



EXPLORATORY RESEARCH ON TRANSPORTATION RELATED ISSUES WITH MANUFACTURERS IN SMALL URBAN, RURAL AND TRIBAL AREAS

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Personal Motivation

Growing up on the Blackfeet Reservation, my view of the world was slightly limited. I knew that you could always count on family and that having pets was a way of life. As an adult, it has become apparent that the world requires more than family and a couple of dogs.

Working with small businesses in overcoming challenges became a large part of my adult life. This experience allowed me to see similarities between the rural Reservation businesses and the manufacturing businesses in a growing region. A common challenge between these sectors is the lack of cost-effective means to ship raw or finished goods in bulk.

In Browning, Montana, the economic hub of the Blackfeet Reservation, small businesses wanted to come together and co-op a storehouse for staple items such as paper towels or receipt tape. To secure the best prices on goods and shipping, business owners attempted to collaborate on orders and coordinate shipping schedules. The effort never got off the ground. In 2017, the idea of "collaborating" resurfaced among another group of small business owners, this time manufacturers in southwest Montana who wanted to cut the cost of packaging supplies for their rural manufacturing companies. Both the tribal and the rural manufacturers were similar in that they were business owners paying a higher cost for goods while ordering "smaller" quantities of staple products or shipping smaller outbound goods.

Growing up in Montana has allowed me to see the incredible benefits and possible potential of small rural communities that never lacks heart. I now better understand small businesses and the challenges they overcome to make rural living possible.

~ Elva Dorsey

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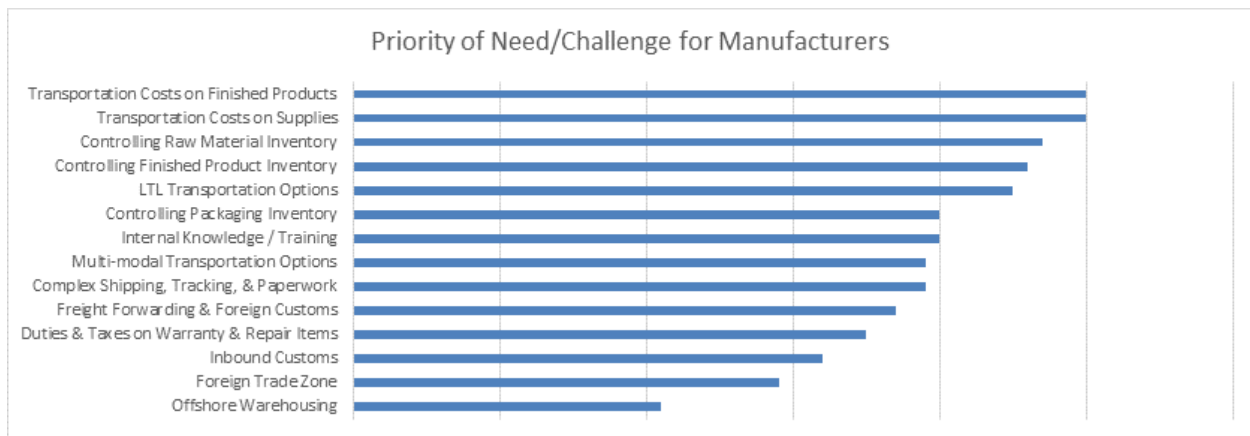
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Introduction

In 2017, the Montana Manufacturing Extension Center (MMEC), part of the National Institute of Standards and Technology (NIST) Manufacturing Extension Partnership (MEP) National Network, hosted a series of local workshops for small and medium-sized enterprises (SME) in Montana to identify and address challenges common to manufacturers in the Gallatin Valley. SMEs are businesses with 500 or fewer employees. Workshop participants were divided into small groups, each focusing on an issue of concern identified and voted upon prior to the workshop. The workshop group tasked with focusing on “Transportation, Warehousing and Logistics” conducted a brief online survey of local manufacturers who identified 14 major challenges in this area, presented in Table 1, that were affecting business operations and profits. Three of the top five challenges in this topic area faced by manufacturers in the greater Bozeman, Montana area were specifically related to transportation.

Table 1: Challenges identified by small to medium Montana manufacturers (2017)



The 2017 MMEC-led workshops raised the question: what transportation issues are manufacturers or small businesses in other rural or tribal areas experiencing?

Rural America makes up more than 80% of the nation’s land (Westerntransportationinstitute.org, 2019). There are more than three million miles of rural roads, which carry 40% of all vehicle miles traveled, and 90% of these rural roads are only one or two-lanes (WTI, 2019). Truck traffic on major trade corridors has increased by 80% in the last decade and is expected to increase 400% in the next decade (WTI, 2019). To what extent do these rural mobility issues affect manufacturing in rural areas?

The Small Urban, Rural and Tribal Center on Mobility (SURTCOM) at Montana State University focuses on research that improves the mobility of people and goods in small urban, rural and tribal areas. In response to the challenges identified during the 2017 workshop, SURTCOM, in partnership with MMEC, began exploratory research. The goal of this project was to better understand specific challenges manufacturers face when receiving raw materials into their facilities or transporting finished products to the next facility. The research explored production in

rural communities and how current transportation issues will likely increase as populations and demands continue to grow in rural and mega regions.

