North Dakota Strategic Freight Analysis:

The Role of Intermodal Container Transportation in North Dakota

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Message to the Reader

This report is organized into three different sections: the executive summary, the main report, and appendices. The first three pages of the executive summary provide the reader with valuable information on the study and findings. These pages provide an intermodal definition, significant findings, and keys to developing an intermodal facility in North Dakota.

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EXECUTIVE SUMMARY

Intermodal Definition

Intermodal freight transportation is defined as the seamless and continuous door-to-door transportation of freight on two or more transportation modes. (Muller, 1995).

Significant Findings

- Nationwide, from 1990 to 1999, trailer and intermodal container loadings in the U.S. increased from 6.2 million to 9.18 million respectively (AAR, 2001). Loadings were down somewhat in 2001 to 8.94 million, but again have rebounded in 2002. Loadings are up 9 percent over 2001 loadings for the first 35 weeks of 2002 (AAR, 2002)

- In addition to the freight rate, important factors in the choice of transportation modes include transit time, reliability, capability, accessibility, customer shipping preference, and security.

- Intermodal truck-rail transportation offers two distinct advantages: (1) it allows combining the better service characteristics of truck with the lower rates of rail, and (2) it increases the ease of shipping products internationally.

- North Dakota commodities ideal for container movements may include skid steer loaders, mini excavators, value-added wood products and furniture, industrial and agricultural machinery, and agricultural products such as soybeans, confection sunflowers, and organic and identity preserved grains.

- Viable intermodal container transportation may provide an avenue for North Dakota manufacturers and value-added agricultural producers to compete in international and domestic markets.

- Benefits of intermodal transportation include:
    - lower overall logistics costs
    - increased economic productivity and efficiency
    - reduced congestion and burden on over-stressed highway infrastructure
    - higher returns from public and private infrastructure investments
    - reduced energy consumption
    - increased safety
    - opportunities for new business growth and diversification

- An intermodal loading facility in North Dakota may result in an overall reduction in truck traffic and highway system maintenance.

- The largest barrier to many companies using intermodal shipping is the location of an intermodal loading facility within a reasonable distance.

- Although the intermodal facility at Dilworth, MN is close to North Dakota, alleged problems with customer service, capacity, truck access, and limited space for warehousing cloud its future viability.

- An intermodal facility serving North Dakota may be viewed as an economic development tool that will help promote the success of existing businesses and draw new businesses to the state.

- For an intermodal facility to be located in North Dakota it must meet one of two criteria: (1) it must have a traffic volume that is large enough to generate efficient shipment sizes to final destinations without being consolidated with other traffic, or (2) it must have ancillary services available to the railroad that would give it a reason to stop and receive extra cars.

- Location factors contributing to the success of an intermodal facility include potential container volume, multiple railroad alternatives, location on an intermodal line, location on the National Highway System, and the availability of accessorial rail services.

- The largest amount of potential intermodal container traffic is in the southeast portion of North Dakota, near Fargo. This is due in part to potential container traffic in northwestern Minnesota.

- In order to be successful, an intermodal facility may have to be located on a Class 1 railroad intermodal line.

- Minot is the only location in North Dakota where two Class I railroads interchange freight cars and where two competing railroad intermodal lines intersect.

- The success of the Port of Montana has important implications for North Dakota. A successful intermodal facility may need to diversify in order to achieve success.

- To be successful, an intermodal facility will need to handle between 13,000 and 21,000 containers per year.

- A base intermodal facility capable of handling 50,000 lifts per year is estimated to cost in excess of $2 million and have an annual estimated operational cost of approximately $500,000.

- Adequate capital funding and operating revenues are the two main obstacles to constructing and operating a successful intermodal facility.

- One of the largest barriers to funding an intermodal container facility is that federal and state highway funding rules limit the ability to accomplish multimodal projects.

- A possible funding scenario may be to follow the Montana example of a combination of general fund and utilization of Port Authority.

- North Dakota may need to establish enabling legislation allowing the formation of a Port Authority.

Keys to Developing an Intermodal Facility in North Dakota

Many parties have expressed a strong interest in developing a highway/rail intermodal container transportation facility. The development of a successful facility will require someone or an entity to take a strong leadership role. It will also require a cooperative effort among federal, state, and local government, economic development groups, railroads and other transportation companies, manufacturers and specialty agricultural producers. This effort may include such actions as:

1. Pursuing state enabling legislation allowing for creation of a port authority for communities and regions
   - Bonding authority
   - Power to tax

2. State legislation allowing joint state/local funding cooperation for non-highway components
   - Start-up grant from state or federal sources
   - Low-interest loans

3. Local community support of creation of diversified shipping/business model

4. Commitments and Cooperative Effort
   - Commitment of rail carriers for rates and service
   - Commitment of a jurisdiction (city, state, county and rail)
   - Cooperation among states and provinces
   - Commitments from shippers and third party transportation providers

5. Specific site analysis
   - Business plan
   - Engineering plan

6. Creation of an outreach program educating shippers about intermodal transportation using an internship program and other educational methods

Final Commentary

Final determination as to whether or not a facility is built in North Dakota is up to the leadership of both public and private sectors. The information in this report provides a basis for discussing the pros and cons of constructing an intermodal terminal. Cooperation among state and local government leaders along with business leaders can bring about a plan for increasing the transportation options for the shippers of the state.

A multi-faceted terminal serving many different interests and filling niche transportation demands may provide opportunities for existing businesses to diversify and grow, and for potential new businesses in the state and surrounding region. The trend of increased production of identity preserved agricultural products and a growing viable manufacturing sector requires additional logistical and transportation options be considered.

I. PURPOSE AND PROCESS OF THE STUDY

This report examines the potential role of a newer form of transportation-intermodal truck-rail container transportation, in the state's expanding manufacturing and value-added agricultural base. The objectives of the study are to: (1) examine the current transportation system for value-added processors, manufacturers and specialty agriculture producers, (2) provide information and analysis necessary for decision makers to evaluate the viability of an intermodal container facility serving North Dakota, and (3) provide information related to the transportation needs of manufacturers and value-added agricultural producers to allow informed decision making by public policy makers.

Specifically, the report explores general advantages of intermodal container transportation, examines factors that make intermodal container transportation successful, examines functions performed by successful intermodal facilities, evaluates characteristics of various locations that are desirable for an intermodal facility, estimates potential traffic volumes and other characteristics of various North Dakota locations where such a facility might be located, and explores various funding options for an intermodal facility.

Characteristics of Container/Trailer Intermodal Transportation (Highway/Rail)

The definition of intermodal freight transportation is the seamless and continuous door-to-door transportation of freight on two or more transportation modes, for example, truck-rail or truck-ocean (Muller, 1995). Although many types of intermodal transportation exist, this study examines intermodal container transportation-where containers or trailers are loaded on rail cars for transportation to domestic markets or ocean vessels for international markets.

Intermodal transportation is an important part of value-added manufacturing. Lower total logistics costs are realized by using each mode for the portion of the trip for which it is best suited. For example, rail is used on the long-distance haul and truck on the short-distance haul to and from the intermodal facility, providing advantages of truck's door-to-door service and increased security, and the economies provided by rail. Moreover, intermodal truck-rail service also mimics improved reliability of truck over rail, as rail carriers have placed an emphasis on reliability for intermodal services. Using rail for the long-haul portion of the trip also may result in improved environmental conditions including improved air quality because of reduced energy consumption. Finally, using fewer trucks for the long-haul portion of the trip also lessens congestion in major metropolitan areas and reduces damage to the roadway.

Benefits of intermodal transportation include:

- lower overall logistics costs
- increased economic productivity and efficiency
- reduced congestion and burden on over-stressed highway infrastructure
- higher returns from public and private infrastructure investments
- reduced energy consumption
- increased safety

Intermodal transportation is used in domestic and international shipments. The domestic movement usually is truck-rail, while internationally it can be a truck-rail-ocean or rail-ocean, or truck-ocean. Containers have increased in popularity in international trade. However trailers will remain important in the short-haul and low-volume loads.

II. EXISTING TRANSPORTATION CONDITIONS IN NORTH DAKOTA

The state's transportation system largely has been built to accommodate North Dakota's bulk agricultural production. While bulk agriculture is still and will continue to be a large part of the state's economy, recent rapid growth in the manufacturing industry suggests that manufacturing will play an increasingly important role in the state's economy.[1]

For the state's growing manufacturing and value-added agricultural industries, where fast delivery times and low inventory costs are important elements in doing business, new forms of transportation outside the traditional bulk-handling system are needed. One form of transportation that has not been fully utilized by North Dakota shippers is intermodal container carriage on rail cars. Viable intermodal container transportation may provide the avenue for North Dakota manufacturers and value-added agricultural producers to compete in international and domestic markets.

Within the state, many parties have expressed interest in having close proximity to intermodal container transportation. Producers of specialty crops, along with manufacturers from different parts of the state have expressed an interest in locating an intermodal facility within close proximity to their plants or production. The closest facilities are in Dilworth, Minn.; Winnepeg, Mant.; Minneapolis, Minn.; Regina, Sask.; Chicago, Ill.; Billings, Mont., Butte, Mont., and Shelby, Mont..

Although Dilworth, Minn. is in close proximity to many North Dakota shippers, several problems exist with the current facility. In conducting a survey of North Dakota firms, we found

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[1]Appendix 1 of this report provides a description of the North Dakota Economy, with a specific focus on the manufacturing sector.

that 9 percent of respondents who reported using an intermodal container facility reported they were denied intermodal container service at least once during the last year. In fact, the BNSF Railroad projects the facility may reach capacity limitations by 2008. The Dilworth facility offers limited space for other complementary activities such as warehousing.

Case Studies of Intermodal Container Transportation

To gain insight into the types of benefits that intermodal container transportation provides to North Dakota shippers, we performed several short case studies. We performed case studies to: (1) show rate and transit time implications associated with shipping specific North Dakota products to specific markets using an intermodal container option, and (2) show changes in transportation competitiveness of North Dakota shippers resulting from an intermodal container option.

In estimating transportation charges and transit times for shipping North Dakota products by truck and/or intermodal container to foreign markets we found: (1) sugar and dry pasta are transported to Kobe, Japan, at substantially lower costs using an intermodal container rather than using truck and transloading into containers at coastal ports (18 to 25 percent savings), and (2) these same products experience transit times that approximately one-third higher using the intermodal option. For mini excavators shipped by intermodal container to Antwerp, Belgium, we found an estimated 34 percent savings in transportation charges in comparison to truck transloading into containers at a coastal port, and transit times that are approximately equal to the truck-transloading option.

In comparing estimated transportation charges and transit times for select North Dakota products to those of major domestic competitors, we found: (1) Transportation charges for shipping dry pasta to Kobe, Japan, are much higher for North Dakota shippers than for shippers in Salinas, California, or Excelsior Springs, Missouri, (2) Transportation charges for shipping excavators to Antwerp, Belgium, are much higher for North Dakota shippers than for shippers in Dubuque, Iowa or Peoria, Illinois, and (3) the intermodal container option greatly reduces transportation disadvantage for North Dakota shippers of these products. The findings of all the case studies suggest that intermodal container shipping provides an important option for many North Dakota shippers.

Shippers' Views of Intermodal Service

The largest barrier to many companies using intermodal shipping is the location of intermodal loading facilities. An intermodal loading facility located within a reasonable distance is essential to justify using intermodal as a viable transport mode. As distance to an intermodal facility increases, rate savings decrease, due to increased drayage costs. Moreover, this increased distance also causes transit times and the resulting logistical costs to increase. This explains why many small, rural companies simply continue to use trucks to transport their products.

Railroad's View of Intermodal Service

Much of the success of intermodal operations can be attributed to the development of intermodal hubs, or terminal locations, where trains are gathered and cars are exchanged or switched to form new trains. "These "hub-and-spoke" operations take advantage of reducing the number of point-to-point operations when the volume is not large enough to make them cost efficient" (Muller, 1999).

