Transportation Enablers

The medical device industry cluster relies heavily on a combination of surface and air transportation. In order to satisfy consumers who are located nationally and globally – by providing a reliable, fast, and cost-efficient delivery—it is crucial to have a well-designed multimodal transportation system that supports not just the end delivery of medical devices but the medical device industry’s supply chain. The Minnesota Department of Transportation (MnDOT) recognizes the role of transportation when it comes to economic growth. Without an efficient transportation system that facilitates the movements of goods, the state’s economy can be jeopardized. As a result, MnDOT has made direct and indirect investments related to the state’s transportation network to maximize its economic potential. Organizations related to freight planning and movement, such as the Minnesota Freight Advisory Committee (MFAC), have been created in the past few decades to redirect attention on how to improve the current transportation system in order to support Minnesota’s growing export economy.

In today’s global economy, the delivery of products in an orderly manner is crucial. Transportation is one of the prioritized fields of supply chain logistics. Without a functioning and reliable transportation system, the product flow is disrupted due to delays that degrade product quality. For example, biopharmaceutical products that require to be transported in temperature-controlled environments may have very small loading windows in which the goods are exposed to colder or warmer temperatures. When product flow issues arise due to transportation network and infrastructure weaknesses, these costs are endured by businesses. These costs could be avoided if transportation reliability and travel time variability were more predictable.

Currently, the Minneapolis-St. Paul International Airport (MSP) plays a crucial role in enabling the export of MDIC products, and these goods represent some of the highest value shipments out of MSP. To date, policy surrounding MSP has been highly passenger-oriented but additional attention to the air-freight element is warranted. Air transportation is often overlooked even though it has one of the greatest potentials to improve regional connectivity and increase economic gains. Researchers have shown that there is a relationship between the volume of air passenger and cargo traffic with gross domestic product (GDP). However, there is a silver lining: the impact of air passenger and cargo on GDP is a long-term process which requires a bit of time lapse before economic benefits can be notable.

The common benchmark used to measure freight movements –ground, air, or maritime— has been volume rather than the value of the goods. However, it is incorrect to conclude that a simple increase in the volume of cargo over time would translate to an increase in economic gains. There is a need to look at the value of the goods based on price per weight. Figure 2 and Figure 3 illustrate the total tonnage and value of medical goods by different modes of transportation (3). Based on the tonnage, air freight does not even compare to that of trucks. However, when we compare the value of goods being transported between the two modes of transportation, it is almost the inverse.

Figure 2. Total thousands of tons (in lbs.) of medical goods in Minnesota by different modes of transportation