Following a literature review, the research team reached out to the MEP National Network Centers in 14 “peer states” (large, rural, western states) for help distributing a survey to manufacturers to quantify to what extent transportation issues affect them. For this study, when reaching out to tribal manufacturers, only federally recognized tribal communities were considered, omitting tribes that are state recognized but not federally recognized (Oklahoma Tribal Statistical Areas were not used to measure tribal population).

The remainder of this document covers the main tasks conducted as part of this project which include: 1) Literature Review; 2) Survey; and 3) Summary.

Literature Review

The research team conducted a literature review to identify the scale of transportation challenges documented for rural and tribal areas. Research sources included the Transportation Research Information Service (TRIS), the Montana State University Library, and databases and publications from state departments of transportation (DOTs) and the United States Department of Transportation (USDOT).

At the state level, publications and databases from the state departments of transportation were reviewed. Each state has a transportation plan that provides a general infrastructure description and statistics on the movement of goods through the state. These reports focused primarily on general information and did not offer specifics on rural and tribal communities; however, the literature did suggest that rail transportation is a challenge for states that are shipping smaller loads, which is often the case for rural communities. Information and research on manufacturing issues in tribal areas was lacking.

Modes of Transportation

Transportation modes had varying degrees of challenges and positive aspects depending on the location. In 2015, value-added manufacturing increased, and nearly 20% of manufacturing jobs were in rural counties (Low, 2017). As rail companies focused their attention on companies with bulk items that could fill an entire rail fleet in a single stop, companies with smaller goods turned to truck transportation and moved away from rail shipping. “Collaboration is needed—between the federal government, states, metro areas, freight industry and shippers. We need to come up with a comprehensive plan that identifies the best ways to help the flow of freight.” (Puentes, 2011). Rural states have additional challenges when trying to ship via rail for two reasons: 1) Rail companies control pricing and discourage rural areas that are located between high volume areas from using rail by charging a higher rate, and 2) It is rare for a rail company to invest in short lines that can reach producers 15 or more miles from the main line.

After the broader literature review, the research team selected 14 “peer states” (large, rural, western states) with MEP National Network Centers to be the primary catalyst for the study. The literature review then focused on the modes of transportation available in these identified states. A statistical summary of modes used to transport manufactured goods in these states is provided in Table 2.

Table 2: Statistical Summary of Shipping Modes in Study States

Mode of Transportation	Average of Total Ktons in 2016													
	AZ	CA	CO	ID	MT	NV	NM	ND	OK	OR	SD	UT	WA	WY
Air (include Truck-air)	0.02%	0.02%	0.01%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.20%	0.00%	2.70%	0.02%	0.00%
Multiple modes & mail	0.44%	1.56%	1.96%	3.11%	0.89%	0.69%	0.60%	0.71%	0.99%	3.47%	2.36%	3.12%	3.29%	0.15%
Other and unknown	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.10%	6.31%	0.00%	0.00%	0.00%	2.71%	0.00%	1.74%
Pipeline	9.83%	8.04%	26.02%	12.99%	20.78%	20.64%	56.01%	36.16%	31.79%	9.17%	11.39%	33.86%	12.17%	23.59%
Rail	4.19%	2.43%	6.71%	7.75%	37.98%	1.08%	8.68%	19.21%	7.38%	3.84%	11.58%	9.20%	5.19%	68.89%
Truck	85.52%	87.00%	65.30%	76.15%	40.34%	77.56%	31.62%	37.61%	.56.86	83.43%	74.67%	.50.83	77.36%	5.63%
Water	-	0.95%	-	-	-	-	-	-	2.98%	0.08%	-	-	1.97%	-

Most of these 14 states are landlocked, leading to limited information on water transportation. Trucking was the mode of transportation used by most businesses in the identified regions. On-demand shipping and 3rd party-shipping have been the fourth most utilized modes of transportation since 2012 when comparing total tonnage among the 14 states. Air transportation shipped less than a percent of products in 2016, counting for about 2% of the total value transported in 2016.

Air

Across the identified states, air transportation moved the least number of products. Between 1997 and 2012, shipping via air went through a significant decline. Since 2012, however, shipping increased by 2% each year. In 2016, 738,000 tons of freight among the 14 states was moved using some air transportation, although this was half of what shipped in 1997 (FAF, 2019). There was no research found on air transportation specific to rural communities. However, there was mention in the workshops held by MMEC that airports would be an ideal place for a "free trade zone" to avoid additional costs when making repairs to warranted products purchased outside the United States.

Rail

The 14 identified states had access to a minimum of two main railway routes for transporting bulk freight. In Montana specifically, consolidating railroads has resulted in the abandonment of smaller lines in rural areas, as well as a lapse in maintenance and safety improvements. Figure 1 shows rail options across the western United States. The orange lines (left image) show the Burlington Northern Santa Fe (BNSF) Railway Class I routes and the yellow lines (right image) show the Union Pacific (UP) Railroad routes across the United States (User, 2019).