However, while a generalized version of the 'hub-and-spoke' system has been used to make railroads successful in intermodal operations, some rural areas have been excluded from this system. Many rural areas in the western part of the U.S. have such low intermodal traffic volumes and are at such long distances from large volume intermodal facilities that they have not been fully included in the intermodal "hub and spoke" system. In many cases, their intermodal service has been eliminated. This service has been reduced from approximately 1,500 operations in 1970 to less than 370 in 1998 (Muller, 1999). This reduction in facilities has limited transportation options for many shippers in smaller cities or rural areas.

This trend has important implications for future intermodal service to North Dakota. Because an intermodal facility serving North Dakota would not be fully included in the railroad's "hub-and-spoke" network, it must meet one of two special criteria: (1) it must have a traffic volume that is large enough to generate sufficient shipment sizes to final destinations without being consolidated with other traffic, or (2) it must have ancillary services available to the railroad that would give it a reason to stop providing an opportunity to switch rail cars.

Montana: Two Different Terminal Options

Two intermodal terminals in Montana provide insight into factors that might make an intermodal container terminal successful or unsuccessful in North Dakota. One facility, the Port of Montana, has greatly diversified in order to become a successful intermodal facility.

The Port of Montana, located in Butte, originally was built to provide container/trailer transloading services. After operations began, it was clear that expansion into other shipping services was necessary to have a successful facility. The facility has diversified by providing intermodal container/trailer service, fertilizer bulk handling, liquid materials, auto storage for distribution, lumber storage for distribution, silica sand storage for distribution, and other functions on an individual basis. One of the facility's main businesses is regional distribution for GM automobiles. The cars are brought to the facility, off loaded, and stored in the secure storage area until they are ordered for distribution.

The success of the Port of Montana has important implications for a potential intermodal facility in North Dakota. Just as the base container traffic for an intermodal facility in Butte is limited, this also is likely to be the case for North Dakota. The case suggests that a potential facility in North Dakota may need to diversify to achieve success in a similar way to the Port of Montana.

Another intermodal facility in Montana is the intermodal facility at Billings, which is operated by BNSF. The facility's focus is on less-than-truckload (LTL) traffic. The LTL carriers of Roadway, Yellow, UPS, FEDEX, and the USPS dominate the transloading for the Billings facility. Outside of this traffic, the facility has had limited success in obtaining intermodal container traffic.

A potential reason why the facility has not obtained a large amount of container traffic is that it is not on a railroad intermodal route. Billings is located on a coal route, and therefore container traffic must yield to coal trains, greatly slowing transit times. Another problem faced by the Billings facility is that traffic must be switched between Montana Rail Link and the BNSF near the facility. This switch delays shipments in and out of the facility.

These problems also have important implications for a potential North Dakota facility, suggesting that any new facility should be on an intermodal line and not rely on multiple railroad coordination near the facility for short and reliable transit times.

III. SUMMARY OF FINDINGS

A survey was administered to gain insight into the modes of transportation used by manufacturers and specialty agricultural producers in the North Dakota region, reasons they use such modes, experiences of shippers with intermodal service, and transportation volumes. The survey was sent to all manufacturing companies in North Dakota and in the counties of surrounding states, as well as to a number of specialty agricultural companies in the region. Specifically, shippers were surveyed in North Dakota, Minnesota, Montana, and South Dakota. Although the survey was preceded by a letter explaining its importance, and followed by postcard reminders and telephone calls, the response rate was limited. Moreover, many responses were partial or incomplete.

Of the 2,039 manufacturing locations in surveyed areas, 261 responded, representing a 12.8 percent response rate. While the response rate was low, the locations responding employed 27,402 of the 58,318 manufacturing workers employed in the region (47 percent). This suggests that the responses we received should be representative of a large portion of the region’s manufacturing.

The survey revealed several important findings; (1) modal shares for outbound products were 53 percent by truck, 45 percent by rail, and 2 percent by container, (2) modal shares for inbound raw materials were 98 percent by truck and the rest by rail, (3) in responding to a question asking why firms use the transportation modes they use, more than half reported timely and reliable service as one reason, 46 percent reported direct access as a reason, and 40 percent reported low rates - this may suggest that an intermodal option that combines timely service with lower rates in comparison to truck transport may be desirable for shippers in the region, (4) a large amount of the freight volume from the surveyed regions is located in the southeast portion of North Dakota and northwest Minnesota, and (5) of the firms that use intermodal container transportation as an option, 9 percent reported having been denied service within the last year.

Potential Traffic of an Intermodal Container Facility

Perhaps the most important factor in determining viability of an intermodal container facility is the potential traffic that would use such a facility. The amount of potential traffic for a facility provides three important pieces of information: (1) it provides a measure of the benefit of such a facility - a larger amount of potential traffic means larger total savings in logistics costs for regional manufacturers and specialty agricultural producers, and (2) it provides an indicator of whether a new facility would generate enough business to become a profitable and viable venture, and (3) it may provide an indicator of the quality of service and level of rates that might be charged for such a facility, as railroads are able to produce higher quality intermodal services at lower costs with larger shipment volumes. One difficulty in estimating potential traffic is that the amount of traffic depends on rates and service levels, and these are unknown for a new facility. Essentially, our methodology estimates tons of various products transported from the region, multiplied by the Illinois percentages of these same products that move in intermodal truck-rail configurations providing an estimate of potential intermodal freight.

Table A shows the estimated potential outbound and inbound containers from each of the previously defined regions.[2] As the table shows, the largest amount of potential intermodal container traffic is in the southeast portion of North Dakota. Moreover, other regions in close proximity to southeast North Dakota, including western Minnesota and northeastern North Dakota, also include large amounts of potential intermodal container traffic.

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[2]These estimated potential containers are expected to occur only in the region where the facility is located, and in other regions in close proximity. For example, if a facility were located in Fargo, container traffic from western North Dakota would be much smaller than indicated by the estimate of potential container traffic from western ND regions.

Table A. Estimated Potential Container Traffic with a New Intermodal Facility.

Region	Estimated Potential Inbound Containers If Using 20' Container	Estimated Potential Outbound Containers If Using 20' Container	Estimated Potential Inbound Containers If Using 40' Container	Estimated Potential Outbound Containers If Using 40' Container
MN	1,683	7,184	1,530	6,530
MT	140	1,121	127	1,019
ND1	15	439	14	399
ND2	128	1,230	116	1,118
ND3	118	801	108	728
ND4	447	4,080	406	3,709
ND5	116	809	105	735
ND6	289	1,905	262	1,732
ND7	321	1,576	292	1,433
ND8	940	6,025	855	5,477
SD1	40	569	36	517
SD2	643	3,384	585	3,076

* Caution must be used in interpreting these estimated potential container volumes, as they are not based on an expected rate and service level.

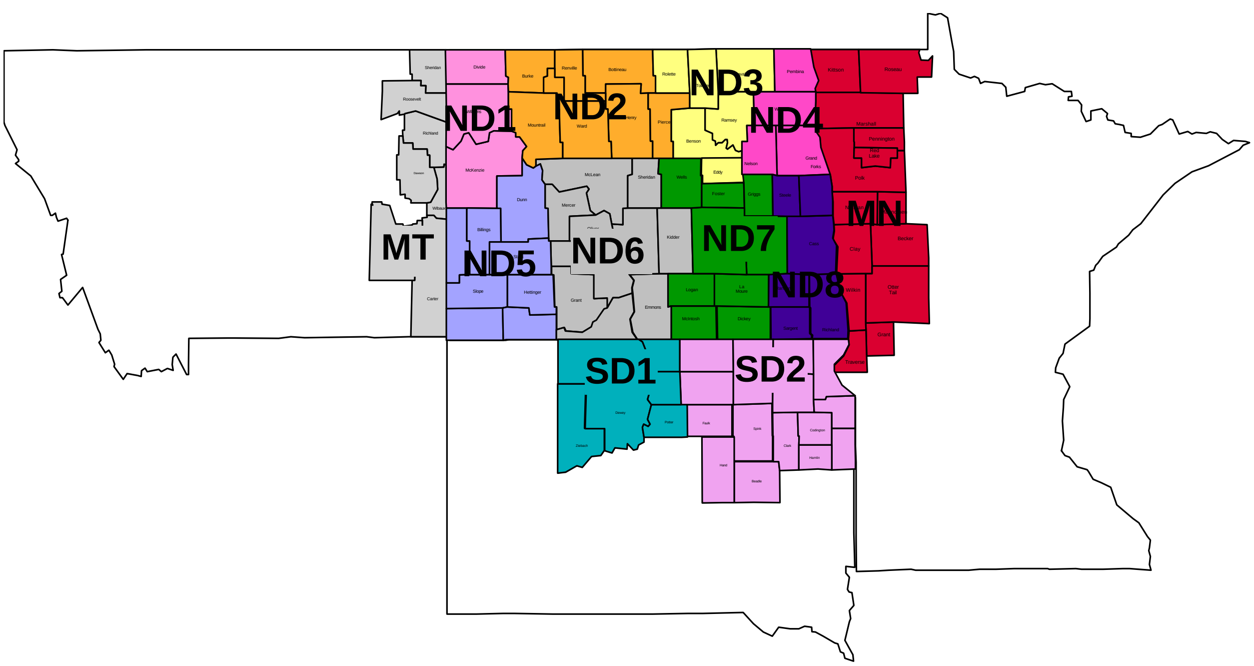

Figure A. Surveyed Regions in North Dakota, South Dakota, Montana (MT), and Minnesota (MN)

Truck/Rail Container Intermodal Terminal Costs

An economic engineering model is developed to simulate costs for an intermodal facility. This model provides decision makers with an estimate of start-up and annual costs. Moreover, it provides insight into traffic volumes needed to make such a facility feasible.

The model shows the estimated investment expenditure for a base case facility capable of handling 50,000 lifts per year to be approximately $2 million. The estimated annual fixed and variable costs for the base case intermodal facility capable of handling 50,000 lifts per year including facility and equipment depreciation, return on investment, taxes, insurance, maintenance, management, building expenses, and accounting expenses is $500,000 per year. While these base case estimates are not exact, they represent a reasonable approximation of what such a facility would cost to maintain and operate. It is possible to reduce costs somewhat by employing used equipment or by using existing track.

Some insight into the types of volumes that would be necessary to support such a facility might be obtained by comparing an average revenue per lift to the costs per lift.[3] Leeper, et. al (1996) estimate that the lift revenues at Dilworth, Minn. are in the range of $10 to $15. If these numbers are put in current dollars using the GDP Implicit Price Deflator, the range is $10.94 to $16.41 in 2001 prices. At the high end of the revenue range, this would suggest that a facility may be feasible with as few as 13,000 containers annually. At the low end of the revenue range

[3]It is important to note that these cost estimates and average revenue estimates are reasonable estimates given the information we have. However, the point where average revenue per lift is equal to cost per lift from this model should not be considered as a solid break-even point. Rather, the numbers are illustrative of a range of traffic where such a facility may be feasible.

would suggest that a facility would need 21,000 lifts per year to be feasible.[4] This is consistent with correspondence with the BNSF suggesting that most of the facilities they serve have at least 20,000 loaded containers per year.

Location Analysis

A variety of locational factors enhance the viability of an intermodal container facility. Locational factors contributing to the likely success of an intermodal container facility include, but are not limited to: (1) potential container volume, (2) the availability of multiple railroad alternatives, (3) location on an intermodal rail line, (4) location on the National Highway System, and (5) the availability of accessorial services such as a fuel stop at the location.[5]

Although not quantifiable, the availability of complementary transportation services, such as international air service, and express package and LTL terminals, as well as business services can also increase the likely success of a new intermodal container facility. In particular, one of the benefits of an intermodal container facility may be to attract firms that may benefit from the lower logistics costs offered with such a facility. The addition of an intermodal facility is likely to have a greater impact on attracting new businesses in locations that may offer a variety of transportation and business services. Because the availability of such services is not quantifiable,

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[4]One container generally requires two lifts.