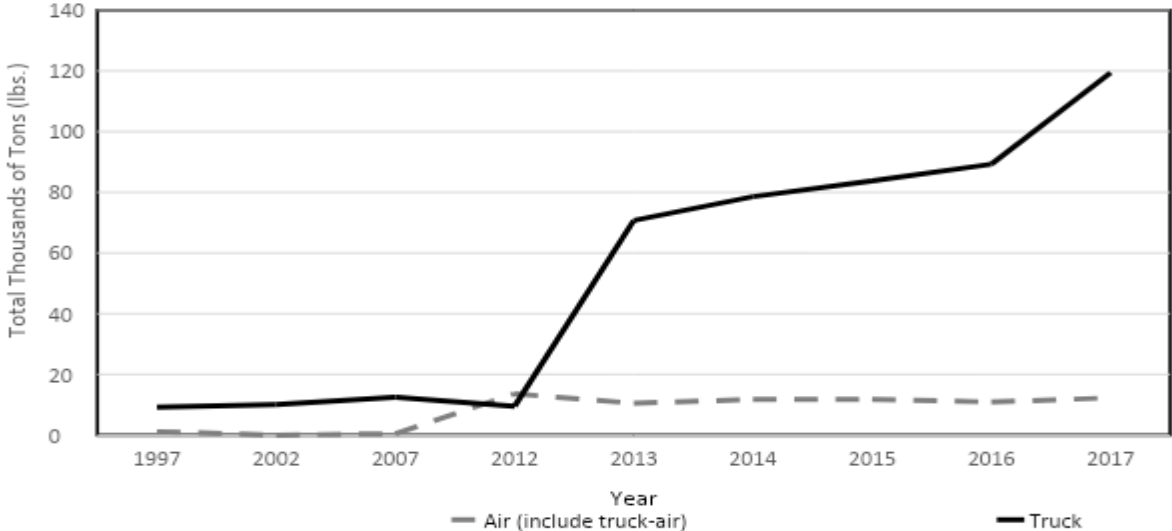
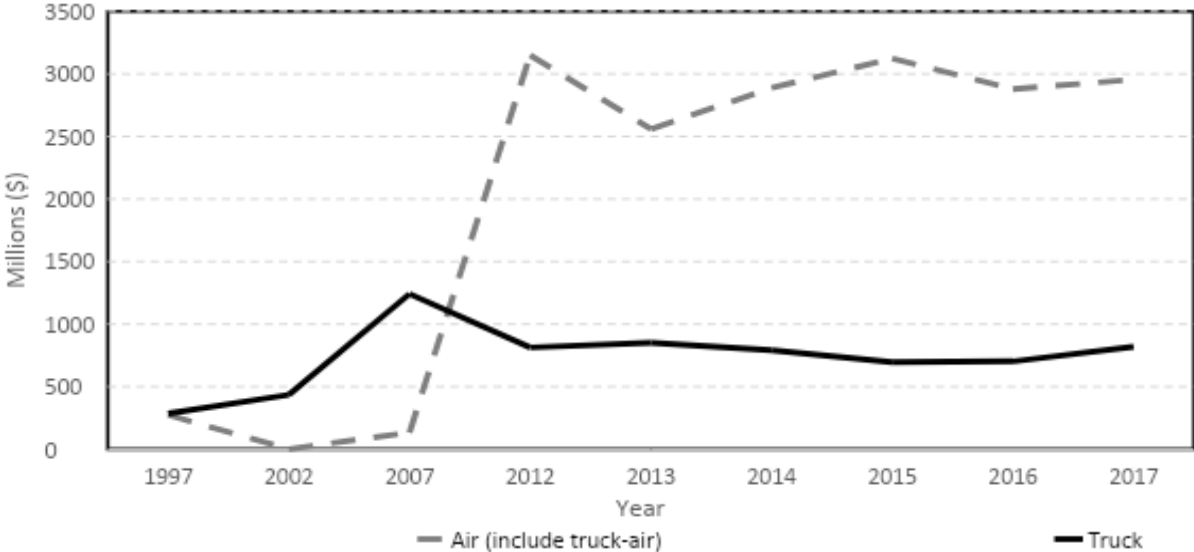


Figure 3. Total value (mil. US\$) of medical goods in Minnesota by different modes of transportation



Medical device and its linked industries, particularly, depend heavily on a strong multimodal transportation system for several reasons. Unlike other goods, medical device goods are high-valued goods that consumers do not purchase in bulk to keep in storage. For example, a prosthetic transcatheter aortic valve replacement (TAVR) device –approximately the size of a quarter— can cost up to \$32,000 (4). Due to the high cost of TAVR devices, healthcare facilities and providers do not stock up on expensive devices such as TAVR in excessive amounts. They usually keep a small inventory and restock every couple of days. Therefore, medical device products like TAVR devices are time sensitive as delayed delivery can also delay surgeries and ultimately cost lives. To ensure reliable delivery of these medical device goods, efficient and resilient multimodal transportation is key (5).

Implications/ Recommendations

While many have acknowledged the importance of a reliable transportation system and Minnesota’s medical device industry as one of the high-value economic drivers in the state, there is a need for a platform in which conversations and information can be shared among the stakeholders. The following transportation implications and research opportunities are offered to inform the discussion and recommendations for how transportation can best foster the continued growth of the medical device industry in Minnesota.