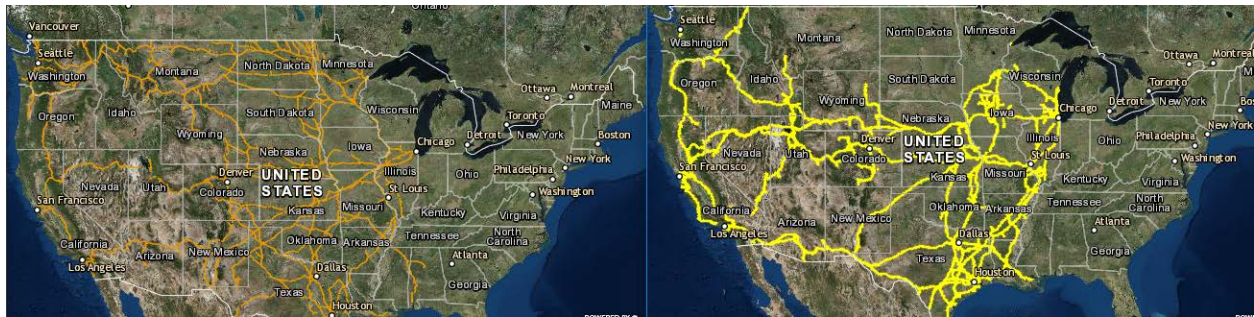


Figure 1: Rail transportation options across the western United States.

Several of the 14 identified states were "captive states," meaning the railway had a relatively high demand, but offered their services at a higher rate to ship from the states with smaller loads than neighboring states, resulting in customers receiving low performance and high pricing (State of Montana, 2004). Due to the Staggers Rail Act of 1980, the rail company had the authority to implement differential pricing, or pricing responsive to competitive conditions. This meant the same load in one state, equal in all aspects, could cost more to ship from North Dakota than Minnesota (State of Montana, 2004). Of Montana's 40-50% of wheat that is shipped via rail (Casavant et al., 2010), shipping costs resulted in a \$1 billion devaluation over the course of a year (State of Montana, 2004). If Montana wheat was compared to Wisconsin wheat; in one-year consumers and businesses moving Montana wheat would pay an additional \$1 billion dollars.

Trucking

When evaluating domestic goods, trucking is the transportation method of choice, primarily for cost-effectiveness and flexibility, as the majority of interstate or intrastate transportation is along state highways and interstates. However, the Federal Highway Administration (FHWA) predicts that in 2040 there will be few freight routes connecting rural states (FHWA, 2019a). In the map on the left side of Figure 2, the black lines represent where the current major interstates are based (FHWA, 2019b). In the map on the right side, the green, yellow, and red lines depict FHWA's predictions of where major truck routes will be in 2040.

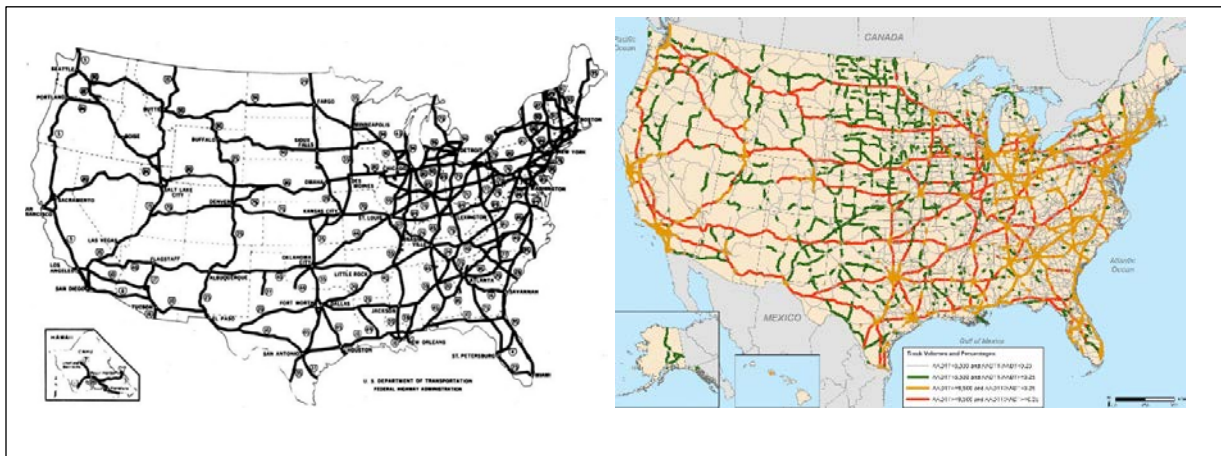


Figure 2: Current U. S. Interstate routes (right, in black) compared to predicted major truck routes (left in green, yellow, red)

As shown, the number of additional highways added throughout rural states is predicted to be minimal, thus large rural states will continue to have limited access to freight routes moving forward. In addition, rural states pose unique challenges for freight transportation and these challenges force trucking companies to evaluate whether to provide transportation to remote communities. With limited services in very rural towns, drivers may not have access to a fueling station within 60-70 miles and would need to plan fuel accordingly. Rest stops, an amenity that provides an opportunity to alleviate driver fatigue, are also lacking in rural areas. The integrity of rural roads could also deter drivers. Narrow roads present possible risk to other vehicles on the road, and semi-trucks could add damaging weight to roads that are not frequently maintained.