[5]These factors were developed from a review of literature related to the development of intermodal container facilities, from site visits at intermodal facilities in Billings and Butte, Mont., and Dilworth, Minn., and from discussions with the BNSF. Unfortunately, we were unable to obtain direct input from the Canadian Pacific Railroad in this study. CP Rail chose not to provide guidance or answer any questions regarding desirable locations or operational characteristics that would fit an intermodal terminal location.

they are not analyzed further. The following paragraphs will explore various potential locations for an intermodal facility in North Dakota in terms of these criteria.

Although the study examines a variety of locations, we highlight Fargo, Minot, and Valley City, as each presents a unique situation in terms of a potential intermodal container facility. Fargo is chosen due to its location in a region that has high potential COFC volumes and its close proximity to other regions with high potential COFC volumes, its location on two interstate highways, its location on an intermodal line, and the fact that it currently serves as a fuel stop for the BNSF railroad. Minot is chosen due to its unique characteristics of being the only location in North Dakota with two competing intermodal lines, its location on the national highway system, and its current fuel stop for the BNSF. Valley City is chosen due to its close proximity to high potential COFC volumes, its location at the intersection of two competing railroads, and its location on the National Highway System.

Figure B shows the three cities and the 100-mile radius around each and Tables 2 and 3 report the other characteristics of each and the estimated potential COFC traffic volumes.

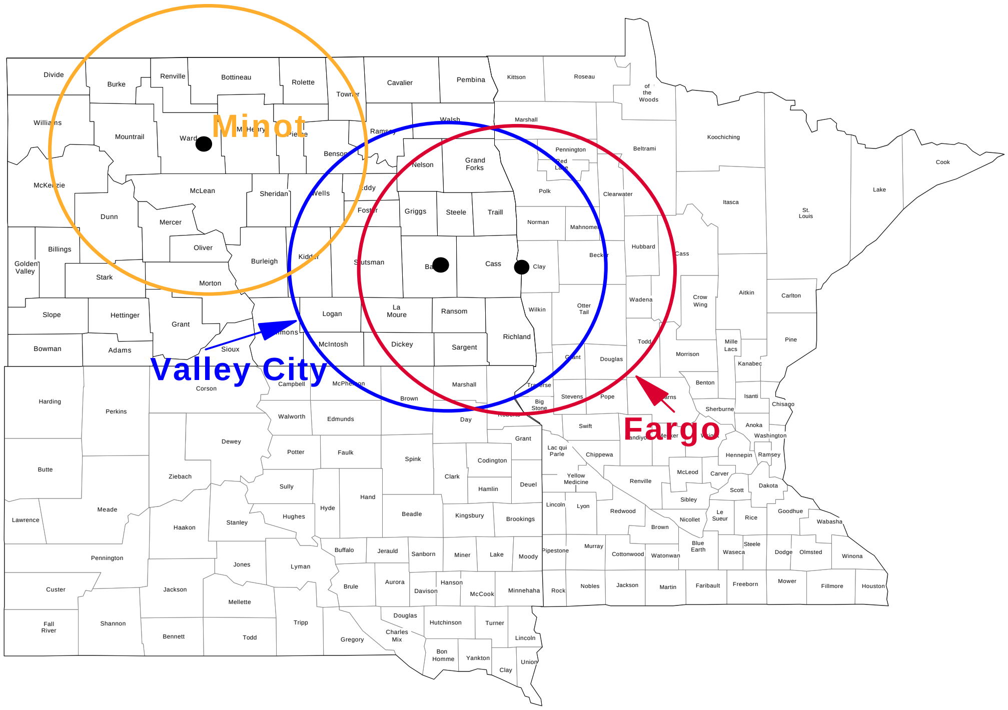

Figure B. 100-mile radius Around Three Cities (Fargo, Valley City, and Minot)

Table B. Cities Chosen for Analysis and Locational Factors.

City	Accessorial Services	Competition CP and BNSF	Intermodal Line	Located on National Highway System
Fargo	**Yes (Fuel Stop for BNSF)**	**No**	**Yes (BNSF)**	**Yes**
Valley City	**No**	**Yes (BNSF)(CP)**	**Yes (CP)**	**Yes**
Minot	**Yes (Fuel Stop for BNSF)**	**Yes (BNSF)(CP)**	**Yes (BNSF)(CP)**	**Yes**

* Assumes 10,000 containers loaded by the Tioga alfalfa pelleting facility.

Table C. Estimated Potential 20' Containers

City	Estimated Potential Twenty foot Containers					
	100-mile radius		**200-mile radius**		**200-mile radius**	
	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound
Fargo	16,021	3,229	20,428	3,884	22,962	4,248
Valley City	15,225	2,757	21,153	4,172	23,282	4,329
Minot	3,391 (13,391)*	488	5,907 (15,907)*	1,022	13,573 (23,573)*	2,186

* Assumes 10,000 containers loaded by the Tioga alfalfa pelleting facility.
** Within the literature containers are measured in TEUs (20 foot equivalent unit).
*** 40' containers may be loaded instead of 20' containers. Estimated potential 40' containers can be obtained by multiplying the above estimates by .909.

As the Table C shows, each of these cities is estimated to have at least 13,000 potential outbound containers. A previous section of the report suggested that under specific conditions, 13,000 to 21,000 containers may be enough to make a new intermodal container facility viable.

In looking at each community separately, Fargo offers the highest estimated potential outbound and inbound container volumes for the 100-mile radius, is on an intermodal line, offers refueling to the BNSF, and has direct access to two interstate highways. However, Fargo does not have multiple railroad options. Nonetheless, the community represents one potentially viable location for an intermodal container facility.

One important discussion point related to Fargo is that a facility already exists in Dilworth, Minn. a location within three miles of Fargo. However, several problems exist with the current facility, and these problems are unlikely to be resolved at the current location. Problems include a lack of space for expansion into other areas such as warehousing, unavailability of equipment, and congestion. Moreover, the facility is privately owned and operated and is not in North Dakota. Therefore, the ability to use state and local economic development tools for this facility - tools that may enhance the facility's chances for success - is limited.

Valley City also ranks high in potential container volume, but not as high as Fargo. While the city has railroad alternatives (BNSF and CP), it is located on only one intermodal line. As suggested previously, competition is not likely to have a big effect on rates and services in cases where the location is not on two intermodal lines. Thus, based on the stated criteria, Valley City does not appear to have advantages over Fargo. However, a more remote or rural site may be desirable for loading and unloading of containers where it would not interfere with other railroad operations, and where more space is available. The rurality of Valley City compared to Fargo may be an advantage.

Finally, Minot has a large amount of potential COFC volume if the estimate of 10,000 potential containers out of the new Tioga alfalfa pellet facility is correct. Moreover, Minot has one advantage that no other community has in the state of North Dakota - it is located on two competing intermodal rail lines. To the extent that such competition acts to discipline railroad rates and service, such a location may have a higher amount of potential container volume than estimated. Other advantages of Minot are the same as Fargo and Valley City, including a location on the National Highway System and the availability of a fuel stop for the BNSF. Finally, the BNSF stated that Minot would cause the least amount of disruptions to its operations, as intermodal trains currently stop there to change crews and some intermodal switching occurs there. The ability to attract the necessary amount of traffic still remains a concern in Minot, however.

The estimates of potential containers for the three cities can be expended to 150 and 200-mile radius (Figures C and D).

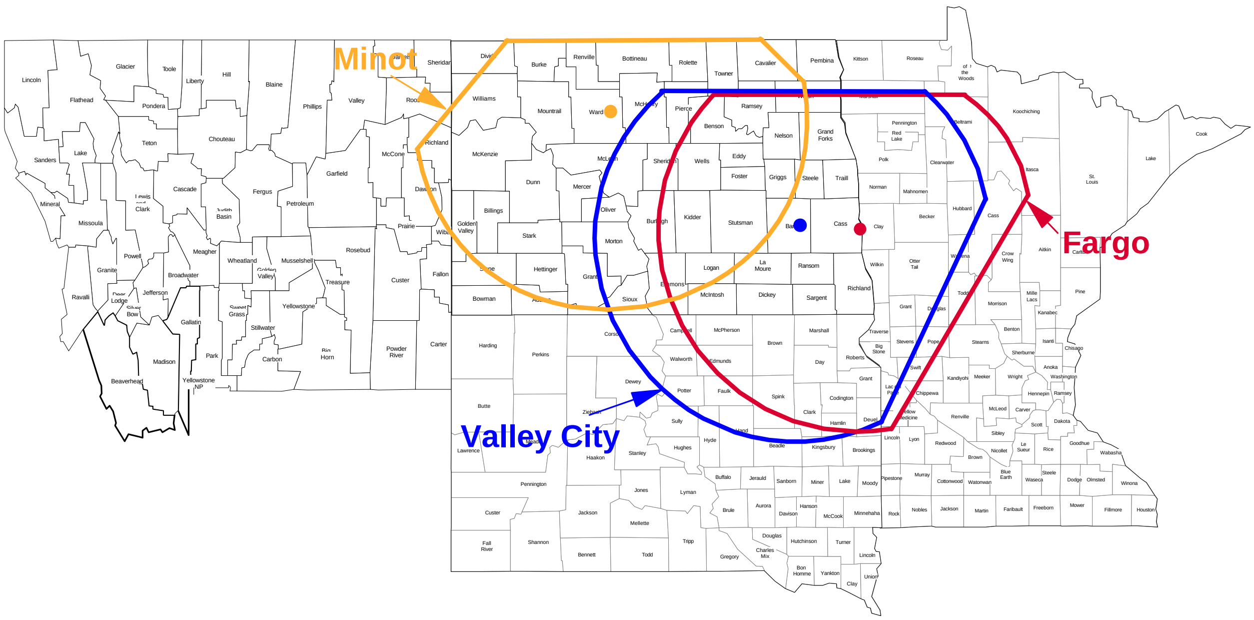

Figure C. 150-Mile Radius of Three Cities (Fargo, Valley City, and Minot) to Estimate Potential Tons with New Intermodal Facility

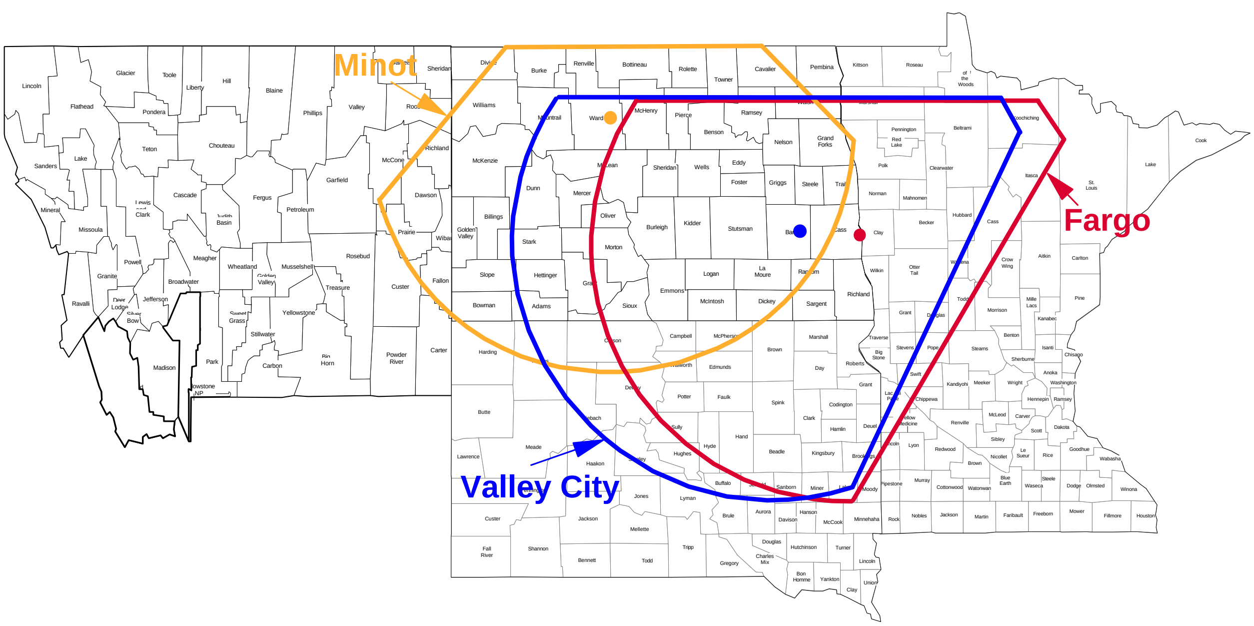

Figure D. 200-Mile Radius of Three Cities (Fargo, Valley City, and Minot) to Estimate Potential Tons with New Intermodal Facility