Corridors of Commerce

The Corridors of Commerce program was introduced to help foster economic growth through strategic transportation investments. The program was first founded in 2013 when the Minnesota Legislature authorized the funding to help improve mobility and cater to freight movements along corridors to better feed the economy. What would truly be helpful is to understand the value of a corridor: the value of goods being transported along each corridor. By monetizing corridors, it helps prioritize financial resources in the most cost-effective manner.

MnPASS Lane Opportunities

In 2005, the region introduced its first MnPASS lane, a high-occupancy toll (HOT) lane, on I-394 to provide a less-congested alternative travel lane for two-person plus carpools, buses, motorcycles at no charge and for single-occupant vehicles that pay a variable fee to use the lane as an alternative to an adjacent general purpose lane.

MnDOT is currently evaluating the benefits of MnPASS lanes as alternatives to general purpose lanes on I-494 and I-94, two interstates that are becoming more congested and are receiving Corridors of Commerce funding for infrastructure improvements as critical to the Minnesota economy. These routes are particularly important to the medical device industry, which has a concentration of medical device firms located along these corridors. The benefits of time-savings and reliability to high-value freight such as medical devices should be taken into account when considering MnPASS lanes on these corridors.

Air Transportation Data Needs

MSP airport plays a critical and essential role current and future growth of the medical device industry. Yet, when it comes to air transportation, there is a lack of information on air cargo. There is an abundance of data made available to the public when it comes to passenger travel patterns on flights. To the contrary, there is very little available data on what is underneath the passenger flight in the “belly” of the plane. These passenger planes have potential to transport more than just people and cargo spaces can be better utilized through shared information between airline carriers. A conversation can be initiated by regional transportation agencies to share information and expand air cargo routes.

In 2017, a partnership was formed between Greater MSP and the Metropolitan Airports Commission (MAC) in order to add new direct routes for passengers from MSP. This partnership was significant because it allowed private companies to share valuable airline travel data in a manner that would help

achieve a greater common goal: the exploration of new direct routes to new destinations. This effort came to be very effective, as the partnership resulted in three new direct flights out of MSP to South Korea, Japan, and Mexico.

If this similar effort can be replicated for air cargo, air travel has the potential to be more resourceful and efficient. In order for conversations to occur, a proper environment needs to be created for businesses to share information in a way that can be beneficial and non-threatening. The idea of air cargo data sharing must be presented in a manner in which all participants will be able to benefit. The ideal outcome of such conversations with key actors in the air cargo industry is a better grasp of the types and values of goods that are transported on planes. A better understanding of the value flow of air cargo goods can improve freight mobility, and also has the potential to demonstrate how a well-coordinated intermodal transportation system can maximize Minnesota's export economy and establish itself as a global player in the medical device industry.

Tracking Spatial Growth

Once air cargo value data is made available, it is crucial that this information serve as a database that can be referenced by municipals and other stakeholders. Space-Time Cube is a geoprocessing tool that shows trends and patterns over time in a given area. Therefore, with the appropriate dataset, Space Time Cube can help depict economic growth, business value, employment size, etc. in a given area or region. Again, for this tool to be effective and efficient, there needs to be a uniform system in which data is collected and stored. Developing such a database would require substantial conversations and collaboration between companies and industries, with local municipalities and agencies playing the role of facilitators.

Conclusion

The medical device industry in Minnesota has established itself not only nationally but globally. With world-renowned health care providers and facilities located in Minnesota, the medical device industry has been able to flourish over the years, and has earned a reputation for advancements in the medical field to improve health care and people's well-being. The success of the industry also benefits other linked industries. While most medical device companies are located in the seven-county metro region, many businesses in the linked industry clusters are dispersed throughout Greater Minnesota. As such, there is a continuing if not growing need for a highly efficient and reliable transportation system to support the production and distribution of medical device products. Several innovations in air and ground transportation will ensure this efficiency and reliability.

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