Truck trailers that are only half full are also a challenge for rural states. In most rural states, semi-trucks are not typically filled to capacity at a single stop, yet fuel, labor, and maintenance costs remain constant whether the trailer is full or not. Businesses are seeing products devalued due to transportation costs causing company owners to evaluate operating in rural states and smaller communities.

Multimodal or on-demand shipping

States have seen diverse "trends" associated with multimodal or on-demand-shipping. Some states steadily increased from 2012-2016, whereas others had sporadic usage or declines. When comparing the average value of products shipped, rural states shipped products of lesser value. The shipment sizes were slightly different and states with more than 10% "rural population" were shipping more tons on average than states with a rural population of 6-16% (DADS, 2018b). Multimodal shipping is expected to have minimal increases from 2020 to 2045 (DADS, 2018b). Manufacturers in the rural states are assumed to have access to on-demand shipping, but local manufacturing coalitions expressed that shipping on-demand prevented them from being competitive. Predictions on multimodal shipping increases suggested that urban states would have a sharper increase than those with populations that were majority small urban or rural.

The literature review provided insight on shipping frequencies, values, and sizes, but did not provide specific information on the transportation challenges SMEs were facing. In addition, there was little research published specifically on tribal areas. To better understand the scale of transportation issues faced by SMEs and other small businesses in rural and tribal areas, researchers surveyed manufacturers in 14 primarily western rural states. That process, and information from the survey is provided in the next section.

Survey

To gather more specific information, the research team developed a survey to distribute across 14 identified states through the Manufacturing Extension Partnership (MEP) National Network. Qualtrics, an online survey tool, was used to create and distribute the survey and store the response data from the following states:

Arizona	Nevada	South Dakota
California	New Mexico	Utah
Colorado	North Dakota	Washington
Idaho	Oklahoma	Wyoming
Montana	Oregon	

To better understand the rural nature of the 14 identified states, additional census data was gathered. Of the states surveyed, at least 26% of the total counties were "rural" or had a population of less than 50,000. Of the total population, 7.9% were living in rural counties. Table 3 provides the percentage of the state's population that was residing in the different identified levels of population size. Urban populations are counties with population sizes greater than 200,000. Small urban communities are those that have a population between 50,000 and 200,000. Rural populations were further broken down into four categories to represent how rural the counties were.

The highlighted percentages in Table 3 note the most dominate category for the population of counties in each state. California is the most urban state with the highest number of counties that are considered urban, defined for this report as a county with a population greater than 200,000. Wyoming is the most rural state with 39% of their counties having a population ranging between 25,000 to 49,999 individuals. While most of the states that were surveyed could be considered urban based on population, a large percentage of the land is rural. Again, the focus of this research was to identify transportation related issues of manufacturers in small urban, rural and tribal areas.

Table 3: Population Composition of Counties of Targeted States

Category	Population Grouping	AZ	CA	CO	ID	MT	NV	NM	ND	OK	OR	SD	UT	WA	WY
Urban	200,000 or more	91%	95%	77%	39%	0%	89%	43%	0%	43%	66%	0%	76%	80%	0%
Small Urban	50,000 to 200,000	7%	4%	11%	26%	60%	6%	42%	54%	23%	25%	40%	13%	15%	31%
Rural 1	25,000 to 49,999	1%	1%	4%	16%	10%	3%	7%	13%	23%	5%	18%	6%	3%	39%
Rural 2	10,000 to 24,999	0%	0%	6%	15%	15%	1%	7%	13%	8%	3%	19%	4%	2%	22%
Rural 3	5,000 to 9,999	0%	0%	2%	4%	10%	1%	0%	10%	2%	1%	12%	1%	0%	7%
Rural 4	1 to 4,999	0%	0%	1%	1%	5%	0%	1%	11%	7%	0%	10%	0%	0%	1%

Regarding tribal areas, the total population residing on tribal lands, omitting Oklahoma's Tribal Statistical Areas, ranges from .15% to 8.20% (DADS, 2018a). Table 4 shows the estimated percentage of each of the 14 state's populations living on tribal lands. The highlighted cells show which states have the highest (South Dakota) and which has the smallest (California) populations

living on tribal lands. South Dakota has 6 reservations averaging 1,278.72 square miles and California has nearly 100 reservations averaging 9.86 square miles. An assumption is made that the Native American population of Oklahoma is more than 1.2% due to the number of "Tribal Statistical Areas" omitted in this report.

Table 4: Percent of Population living on Tribal Reservations

AZ	CA	CO	ID	MT	NV	NM	ND	OK	OR	SD	UT	WA	WY
3.9%	0.2%	0.6%	1.9%	7.7%	0.5%	3.8%	1.6%	2.2%	0.2%	8.2%	0.9%	2.3%	4.6%

Within each of these states, there is a MEP National Network center working directly with the state’s small and medium enterprise (SME) manufacturers comprised of various industries with enormous diversity in size, revenue, and business models. As coaches and advisors to SMEs, the MEP National Network was an ideal partner for disseminating the electronic survey. To be mindful of MEP limited resources, the data collection was limited to only the online survey.