Potential manufacturing and grain tons were measured to provide total potential 20' container volumes. However, this study has excluded areas located closer to other intermodal facilities, such as Minneapolis, Winnipeg, and Regina. Because shippers are likely to use closer intermodal facilities, it is rational to exclude these areas

According to the analysis, using the 150-mile radius, Valley City was found to have the largest container volume among the three cities at an estimated 21,153 containers (Table C). Unlike the results of the 100-mile radius, Fargo had the second largest container volume at an estimated 20,428 containers. The reason for the lesser volume at Fargo was because the circle was closer to the intermodal facility located in Minneapolis thereby excluding some of the radius. For the 200-mile radius, Minot showed the largest container volume at an estimated 23,573 containers (Table C). This estimate included 10,000 containers loaded by the Tioga alfalfa pelleting facility. Again, Valley City had the second largest volume estimate at 23,282 containers.

In summary all three communities offer some advantage not realized by the other two. A complete feasibility analysis would require better data on potential volumes and capital/operation cost estimates for a specific site and type of facility.

IV. OPTIONS/ACTIONS TO CONSIDER

In examining funding options for a new facility, we found several potential sources, but some problems with each. One of largest barriers to funding and intermodal container facility is that federal and state transportation funding rules limit the way highway funding can be appropriated within the state. Specifically, a North Dakota Statute prevents state highway funds from being used for non-highway purposes. Moreover, allocated Federal highway funds cannot be used to construct an intermodal container facility. Relaxation of state and federal rules limiting funding flexibility may enhance opportunities for funding such a facility.

An important element of intermodal container facility success in Montana has been the enabling legislation allowing for Port Authority. Such authority may serve as a means for funding an intermodal facility. “The term Port Authority refers to a state or local government that owns, operates, or otherwise provides wharf, dock, and other terminal investments at ports” (Coyle et.al., 1994). Ports can be municipal airports or other public transportation systems moving people and goods.

Many cities, counties, regions, and or states have built terminal facilities to promote transit and efficient freight transportation using Port Authority. In the case of freight, the Port Authority may operate portions or all of the facility or lease facilities to private firms. Often, the Port Authority has taxing authority to provide funding for constructing and operating a facility. Many states, counties, and or municipalities have engaged using Port Authority as a tool for providing shipping options for existing and or new development.

Although North Dakota does not have laws allowing for Port Authority, such a law could provide a method for cities, counties and/or regions to access the tax base for funding and/or maintaining for an intermodal facility. However, it may take initial funding from the state’s general fund or a low interest loan from the Bank of North Dakota to make the initial investment.

Other options for funding an intermodal facility include public/private partnerships. Our interview with BNSF revealed a willingness to work with public agencies in a public/private partnership. This may be a desirable option for funding such a facility, since such a commitment from both the public and private sectors may enhance the potential for success.

Other considerations in examining the possibility of funding an intermodal container facility include a need to diversify beyond intermodal container transportation, the need for cooperation/commitment from the railroad(s), cooperation and commitment from shippers, and cooperation among communities, counties, regions, and states.

Another possibility for funding is presented by the recently passed farm bill. A section of the farm bill authorizes a Northern Great Plains Authority in the states of Iowa, Minnesota, Nebraska, North Dakota, and South Dakota. “The Authority is expected to develop a series of comprehensive coordinated plans for economic development of the region. The Authority may approve grants to states and public and nonprofit entities for projects including transportation and telecommunication infrastructure projects, business development and entrepreneurship, and job training. Extends the program but no funds are provided."(source: www.rurdev.usda.gov/rd /farmbill/sections.html)

The main reason for the authority is to provide economic development for the Northern Great Plains regions. Even though no funding has been provided, the possibility exists for funding in the future. This Regional Authority may provide an avenue for funding an intermodal terminal facility.

V. FINAL COMMENTARY

Final determination as to whether or not a facility is built in North Dakota is up to the leadership of both public and private sectors. The information in this report provides a basis for discussing the pros and cons of constructing an intermodal terminal. Cooperation among state and local government leaders along with business leaders can bring about a plan for increasing the transportation options for the shippers of the state.

A multi-faceted terminal serving many different interests and filling niche transportation demands may provide opportunities for existing businesses to diversify and grow, and for potential new businesses in the state and surrounding region. The trend of increased production of identity preserved agricultural products and a growing viable manufacturing sector requires additional logistical and transportation options be considered.

INTRODUCTION

Recent changes in the state's economy suggest that a review of the North Dakota transportation system would be useful. The state's transportation system has been built largely to accommodate North Dakota's bulk agricultural production. While bulk agriculture is still and will continue to be a large part of the state's economy, recent rapid growth in the manufacturing industry suggests that agriculture will not be the only part of the state's economy.[6]

Transportation availability is essential for entering new domestic and international markets and for maintaining existing markets for the all state's industries. For the state's growing manufacturing and value-added agricultural industries, where fast delivery times and low inventory costs are important elements in doing business, new forms of transportation outside of the traditional bulk-handling system may be needed. One form of transportation that has not been fully utilized by North Dakota shippers is intermodal container carriage on rail cars. Viable intermodal container transportation may provide the avenue for North Dakota manufacturers and value-added agricultural producers products to compete in international and domestic markets.

In the state, many parties have expressed interest in having close proximity to intermodal container transportation. Some users of intermodal facilities in the eastern portion of the state have also complained of service problems with the facility located in western Minnesota. Producers of specialty crops and manufacturers from different parts of the state have expressed an interest in locating an intermodal facility in close proximity to their plants or production. The

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[6]Appendix 1 of this report provides a description of the North Dakota Economy, with a specific focus on the manufacturing sector.

closest facilities are in Dilworth and Minneapolis, Minn., Billings, Butte, and Shelby, Mont., Winnepeg, Man., and Regina, Sask.[7].

The interest in intermodal container transportation expressed by different parties across the state prompted the ND Department of Transportation and the Upper Great Plains Transportation Institute to evaluate the possibility of locating intermodal facilities in North Dakota. Improved intermodal container transportation in the state may facilitate future growth of the value-added agriculture and manufacturing industries.

OBJECTIVES

The objectives of this study are to: (1) examine the current transportation system for value-added processors, manufacturers, and specialty agriculture producers, (2) provide information and analysis necessary for decision makers to evaluate the viability of an intermodal container facility serving North Dakota, and (3) provide information related to the transportation needs of manufacturers and value-added agricultural producers to allow informed decision making by public policy makers.

CONTENT

This report will examine the potential role of a newer form of transportation - intermodal truck-rail container transportation - in the state's expanding manufacturing and value-added agricultural base. Specifically, the report will explore the general advantages of intermodal container transportation, examine factors that make intermodal container transportation

[7]The location of these facilities is shown in Appendix 2.

successful, examine functions performed by successful intermodal facilities, evaluate characteristics of various locations that are desirable for an intermodal facility, estimate potential traffic volumes and other characteristics of various North Dakota locations where such a facility might be located, and explore various funding options for an intermodal facility. The following section of the report provides a general description of intermodal container transportation.

CHARACTERISTICS OF CONTAINER/TRAILER INTERMODAL TRANSPORTATION (HIGHWAY/RAIL)

A definition of intermodal freight transportation is the seamless and continuous door-to-door transportation of freight on two or more transportation modes, for example, truck-rail or truck-ocean (Muller, 1995). Many references to intermodal transportation refer to container on flat car (COFC), or trailer on flat car (TOFC). This is intermodal because in most cases it requires at least two modes of transportation to provide for the seamless door-to-door movement of goods. References to intermodal transportation in this report are for TOFC/COFC and movements by other modes that result in door-to-door service. The purpose of container on flat car (COFC) or trailer on flat car (TOFC) intermodal shipping is to take advantage of the economics of each different mode used. Intermodal transportation provides for truck trailer and container convenience while taking advantage of the lower costs provided by rail shipping.

Intermodal transportation growth has been aided by deregulation of U.S. transportation, global business growth, and changes in the business environment. The 1997 Commodity Flow Survey estimated that approximately one-half of 1 percent of all U.S. freight volume moved using truck/rail through either a trailer or container on a flat car. From 1990 to 2000, trailer and container loadings in the U.S. increased from 6.2 million to 9.18 million, respectively (AAR, 2001).

Intermodal transportation is an important part of value-added manufacturing. Lower total logistics costs are realized by using each mode for the portion of the trip for which it is best suited. For example, rail is used on the long-distance haul and truck on the short-distance haul to and from the intermodal facility, providing advantages of truck door-to-door service and increased commodity security, and the economies provided by rail. Moreover, intermodal truck-rail service also mimics the improved reliability of truck over rail, as rail carriers have placed a heavy emphasis on reliability for their intermodal services. Using rail for the long-haul portion of the trip also may result in improved environmental conditions including, improved air quality because of reduced energy consumption. Finally, using fewer trucks for the long-haul portion of the trip also lessens congestion in major metropolitan areas and may reduce damage to the roadway.

Benefits of intermodal transportation include:

- lower overall logistics costs
- increased economic productivity and efficiency
- reduced congestion and burden on over-stressed highway infrastructure
- higher returns from public and private infrastructure investments
- reduced energy consumption
- increased safety

Intermodal transportation is used in domestic and international shipments. The domestic movement usually is truck-rail, while internationally it can be a truck-rail-ocean or rail-ocean, or truck-ocean. Containers have increased in popularity in international trade. However trailers will remain important in the short-haul and low-volume loads.

A new trend in intermodal transportation is that some bulk commodities now are moving by containers. These commodities mostly are food commodities, such as bananas, coffee, and other fresh fruits, but also include soybeans, dry edible beans, wheat, and other traditionally large shipment commodities. The movement towards identity preservation (IP) of traditional low-valued products have increased the demand for containerizing these commodities.

Identity-preserved may be as simple as providing a customer with a specific product origin, or as complex as guaranteeing and ordering specific agronomical practices (Vachal, 2000). Organically grown wheat or soybeans for export are examples of identity-preserved commodities. Although identity-preserved could be a train of 110 cars of 14 percent protein spring wheat weighing 60 pounds per bushel and having 12 percent moisture with less than 1 percent dockage, most identity-preserved shipments are small quantities with higher values. Containerization ensures the shipper and receiver integrity of the product being shipped. Identity-preserved market demands may increase demand for container shipments in rural settings where commodities are grown.

Many farmers seek ways to add value to their farming operations and are exploring the possibility of exporting IP grain in small lots. Rural North Dakota identity-preserved grains need the containers and economies of shipping by rail long distance for this concept to work. Without an intermodal loading facility within a reasonable distance, any premium negotiated for the IP shipment may be lost to transportation costs.