An introductory email, which included a link to the online (Qualtrics) survey, was emailed to the MEP National Network center director for each of the targeted 14 states explaining the background, the goal of the survey, and sample text to include with the distribution of the survey link to their manufacturers. The directors were asked to distribute the information immediately, making note of a two-week survey response time.

The eight-page online survey, provided in the Appendix, was designed to capture possible trends and began with general demographic questions about the manufacturer’s location, size, and products. From there, the survey focused on movement of goods and challenges of inbound and outbound transportation and shipping as it related to the rural landscape and encouraged participants to highlight transportation issues they were experiencing. Next, participants were asked questions on transportation modes, costs, and distances from the production facility. Respondents could then provide information on employee commute time and modes to help understand if the rural nature of the company correlated with employee retention challenges. If rural manufacturers were having difficulty retaining employees because transportation to and from work was too difficult, then pushing goods out of the area may not be the biggest transportation challenge. Finally, respondents were asked if they were interested in collaboration efforts with other manufacturers.

Responses

Responses were received from manufacturers in four of the 14 targeted states (plus a single response from the state of Florida) and included 51 completed and 25 partially completed surveys. Manufacturers in Montana and North Dakota were responsible for 86% of the completed surveys. Figure 3 provides a geographic representation of the respondents. The survey took an average of 14 minutes for respondents to complete.



Figure 3: Locations of the survey respondents.

Manufacturers' Logistics

While some respondents reported having multiple manufacturing facilities, 79% had a single facility. When asked about full-time equivalent employees: 33% of respondents had less than ten, 38% of respondents had between 10 and 50, and 28% had over 50 full-time employees. When asked about the manufacturers' customer makeup they were offered the following choices:

- Shipping to Consumers
- Wholesalers/Distributors
- Other Manufacturers
- Government Agencies
- Other

While many manufacturers (76%) were shipping at least some percentage of their "products" directly to consumers, manufacturers were primarily shipping the bulk of their products to other "manufacturers." On average 58% of shipments went to another manufacturer. Of the 58 manufacturers that shared their target audience, 34% took advantage of at least three of the modes of transportation.

Most manufacturers reported having a reliable outbound carrier or a central distributor that could schedule the pickup and delivery of shipments, with only 17% of respondents reporting that their outbound shipments were turned down by their primary carrier. On a scale from one to ten, with ten being the most limiting factor to growth and success for movement of goods, respondents on average gave "Outbound transportation" a rating of five and gave "Inbound" a rating of four. Nearly a quarter of respondents that expressed challenges of outbound movements of goods as a "limiting factor to growth and success" said it was "Extremely Limiting" (8-10 Rating).

Participants were asked "Would you rank (inbound/outbound) transportation/shipments as one of the top five challenges for your facility?" Those challenged by inbound issues identified shipping delays, material availability, and trucks that were willing to come into the state to deliver but leave empty as top reasons. Outbound shipping challenges included product devaluation, lack of carriers and options, fluctuating shipping times, and moving goods overseas.

When asked how transportation challenges impacted business, 23% of respondents said they were losing business. Other impacts included customer complaints (22%), high maintenance cost (18%), and loss of productivity (18%). Respondents with a higher percentage of cost of goods sold did not report a correlation to transportation challenges.

Special handling was necessary for the outbound goods of 20 companies and the inbound goods of 15 companies. Ten companies required "special handling" for both inbound and outbound goods. Special handling ranged from temperature and humidity controls to size and timeliness.

When manufacturers were asked to describe their most impactful transportation challenge, "cost" came up most frequently. These costs resulted in a variety of challenges and other issues for manufacturers. The top five self-identified transportation challenges for manufacturing facilities were:

1. Total Cost
2. Scheduling Delays
3. Changes in Raw Material Availability/Cost
4. Limited Trucking Availability/Special Handling
5. Distance from Processor

Forty-seven of the manufacturers were moving their goods farther than 200-miles from their facility, but still within the U.S. Thirty-nine manufacturers are shipping their goods within 200 miles of their facility. Twenty-eight manufacturers responded that they ship their products to Canada or Mexico, with 23 manufacturers noting that they ship to other international destinations.

Manufacturers were asked what percentage of **Outbound** products left their facility using the following transportation methods:

1. We deliver ourselves:
2. By on-demand shipping company (e.g. USPS, UPS, FedEx, DHL)
3. By third party trucking company, Full truck load (FTL)
4. By third party trucking company less than a truckload (LTL)
5. By Rail
6. By Air
7. By Water (river/ocean)
8. Intermodal (e.g. truck and ocean, truck and air, truck and rail, etc.)
9. Other (Please Describe)

Table 5 summarizes the responses by the manufacturers. Note that the modes are ranked based on the number of respondents using the mode, and not the average percentage of outbound goods moved using that mode.

Table 5: Modes of Transportation/Shipping Used for Outbound Goods

Mode	Number of Respondents	Average % of Outbound Goods Shipped through Listed Mode
3 rd Party-LTL	36	14%
On-Demand Shipping	31	20%
3 rd Party-FTL	23	10%
Self-Delivery	22	14%
Intermodal	8	4%
Other	4	1%
Air	8	0.62%
Water	3	0.55%
Rail	1	0.04%

Question 15 of the survey asked manufacturers how often outbound shipments have been turned down by their primary carrier. Of the 48 respondents who answered the question, 40 had been turned down less than 5% of the time, four reported they had been turn down less than 10% of the time, two had been turned down less than 20% of the time, and only two reported being turn down more than 20% of the time. Only 15% of respondents noted having an issue of being turned down by a primary carrier.

One of the most profound comments from the survey was from a company that reported moving 99% of their business out of a rural state due to transportation issues. This company has three facilities with 10-20 full-time equivalent employees, shipping 70% of its products to wholesalers. Cost effective and time efficient shipments to wholesalers was perceived to be essential. In respondents' final remarks, "Cost of transportation" was cited as a challenge to receiving supplies, as well as staying competitive.

Employee Mobility

The survey included four questions specific to the commuting habits of manufacturers' employees. Respondents reported employees were commuting 12 miles to work, on average. Depending on traffic, a 12-mile commute could be an 11-minute drive, an hour and four-minute bike ride, or a four-hour walk. The commuting range reported was between 0 and 72 miles. Less than a third of the respondents expressed that employee commute concerns were an issue, either "sometimes" or "frequently."

Most companies did not cite a large impact on operations due to employee commute. Potential impacts fell in the following ranking:

1. Frequent Tardiness
2. Increased Absenteeism
3. High Turnover Rate
4. Other

Of the respondents reporting on commuting opportunities available to their employees, most reported that alternative commute options did not exist. For those with options, the majority noted their facility is in a bike-friendly community.

With limited information from the literature review, the survey was intended to bring new and substantial data regarding transportation issues faced by manufacturers in small urban, rural and tribal areas. Unfortunately, the survey process yielded limited results, with the majority of completed surveys coming from Montana and North Dakota. However, the survey results do reveal some interesting information, including the modes of shipping used and the issues manufacturers have when operating in small urban, rural and tribal areas. Smaller shipments versus bulk, delayed production, and costs associated with bringing goods into the facility and the actual cost of shipping goods were referenced as primary challenges of businesses operating in less populated areas. Lack of carriers and moving goods overseas were also issues for small rural businesses.

Summary

This report presents the challenges manufacturers experience when operating in rural areas, which make up 80% of the land mass in the country. While the literature review found little published information on transportation challenges faced by SMEs and the survey results of this pilot study were limited, it is worth noting that 22% of respondents express the movement of outbound goods as an extremely limiting factor to growth and success. As transportation demand increases and resources remain the same, it is assumed the impact of these challenges will also increase.

Under Title 23 U.S.C. § 150 - National Goals and Performance Management Measures developed by the USDOT and FHWA, there are seven goals:

- 1. Safety:** To achieve a significant reduction in traffic fatalities and serious injuries on all public roads.
- 2. Infrastructure condition:** To maintain the highway infrastructure asset system in a state of good repair.
- 3. Congestion reduction:** To achieve a significant reduction in congestion on the National Highway System.
- 4. System reliability:** To improve the efficiency of the surface transportation system.
- 5. Freight movement and economic vitality:** To improve the National Highway Freight Network, *strengthen the ability of rural communities to access national and international trade markets, and support regional economic development.*
- 6. Environmental sustainability:** To enhance the performance of the transportation system while protecting and enhancing the natural environment.

7. Reduced project delivery delays: To reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion

Of particular relevance to this project is item Number 5. There will need to be improvements to both commercial and non-commercial transportation methods and infrastructures moving forward to

meet this goal. Demand for both freight and passenger transportation are expected to increase by 60% from 2007 to 2067, and this increased need will need to be addressed (USDOT, 2019).

The literature review for this study revealed that there is little information regarding manufacturing or transportation in rural America and on Native American Reservations. Understanding Tribal reservations and rural communities is key to addressing the challenges they face. As urban communities continue to grow in population, moving goods between these communities and from

GOAL: Freight movement and economic vitality

To improve the National Highway Freight Network, *strengthen the ability of rural communities to access national and international trade markets, and support regional economic development.*

Title 23 U.S.C. § 150

rural and tribal areas to these dense communities will become more challenging and could affect the economy in all areas.

With a lack of literature specific to manufacturing related transportation issues in small urban, rural or tribal areas, the research team decided to initiate a survey to further explore the issue. The survey was intended to retrieve more information from rural and tribal manufacturers regarding transportation challenges. However, in the 14 western states targeted for the survey, most of the population was living in urban counties. Six of the 14 targeted states did not have counties with populations of less than 5,000. All of the states had at least 1% of their counties considered rural, with populations of less than 50,000.