Other North Dakota products also may be ideal for movement in containers. These products include some forms of industrial machinery. Skid steer loaders, and mini excavators move by container for export. Other products, such as value-added wood products and furniture, may move by container. Parts for all industrial and agricultural machinery may move by containter. Other agriculture products, such as potatoes (processed or table stock), IP soybeans, confection sunflowers, IP wheat, peas, lentils, beans, IP barley, IP oats, and many other agriculture products and manufactured goods, may move by container.

An intermodal transportation option only is available if transportation companies provide such a service. The next section of the report examines intermodal transportation from the railroad's perspective, focusing on the types of operations where railroads want to provide service.

SUCCESSFUL TOFC/COFC FROM THE CLASS 1 RAILROAD'S PERSPECTIVE

Insight into the goals of railroads in intermodal transportation services can be obtained by examining changes in Santa Fe Railroad's intermodal operations in the early 1990s. In the early 1990s the Santa Fe railroad turned intermodal from their least profitable segment to a level comparable to carload traffic. They modeled their management after motor carriers, viewing intermodal operations as "profit centers." Santa Fe created an intermodal business unit to run independently, creating a new organizational structure. The main advantage of the new department was a complete picture of the business. Previous responsibilities were spread out among many departments. The railroad focused heavily on intermodal marketing companies (IMC). Santa Fe found 20 percent of IMC customers produced 80 percent of the business, so they dropped the number if IMCs used from 260 to 55 (Giblin, 1996). They aggressively invested in new, longer 48-foot containers, compared to the old 45-footers. In 1994, Santa Fe offered six levels of service with six different prices. They found that premium traffic provided the most profit and customers were willing to pay for guaranteed service (Giblin, 1996).

Another efficiency gain for Santa Fe was improved lane balance. Lane balance is the ratio of full to empties moving in any given direction. Trucks usually operate with a ratio of 95 percent full and 5 percent empty, while Santa Fe was 55 percent full and 45 percent empty. Through aggressive pricing Santa Fe improved the ratio to about 95 percent full. Santa Fe also exited from all lanes where they did not see a clear competitive advantage.

Much of the success of intermodal operations can be attributed to the development of intermodal hubs, or terminal locations, where trains are gathered and cars are exchanged or switched to form new trains. "These 'hub-and-spoke' operations take advantage of reducing the number of point-to-point operations when the volume is not large enough to make them cost efficient" (Muller, 1999).

However, while a generalized version of the 'hub-and-spoke' system has been used to make railroads successful in intermodal operations, some rural areas have been excluded from this system. Many rural areas in the western part of the U.S. have such low intermodal traffic volumes and are at such long distances from large volume intermodal facilities that they have not been fully included in the intermodal "hub and spoke" system. In many cases, their intermodal service has been eliminated. This service has been reduced from approximately 1,500 operations in 1970 to less than 370 in 1998 (Muller, 1999). The reduction in facilities has limited transportation options for many shippers in smaller cities or rural areas.

This trend has important implications for future intermodal service to North Dakota. Because an intermodal facility serving North Dakota would not be fully included in the railroad's "hub-and-spoke" network, it must meet one of two special criteria: (1) it must have a traffic volume large enough to generate efficient shipment sizes to final destinations without being consolidated with other traffic, or (2) it must have ancillary services available to the railroad that would give it a reason to stop and receive extra cars for its westbound shipment. Few locations in North Dakota meet the railroad expected criteria. Next, intermodal transportation is examined from the shippers perspective, providing insight into the types of intermodal facilities and services that are likely to generate the most traffic.

SHIPPERS' VIEWS OF INTERMODAL SERVICE

Shippers cite improvements in timeliness and price competitiveness as important enhancements that would cause them to shift to intermodal usage (Spraggins, 1997). A survey reaffirmed that the service gap between intermodal and truckload services is the greatest barrier to improving intermodal transportation's share of the North American freight market. Intermodal transportation generally is thought of as a practical alternative for general freight (non-bulk) that moves in full trailerload or carload lots (Spraggins, 1997). In general, intermodal usage varies by the size of the company, products being shipped, and distance from an intermodal hub.

The largest barrier to many companies using intermodal shipping is location of intermodal loading facilities. An intermodal loading facility located within a reasonable distance is essential to justify using intermodal as a viable transport mode. As distance to an intermodal facility increases, rate savings decrease due to increased drayage costs. Moreover, this increased distance also causes transit times, and the resulting logistical costs to increase. This explains why many small, rural companies simply continue to use trucks to transport their products.

Intermodal marketing companies or third-party firms provide many of the functions associated with intermodal container services. Intermodal marketing companies can provide door-to-door services tailored to specific customer needs. Third-party logistics companies also perform door-to-door service and have been growing in popularity. Most intermodal loading facilities are not operated by the railroad that services the facility. Third party providers act as a liaison between shippers and the railroads, providing customer service, access to equipment, and attractive rates. In most cases, the third-party provider can obtain more attractive rates and better service because of its large volume of transportation purchases (Muller, 1999).

For an intermodal terminal to provide efficient effective service, close cooperation among all parties is necessary. Muller (1999) identified the requirements of a successful intermodal terminal as follows:

- Furnish necessary personnel and container-handling equipment to receive, store, and deliver intermodal trailers and containers.

- Prepare all necessary documents for receiving and delivering intermodal containers and trailers, ensuring that all port, airport, and other terminal charges, customs duties, and freight charges have been paid.

- Maintain a status report of all trailers and containers received, delivered, and on hand in the terminal for submittal to carriers involved.

- Maintain accurate inventory and locations of all intermodal trailers, containers, and equipment.

- Preplan all loading and unloading operations from data supplied by carriers and their agents.

- Provide necessary personnel and equipment to service loading and unloading operations between modes.

- Prepare all cargo plans, hazardous cargo manifests, and related documents for delivery to the carrier and its vehicles.
- Maintain security for all containers and equipment in the terminal.
- Prepare all reports relative to terminal functions.
- Furnish adequate supervision to ensure proper performance of all operations.

If a sole carrier uses the terminal, all functions can easily conform to the needs of that carrier. If more than one carrier serves the facility, all carriers' operational requirements must be met without interfering with other carriers. Other characteristics of a good terminal include a convenient location, access, and adequate infrastructure. To obtain more insight into what makes intermodal facilities successful, the following section discusses two intermodal facilities in Montana.

MONTANA: TWO DIFFERENT TERMINAL OPTIONS

The following paragraphs discuss two different intermodal terminals. One is operated jointly by a city and a county, providing successful economic development to the region, and another that is strictly a highway/rail intermodal terminal, but doesn't generate a high volume of traffic. First, the Port of Montana located in Butte will be discussed.

The Port of Montana is jointly owned by the city of Butte and the county of Silver Bow, as they have a joint city/county government. The port is operated by a board comprised of city/county commissioners and business leaders appointed by the chief executive. The five commissioners oversee general operation of the facility. There is a general manager, six office employees, and seven yard employees.

The Port of Montana's estimated annual volume is 31,000 rail cars for inbound and outbound freight. The annual revenue is estimated at more than $2 million.

The Port of Montana was established in 1989. Initial capital investment was provided partly by the state of Montana and the joint city/county government of Butte/Silver Bow. The port authority established by the city and county allows for the port to receive annual local funding from property taxes. The facility's focus is to provide freight service promoting economic development for the area. It is served by the Burlington Northern-Santa Fe, via Montana Rail Link and Montana Western, and also served by Union Pacific. The competition provided by multiple railroads serving the facility promotes good service and reasonable rates.

The facility's original intent was to provide a container/trailer transloading facility. After operations began, it was clear expansion into other shipping services was necessary to have a successful facility.

The facility has diversified by providing intermodal container/trailer service, fertilizer bulk handling, liquid materials, auto storage for distribution, lumber storage for distribution, silica sand storage for distribution, and other functions on an individual basis. One of the facility's main businesses is the regional distribution for GM automobiles. The cars are brought to the facility, off loaded, and stored in the secure storage area until they are ordered for distribution. This distribution is done by a third party specializing in car hauling. The car distribution is operated in conjunction with the UP railroad.

The Port is equipped with a Fertilizer Transload facility, which consists of a 1,600 sq. ft. direct rail-to-truck transload via a 190 foot covered conveyor, with a 150 ton per hour capacity, and flow-meter scale. A mineral facility also was added to provide the area with storage and a load out facility.

Equipment for the minerals facility consists of a dump truck, front end loader, and conveyor equipment allowing for transloading most types of railcars and trucks. Unloading via truck or rail can be accomplished from most forms of equipment. Certified rail scale weights, and service via Union Pacific and Burlington Northern Santa Fe railroads are available.

The terminal has a dedicated building for forest products. The facility is capable of handling 7 rail cars inside and storing 18 rail cars outside. It also has 84,000 square feet of enclosed storage, paved outside storage, and direct transfer from truck to rail car. There is direct intermodal shipping and transloading of all types of lumber products. The facility also arranges delivery for trailers (TOFC) to destination ramps or to be containerized for export. Services include bracing and blocking, rebanding and utilization of a “dense pack” system that increases the amount of lumber loaded into a 50-foot boxcar to more than 80,000 board feet.

A unique business to the Port of Montana is the importing and storage of silica sand. This material is stored for a just-in-time manufacturer located in Silver Bow county’s industrial park. Advanced Silicon Materials (ASiMI) is a leading producer of ultra-high purity polycrystalline silicon (polysilicon), and the world's largest manufacturer and supplier of Silane Gas (SiH_4). Both products are integrated into a unique core technology to create a base material for silicon wafers and devices produced in the semiconductor industry. ASiMI is the only commercial producer of silane and polysilicon with independent manufacturing sites.

The Port of Montana facility provides many services, including intermodal transportation transloading, truckload, LTL, special project shipping, and logistics services. As a single-source provider the Port can negotiate commitments for long-term rate stability. The Port can provide equipment and service guarantees making rail-intermodal a superior economical alternative to other modes of transport. Steamship and other companies store equipment on site for quick turnaround of containerized freight.

The Port also has access to the U.S. Custom's service. This promotes importing into the area. Having custom's access helps the port provide a supply of inbound containers, that can be stored until needed. The Port has access to Foreign Trade Zone Authority. However, it has been inactive for several years and would have to be re-activated. Foreign Trade Zone Authority allows for goods to enter the port property and leave without duty being collected as long as goods are bound for another foreign country.

General contracting services provided are domestic and worldwide movement, storage, and on-site coordination for commodities. Every logistical step of a move is analyzed, considering every possible mode of transportation - truck, rail, steamship, barge or air - to successfully meet the customers requirements. Service options for each customer and each shipment are analyzed to determine the best service. Arrangements for services can be made from standard TOFC/COFC intermodal service to domestic double stack trains. Every intermodal load is monitored and managed from time of pick-up through final delivery.

The success of the Port of Montana has important implications for a potential intermodal facility in North Dakota. Just as the base container traffic for an intermodal facility in Butte is limited, this also is likely to be the case for North Dakota. The case suggests that a potential facility in North Dakota may need to diversify to achieve success in a similar way to the Port of Montana.

Another intermodal facility in Montana is the intermodal facility at Billings, which is operated by BNSF. The facility's focus is on less-than-truckload (LTL) traffic. The LTL carriers of Roadway, Yellow, United Parcel Service, Federal Express, and the United States Postal Service dominate the transloading for the Billings facility. Outside of this traffic, the facility has had limited success in obtaining intermodal container traffic.

A potential reason why the facility has not obtained a large amount of container traffic is that it is not on a Class 1 railroad's intermodal route. Billings is located on a coal route, and therefore container traffic must yield to coal trains, greatly slowing transit times. Another problem faced by the Billings facility is that traffic must be switched between Montana Rail Link and the BNSF near the facility. This switch delays shipments in and out of the facility.

These problems also have important implications for a potential North Dakota facility, suggesting that any new facility should be on an intermodal line and not rely on multiple railroad coordination near the facility for short and reliable transit times.

While the generalized assessment of what railroads look for in intermodal service, how shippers view intermodal service, and what makes intermodal facilities successful are important components in evaluating the role of intermodal container transportation in North Dakota, they do not provide any information that is specific to North Dakota. The following section examines characteristics of manufactured products transported out of North Dakota, destinations for the state's manufactured products, the competitiveness of various modes in providing transportation services to North Dakota manufacturers, and transportation costs of North Dakota manufacturers relative to competitors. These will provide more specific information relating to the advantages and traffic available for an intermodal facility.

NORTH DAKOTA MANUFACTURED PRODUCT CHARACTERISTICS, DESTINATIONS AND SHIPMENTS

Transportation is critical to the economic success of any society, as it allows countries, regions, or states to produce what they produce best. This specialization resulting from a comparative advantage results in a higher standard of living for everyone. An efficient transportation system allows North Dakota residents to enjoy a larger variety of products at lower prices, and also provides increased market opportunities for North Dakota businesses.

One factor having an important impact on the transportation needs of any producing sector is the value of products being shipped. The reason for the importance of product value in shippers' modal choice becomes apparent in examining modal choice criteria. When shippers choose a transportation mode, they consider many factors in addition to the transportation rate. Important factors in the transportation mode choice in addition to rate, include transit time and reliability, capability and accessibility, customer shipping preference, and security (Coyle et al., 1996). Transit time refers to the amount of time between when a shipper makes goods available for transport and the time they are delivered to the customer, while reliability refers to the consistency of transit time. These characteristics are important because they affect inventory costs and revenues. If the product is in possession of the shipper until it is delivered to the customer, the shipper incurs an opportunity cost resulting from holding inventory for longer periods of time. On the other hand, if the customer takes possession once the product is shipped, the customer will be forced to hold more inventory or incur lost sales as a result of long and unreliable transit times. In these cases, the shipper may lose market share and revenues, when competitors can deliver products more reliably with shorter transit times.

Capability refers to ability of the carrier to provide the types of equipment required to make the shipment, while accessibility refers to the carrier's ability to serve the specific route. In most cases, carriers have the available equipment to make shipments, but accessibility is another issue. Many firms do not have direct access to rail facilities, and therefore, must combine rail and truck modes if they want to use rail service. Finally, security refers to the ability of the carrier to deliver the goods to the customer in the same condition as when received. A lack of security may result in lost sales and/or increased inventory carrying costs if goods consistently arrive at destinations in poor condition.

For products that have high values, the opportunity costs associated with holding more inventory are higher. Thus, shippers of products that have high values are likely to place more importance on transit time and reliability, and the security of goods than on the transportation charge incurred. Figure 1 shows the value per ton of manufactured products produced in North Dakota in 1997.[8] As the figure shows, many of the products produced by North Dakota manufacturing, such as electronic equipment, industrial machinery, transportation equipment, printing, furniture, and fabricated metals, have high value to weight ratios. For these products, inventory storage costs are high, and minimizing total logistics costs often requires using a premium form of transportation.

[8]Data on value of shipments and number of tons are available from the Commodity Flow Survey. The most recent year of Commodity Flow Survey Data available is 1997.

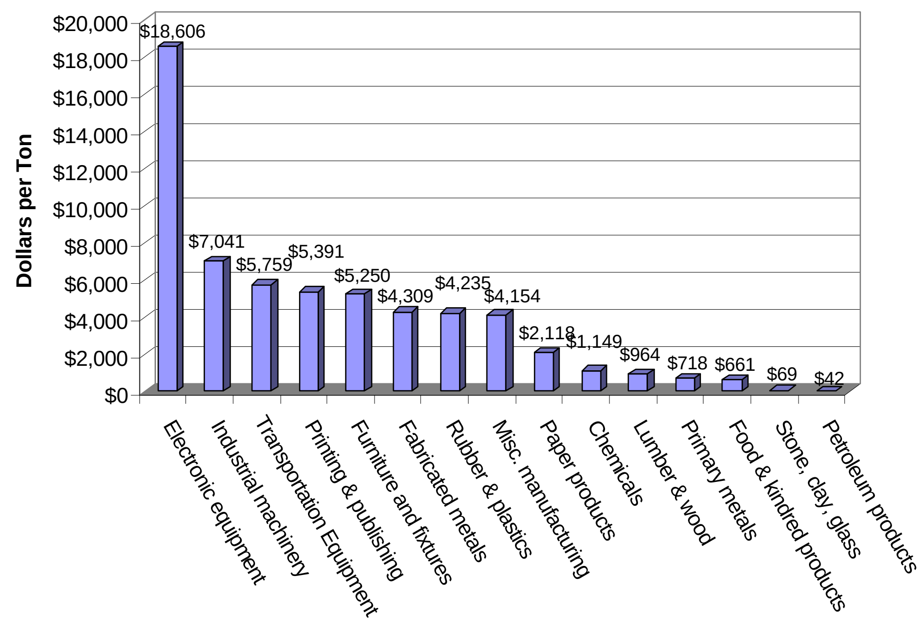

Figure 1. Value of Products Shipped by ND Manufacturers - 1997
(Source: U.S. Bureau of Census, Commodity Flow Survey, 1997)

Ballou (1999) characterizes U.S. transportation modes by their performance characteristics, as shown in Table 1. As his characterization shows, truck and air tend to be premium forms of transportation when compared to rail or water. These modes offer faster and more reliable transit times and increased security. When product values are high, the reductions in inventory costs and increases in revenues tend to be high enough to offset the increased transportation charges associated with these premium transportation modes.

Table 1. Performance Characteristics of Transportation Modes

Mode	Cost (1=Low)	Avg. Delivery Time (1=Fast)	Absolute Delivery Time Variability (1=Least)	Loss and Damage (1=Least)
Rail	3	3	4	5
Truck	4	2	3	4
Water	1	5	5	2
Pipeline	2	4	2	1
Air	5	1	1	3

Source: Ballou, Ronald H. *Business Logistics Management*, 4th Ed., Upper Saddle River, NJ: Prentice Hall, 1999.

While theory suggests that more valuable products should be shipped by premium forms of transportation, it is useful to examine actual U.S. shipments to determine whether this is the case. Figure 2 shows the value per ton of products shipped by various modes in the U.S. in 1997. This figure confirms the belief that more valuable products are likely to move by premium forms of transportation. As the figure shows, air and parcel service are used only for the most valuable products, for-hire truck and truck-rail combinations are used for products with average values per ton between $638 and $1,395, and rail/pipeline/water are used for products with low values.

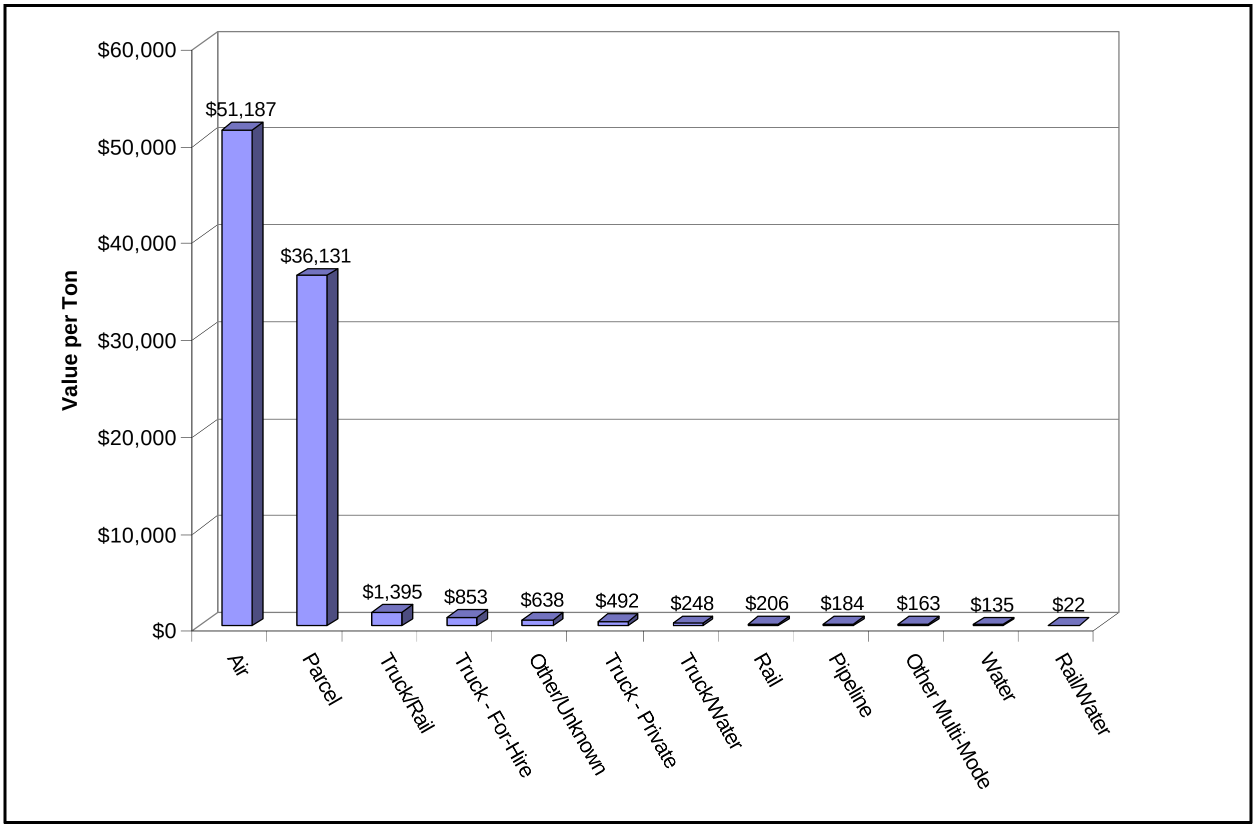

Figure 2. Value per Ton of U.S. Product Shipments by Mode - 1997
Source: U.S. Bureau of Census, *Commodity Flow Survey, 1997*.

SURVEY AND ESTIMATED FREIGHT VOLUMES BY DESIGNATED ECONOMIC REGIONS

To gain insight into the modes of transportation used by manufacturers and specialty agricultural producers in the North Dakota region, reasons for using such modes, experiences of shippers with intermodal service, and transportation volumes we administered a survey. The survey was sent to all manufacturing companies in North Dakota and in the counties of surrounding states, as well as to a number of specialty agricultural companies in the region. Specifically, shippers were surveyed in North Dakota, Minnesota, Montana, and South Dakota. Although the survey was preceded by a letter explaining its importance, and followed by postcard reminders and telephone calls, the response rate was limited and many of those were partial or incomplete.

Of the 2,039 manufacturing locations in surveyed areas, 261 responded, representing a 12.8 percent response rate. While the response rate was low, the locations responding employed 27,402 of the 58,318 manufacturing workers employed in the region (47.0 percent). This suggests that the responses we received should be representative of a large portion of the region's manufacturing.

Table 2 shows the response rate by industry, as well as the portion of that industry's employees represented by the responding firms. As the table shows, firms representing large portions of each industry's employment responded to the survey in the transportation equipment, lumber and wood products, paper products, furniture and fixtures, industrial machinery, food products, fabricated metals, electronic equipment, and primary metals industries.