With only 50 completed and 23 partially completed surveys submitted from across five states (four from the targeted states and one from Florida), the research results were limited. Responses from the survey indicated that the targeted manufacturers were experiencing loss of business, customer complaints, high maintenance costs and loss of productivity due to the impacts of transportation challenges. Repeatedly, transportation costs were indicated as a significant challenge by the 73 respondents. These costs are likely associated with the distance products must be moved before reaching their destination.

Given the limited responses to the survey, additional research is needed to better understand the issue, further define the scope, and develop potential solutions to challenges resulting from effects of manufacturing related transportation issues. Further research is also needed to better understand transportation-related cost factors such as scheduling delays, raw material accessibility, special handling availability, and the location of processors and manufacturers relative to their customers. Further studies on population movement and potential (future) workforce availability is also needed to predict operational challenges that will be faced by manufacturers in small urban, rural and tribal areas.

References

Casavant, Ken , Marina Denicoff, Eric Jessup, April Taylor, Daniel Nibarger, David Sears, Hayk Khachatryan, Vicki McCracken, Eric Jessup, Marvin Prater, Jeanne O’Leary, Nick Marathon, Brian McGregor, and Surajudeen Olowolayemo. Study of Rural Transportation Issues, U.S. Department of Agriculture, Agricultural Marketing Service, April 2010. Web. <http://dx.doi.org/10.9752/TS041.04-2010> .

Data Access & Dissemination System (DADS), D. (2018a). *American FactFinder - Results*. [online] Factfinder.census.gov. Available at: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_17_5YR_B01003&prodType=table [Accessed 21 Dec. 2018]. For Native American Populations

Data Access & Dissemination System (DADS), D. (2018b). *American FactFinder - Results*. [online] Factfinder.census.gov. Available at: <https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?fpt=table> [Accessed 21 Dec. 2018].

Federal Highway Administration, Office of Operations. (2019a). *Major Truck Routes on the National Highway System: 2040 - FHWA Freight Management and Operations*. [online] Available at: https://ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/nhsmajortrkrts2040.htm [Accessed 17 Sep. 2019].

Federal Highway Administration. (2019b). Dwight D. Eisenhower Highway - Interstate System - Highway History - Federal Highway Administration. [online] Available at: <https://www.fhwa.dot.gov/infrastructure/ddehwy.cfm> [Accessed 1 Nov. 2019].

Freight Analysis Framework (FAF). (2019). Retrieved from <https://faf.ornl.gov/faf4/Extraction2.aspx>

Kunesh, Patrice H. (2019). *Getting real about Indian Country — surprising progress in the heartland*. [online] Available at: <https://newsmaven.io/indiancountrytoday/opinion/getting-real-about-indian-country-surprising-progress-in-the-heartland-P9OJ5PA0aECquc42NM5dYg/> [Accessed 4 May 2019].

Low, S. (2017). Rural Manufacturing at a Glance, 2017 Edition. *Economic Research Service, Economic Information* (Bulletin 177).

Puentes, R. (2011). *Move it: How the U.S. Can Improve Transportation Policy* Retrieved from <https://www.brookings.edu/opinions/move-it-how-the-u-s-can-improve-transportation-policy/>

State of Montana Governor's Office of Economic Development & Montana Department of Transportation. (2004). *Rail Freight Competition Study as provided by Montana Senate Bill (SB) 315* (pp. 6-44). Washington DC: R.L Banks & Associates, Inc In Association with Railroad Industries Incorporated.

US Department of Transportation. (2019). *The Surface Transportation System: Challenges for the Future*. [online] Available at: <https://www.transportation.gov/content/surface-transportation-system-challenges-future> [Accessed 18 Jan. 2019].

User, S. (2019). *Union Pacific Railroad Map - ACW Railway Company*. [online] Acwr.com. Available at: <http://www.acwr.com/economic-development/rail-maps/union-pacific> [Accessed 11 Jan. 2019].

Appendix

Rural Transportation Survey

Introduction

The Western Transportation Institute (WTI) and Montana Manufacturing Extension Center (MMEC) at Montana State University are interested in learning more about transportation challenges faced by manufacturers in small urban, rural and tribal areas/communities. The following survey, which should take only five to seven minutes to complete, will help WTI and MMEC identify the most challenging issues, and may lead to further research to address these issues.

We hope you will share your information with us as we work to identify the transportation issues faced by manufacturers in small urban (populations between 50K and 200K), rural (under 50K), and tribal areas/communities. If your company has multiple plants/manufacturing locations, please forward the survey link to the managers of each location so they can complete the survey. We would like to survey all relevant locations to obtain a complete representation of your company. If your company does not have a manufacturing facility located in one of these areas/communities, you do not need to respond to the survey.

If you have any questions regarding this survey, please contact David Kack at the Western Transportation Institute, dkack@montana.edu or call 406-994-7526.

Thank you for your participation!

If you are completing the survey, please answer the following questions regarding the specific manufacturing location where you work. Participation in the survey is strictly voluntary, your answers will remain anonymous, and you can skip any questions you want.

Email Please provide an email address, which ensures the data is valid. All questions that follow will remain voluntary, and your email will not be tied to the published data

1. How many total manufacturing facilities does your company have including the facility you are overseeing?

___ 1 (This is our only facility)

___ 2 Please forward the survey to managers of your other facilities and complete the survey thinking about your largest facility.