Table 2. Percentage of Employees in Industry Represented by Firms Responding

Industry	Percent of Firms Responding	Percent of Employees at Resp. Firms
Transportation Equipment	21.92%	79.67%
Lumber & Wood Products	17.29%	70.64%
Paper Products	35.71%	65.89%
Furniture and Fixtures	15.00%	49.25%
Food & Kindred Products	17.34%	48.48%
Industrial Machinery	11.14%	46.59%
Fabricated Metals	20.26%	44.15%
Electronic equipment	24.07%	41.32%
Primary Metals	18.75%	37.77%
Rubber & Plastics	18.03%	31.27%
Printing & Publishing	7.45%	25.66%
Stone, Clay, Glass Products	9.56%	24.77%
Misc. Manufacturing	5.59%	24.57%
Leather Products	14.29%	19.18%
Apparel & Textile Products	8.04%	17.49%
Instruments & Related Products	6.67%	13.84%
Chemicals	8.11%	9.91%
Textile Mill Products	0.00%	0.00%
Petroleum Products	0.00%	0.00%
Overall	**12.80%**	**46.99%**

Figure 3 shows the modal shares obtained from manufacturing locations responding to the survey for outbound manufactured products. A total of 163 manufacturing locations responded to this question, representing 8 percent of the firms, but 43 percent of the manufacturing employees in the region. As the figure shows, the manufacturing locations responding use truck for more than one half of their outbound shipments, rail for 45 percent, and the remaining shipments by 20-foot and 40-foot container.

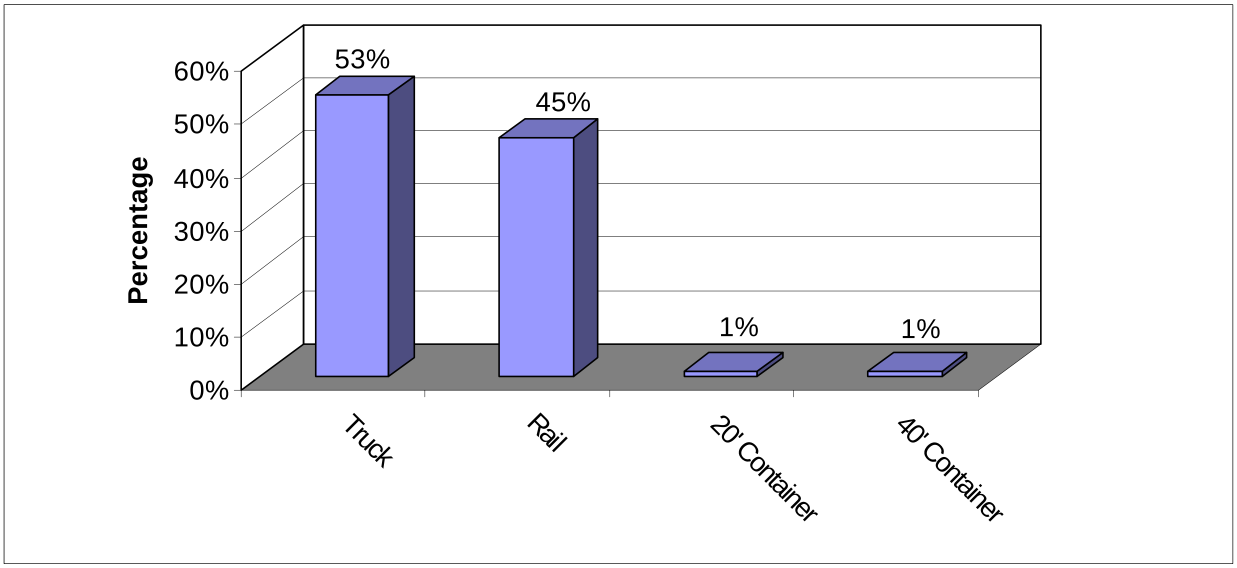

Figure 3. **Modal Shares of Outbound Tons from Survey Respondents (Source: Survey of North Dakota and the Border Regions of Minnesota, Montana, and South Dakota - 163 Responding)**

Figure 4 shows modal shares for inbound volumes of raw materials and components for the manufacturing locations responding to the survey. A total of 142 locations responded to this question, representing 7 percent of regions manufacturing firms and 35 percent of manufacturing employees. As the figure shows, truck dominates the inbound shipments for these firms, accounting for more than 98 percent of all inbound volume. This seems to suggest that North Dakota firms require the characteristics of secure, reliable, timely, and accessible service provided by truck transportation for their inbound components. The implication is that an opportunity may exist for a shift to containers for some inbound truck movements. If an intermodal container facility were available to provide service to the area, a shift to intermodal inbound freight could save potentially on inbound freight costs, and bring containers into the area. This may provide container capacity needed for outbound shipments.

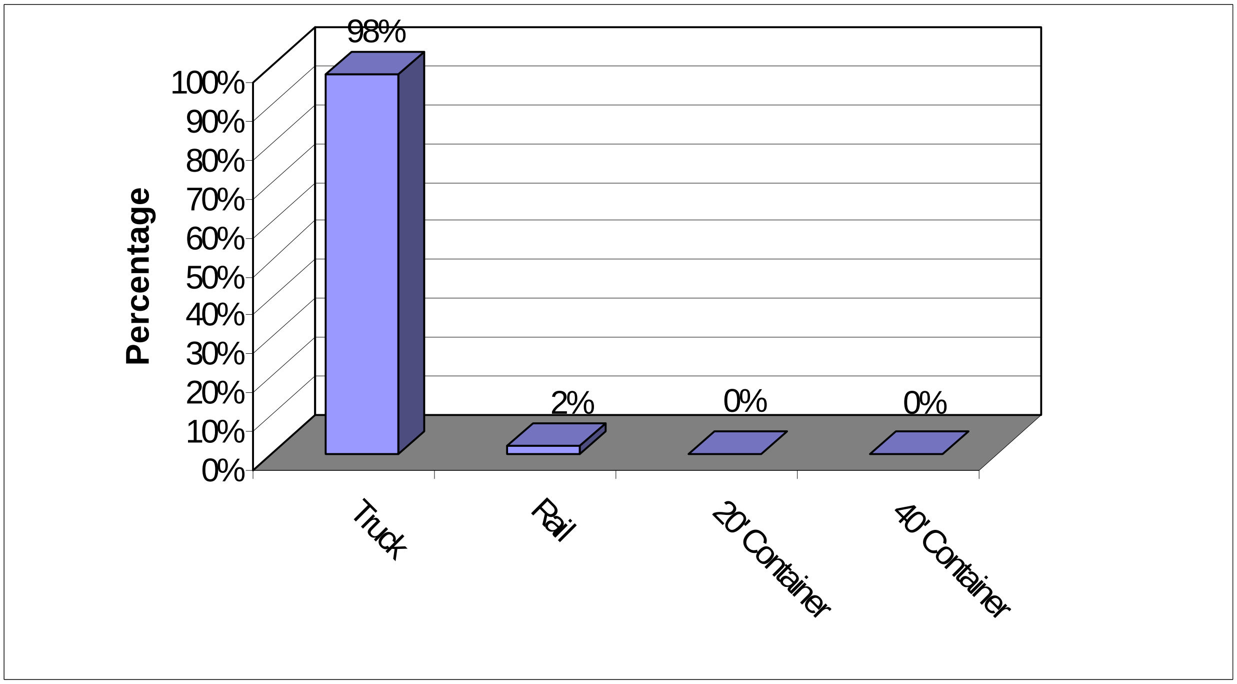

Figure 4. **Modal Shares of Inbound Raw Materials or Components Tons from Survey Respondents (Source: Survey of North Dakota and Border Region Firms - 142 Responding)**

Additional insight into reasons why firms choose the modes they do was obtained by asking manufacturing firms the following question: "Why do you use the transportation modes that you use? (check all that apply)." Figure 5 shows the percentage of firms checking various responses to this question. As the figure shows, more than one half of the 174 firms responding to this question answered that timely and reliable service are reasons they use the mode they use. Moreover, 46 percent answered that direct access is a reason for using the particular mode, while only 40 percent reported low rates as a reason for using their mode. This provides further support for the notion that the reason the regions manufacturing firms are using trucking as their primary mode is due to the premium service provided.

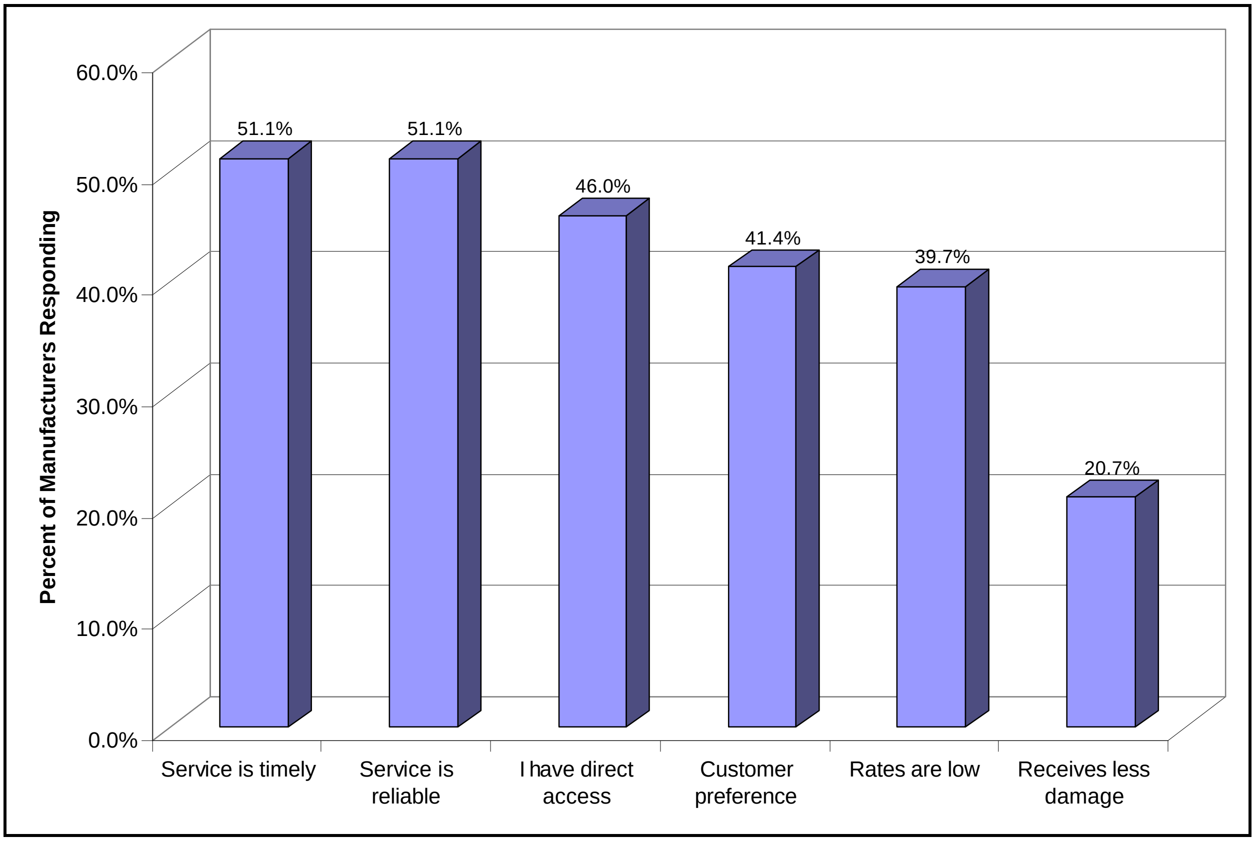

Figure 5. **Responses to "Why Do You Use the Transportation Modes You Use?" (Source: Survey of North Dakota and Border Region Firms - 174 firms responding)**

The following section of the report provides more detailed data regarding shipment volumes from the survey, estimated shipment volumes for the population of manufacturing firms in the region, and answers to other questions related to modal preferences and barriers to intermodal transportation in the region.

In the following summary of freight volumes, data are presented at substate regional levels. The data has been sorted by region to present freight volumes by these 12 regions. Maps of each state's economic regions, along with a list of counties surveyed are provided in Appendix 3. In North Dakota there are 8 regions. In the bordering states, the regions containing the counties closest to North Dakota were surveyed.