___ 3 Please forward the survey to managers of your other facilities and complete the survey thinking about your largest facility.

___ 4+ Please forward the survey to managers of your other facilities and complete the survey thinking about your largest facility.

2. Where is this facility located?

(Please enter the five-digit zip code for the facility you will be answering for)

3. What products are manufactured at this facility? *Please provide [NAICS](#) Code and/or a General Description.*

4. Please indicate the number of employees (full-time equivalent) at your facility?

___ <10 (1)

___ 10-20 (2)

___ 21-50 (3)

___ 51-100 (4)

___ 101-200 (5)

___ 201-500 (6)

___ 500+ (7)

5. What percentage of your products (in volume, not \$) go to the following clients:
Approximate your percentage so that the combined responses will be equal to 100%

_____ Consumers

_____ Wholesalers/Distributors

_____ Other Manufacturers or Service Providers

_____ Government (DOT, DOI, etc.)

_____ Other (Please Describe)

6. On a scale of 1 to 10, how would you rank the **movement of goods** as a limiting factor to growth and success for:

	1	2	3	4	5	6	7	8	9	10
Inbound Movement of Goods	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Outbound Movement of Goods	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

7. Do your products require special handling? (*such as refrigeration, pressure, security, time-sensitive, etc.*) If yes, please describe in the text box provided

	Inbound Movement of Goods	Outbound Movement of Goods
No	<input type="checkbox"/>	<input type="checkbox"/>
Yes	<input type="checkbox"/>	<input type="checkbox"/>

(7a) Please briefly describe the special handling

8. Would you rank **Inbound** transportation/shipments (bringing in materials, subassemblies, etc.), as one of the top five challenges for your facility?

___ Yes. If yes, why... _____

___ No

9. Would you rank **Outbound** transportation/shipments (sending our materials/finished goods), as one of the top five challenges for your facility?

___ Yes. If yes, why... _____

___ No

10. Please describe your most impactful transportation challenges (e.g. cost, capacity, required documentation, special handling requirements, etc.)

11. How do transportation problems impact your firm?

- Loss of Business
 - Customer Complaints
 - Could go out of Business
 - Loss of Productivity
 - Claims Against Firm
 - High Maintenance Costs
 - Other (Please describe) _____
-

12. What is the approximate percentage of Cost of Goods Sold that can be attributed to transportation? (both inbound and outbound shipping)

0 20 40 60 80 100



13. Approximately what percentage of your **Outbound** products are shipped...
Approximate your percentage so that the combined responses will be equal to 100%

- Within my local area (200-mile radius)
- Outside local area, but within the U.S.
- To Canada &/Or Mexico
- Internationally Other than Canada or Mexico

14. What percentage of **Outbound** products leave your facility using the following transportation methods:

Approximate your percentage so that the combined responses will be equal to 100%

- We deliver ourselves:
- By on-demand shipping company (e.g. USPS, UPS, FedEx, DHL)
- By third party trucking company, Full truck load (FTL)
- By third party trucking company less than a truckload (LTL)
- By Rail
- By Air
- By Water (river/ocean)
- Intermodal (e.g. truck and ocean, truck and air, truck and rail, etc.)
- Other (Please Describe)

15. In the last six months, what percentage of the time have any of your outbound shipments been turned down by your primary carrier?

- Less than 5% of the time
- 6-10% of the time
- 11-20% of the time
- More than 20% of the time

16. What is the approximate distance (average one-way distance) for your employees' commute?

0 20 40 60 80 100

Miles ()	
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17. Have your employees ever expressed concern that their commute was an issue for them?

- Never
- Infrequently
- Sometimes
- Frequently

18. Of the employees that work at this facility, their commute may impact through ...

	1	2	3	4	5
Increased Absenteeism					
Frequent Tardiness					
Higher Turnover Rate					
Other (Please describe)					

19. The employees have access to our facility through:

	Yes	No
Public Transportation		
Vanpooling		
Car-pooling Options		
Walking Distance		
Bike Friendly Community		

20 Please provide any additional information regarding transportation challenges (either freight or commute related) for your facility:

21. Approximate Gross Annual Revenue of your entire company?

(Not just for your facility)

- <\$100,000
- \$100,000-\$249,999
- \$250,000-\$499,999
- \$500,000-\$999,999
- \$1,000,000-\$1,999,999
- \$2,000,000-\$4,999,999
- \$5,000,000+

22. Approximate % of revenue for your company from sales outside the U.S.:

0 20 40 60 80 100

% ()



23. Would you be interested in collaborating with other manufacturers in your area to reduce transportation costs?

- Yes
- Maybe
- No

24. Would you be interested in receiving a copy of the final study results when available?

- Yes
- No

25. Can we follow up with you for more detailed information?

- Yes
- No

Contact Information If you answered "Yes" to any of the previous three questions, please provide your contact information below. This information will not be shared. We appreciate your participation!

Name _____

Email _____

Address _____

City _____

State _____

Zip code _____