FREIGHT VOLUMES

Truck dominates as the mode of transporting manufacturers' and specialty agricultural producers' freight in the rural areas of North Dakota, Northern South Dakota, Western Minnesota, and Eastern Montana. Table 3 identifies the reported inbound freight by mode and region. Data reveal that Minnesota and Region 8 in North Dakota received the highest freight volumes. These areas have the largest population bases, the largest number of firms recognized as manufacturers, and highest manufacturing revenue. One explanation for the high inbound shipments for Minnesota and Region 8 in North Dakota also could be the sugar beets inbound as raw material for the processors.

Table 3. Inbound Freight from Survey Responses

Region	Trucks	Rail Cars	20' Containers	40' Containers
MN	236,869	1	0	0
MT	13,202	0	0	0
ND1	136	0	0	0
ND2	526	0	0	0
ND3	409	0	0	0
ND4	77,960	0	0	0
ND5	960	323	0	0
ND6	871	3	0	0
ND7	12,987	0	0	0
ND8	122,393	1,352	30	0
SD1	229	0	0	0
SD2	6,874	17	0	0
Total	**473,415**	**1,695**	**30**	**0**

(Regional maps are in Appendix 5, Figures 21-24)

The survey shows a limited number of inbound containers. Previous estimates of North Dakota inbound containers also have been small, although the numbers found by Berwick (2001) were somewhat higher. These low numbers of inbound containers may mean higher rates for outbound container shipments from this area, as few empty containers are readily available at Dilworth.[9]

Table 4 shows outbound freight volumes by mode and region from the surveyed firms. As the table shows, the survey identified 7,010 outbound containers and 144,673 truckloads originating in the region. Again eastern North Dakota and western Minnesota represent the largest volumes.

Table 4. Outbound Freight from Survey Responses.

Region	Trucks	Rail Cars	20' Containers	40' Containers
MN	53,056	10,022	1,650	0
MT	2	4,578	0	1
ND1	374	210	40	0
ND2	948	0	0	0
ND3	585	0	0	0
ND4	11,064	2,894	35	200
ND5	1,010	0	0	0
ND6	14,221	129	955	0
ND7	13,308	0	0	9
ND8	39,897	9,457	1,272	2,843
SD1	2	0	0	0
SD2	10,207	1,396	5	0
Total	**144,673**	**28,684**	**3,957**	**3,053**

From the Manufacturers' News, Inc. (MNI) database, employee numbers are available for every manufacturing firm in the region. Using these numbers, we estimate the total tons outbound and inbound to every substate region by using average tons per employee by industry

[9]It should be noted that we did not survey wholesalers or retailers - two potential recipients of inbound containers. Thus, the inbound containers captured in the survey and estimates are likely understated.

and region for responding firms and expanding that to regional totals using employee numbers.[10] Using SAS (SAS System for Windows, version 8.01), we develop an estimate of truckloads, railcars, 20-foot containers, and 40-foot containers by sub-state economic region. Table 5 shows the estimated inbound freight volumes for the entire region.

Table 5. Estimates of Regional Inbound Freight (Estimated by Employee Numbers)

Region	Trucks	Rail Cars	20' Containers	40' Containers
MN	501,211	276	0	0
MT	15,477	47	0	0
ND1	8,233	41	4	0
ND2	34,120	107	0	0
ND3	27,621	28	0	0
ND4	167,197	220	0	0
ND5	2,482	296	0	0
ND6	13,238	0	0	0
ND7	19,183	0	0	0
ND8	424,867	1,874	52	0
SD1	13,522	4	1	0
SD2	25,069	4	1	0
Total	**1,252,220**	**2,898**	**59**	**0**

(Regional Maps are in Appendix 5, Figures 37-40)

Table 6 shows estimated outbound freight volumes for the region. Comparing estimated inbound and outbound shipments shows a disparity between inbound and outbound trucks. This problem exists for rural areas of North Dakota, where inbound trucks have problems finding a load out of the state. If some of this inbound truck traffic could shift to containers with an

[10]Because the MNI database only includes manufacturers, we add specialty agricultural producers and raw food producers to the MNI database to obtain these estimates. These producers were identified through discussions with the North Dakota Department of Agriculture and others.

improved intermodal container option available, more containers would be available for outbound shipments.[11]

Table 6. Estimates of Regional Outbound Freight (Estimated by Employee Numbers).

Region	Truck	Rail Cars	20' Containers	40' Containers
MN	103,850	19,030	2,043	18
MT	3,063	5,662	38	34
ND1	4,963	651	121	58
ND2	16,158	1,900	56	84
ND3	9,644	1,552	37	93
ND4	111,000	7,819	205	1,050
ND5	4,307	18	57	113
ND6	50,566	660	1,148	2
ND7	31,762	0	6	38
ND8	99,644	25,534	2,927	6,084
SD1	3,384	543	115	27
SD2	42,839	3,153	65	0
Total	**481,180**	**66,522**	**6,819**	**7,600**

Estimating freight volumes based on the entire manufacturing sector provides valuable insight into the potential of highway rail intermodal transportation by economic region. In terms of container traffic, some moves out of Dilworth, some from Minneapolis, and some from Regina. It is estimated by the BNSF that there are approximately 11,000 lifts annually at Dilworth.[12] The BNSF has estimated that the facility has the capacity to handle approximately 16,500 lifts per year, although the crane can handle 60,000 lifts per year. The limiting factor appears to be parking space. This service problem may provide insight into why some container shippers use the Minneapolis facility for outbound container shipments.

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[11]Again, there are probably more inbound containers into the region than estimated here, since we do not survey wholesale or retail firms - two potential recipients of inbound containers.

[12]Because most of the inbound containers are empty, one lift usually represents one-half of a loaded container. Thus, the number of loaded containers are estimated at approximately 5,500.

Along with the previously discussed freight volume questions, the following section describes responses of the firms to other questions. Figure 6 shows almost 70 percent of responding firms are privately held, and less than 10 percent of responding firms are cooperatives.

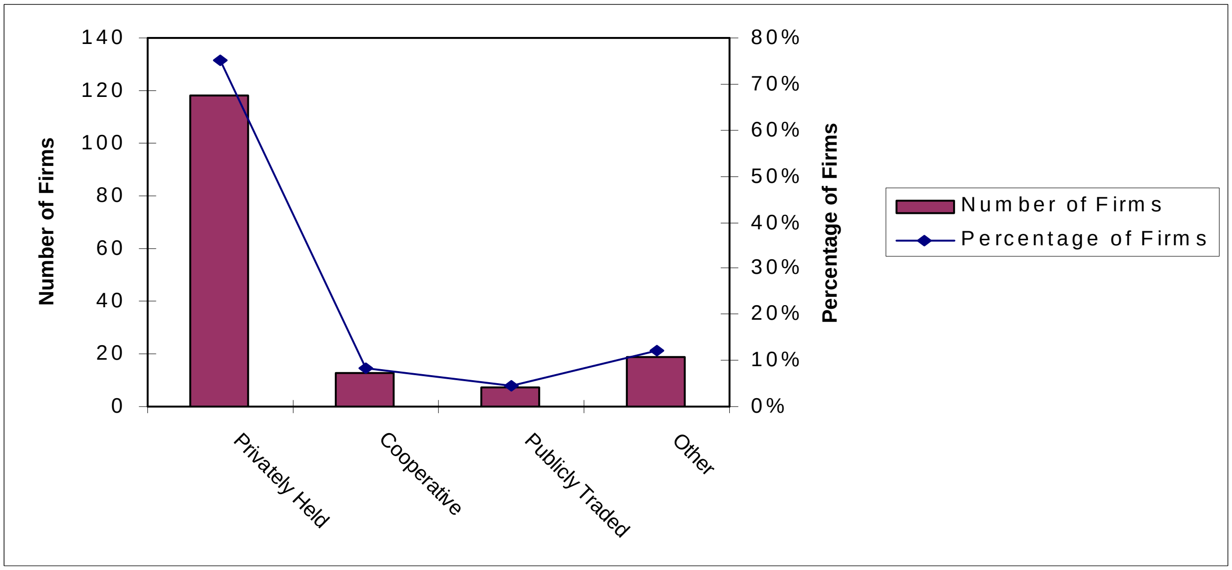

Figure 6. **Responses to "Select the type of business ownership" in the Intermodal Survey (2001) - 157 Firms Responding**

Another question in the survey asked about the percentage of business conducted in a close relationship with a trading partner. As Figure 7 shows, 60 percent of the responding firms report close relationships with customers, 40 percent with suppliers, and almost that same percentage with transportation providers. This suggests a much higher percentage than found in a previous study by Gieger & Dooley (1996). Geiger and Dooley (1996) found that North Dakota firms lagged behind Minnesota firms in adapting modern business techniques such as developing close relationships with customers and suppliers. This may provide some evidence that North Dakota firms are recognizing the cost saving possibilities of adapting supply chain management strategies.

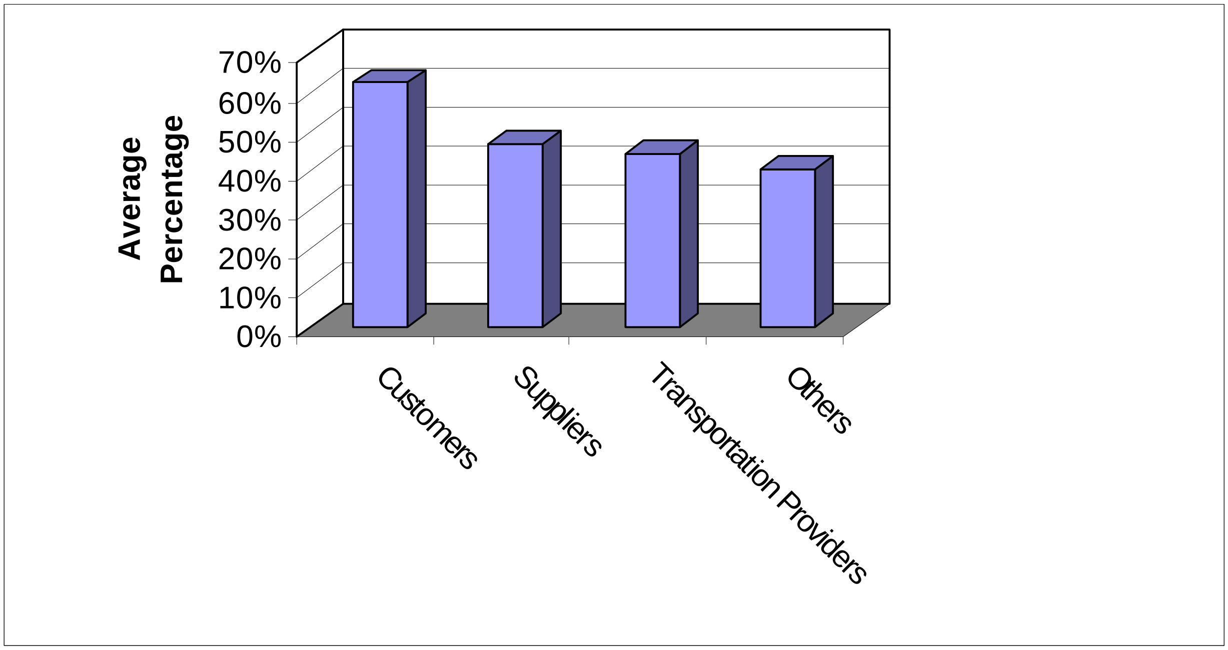

Figure 7. **Response to "What percentage of your business is conducted with a preferred partner or close relationship?" in the intermodal survey 2002. (104 firms responding)**

An important question in the survey was whether companies trying to ship intermodally had been denied service. Figure 8 shows that of the responding firms that use intermodal container transportation as an option, 9 percent claimed to have been denied service in the last year. This suggests that there are some problems with the ability to obtain intermodal container service in the region.

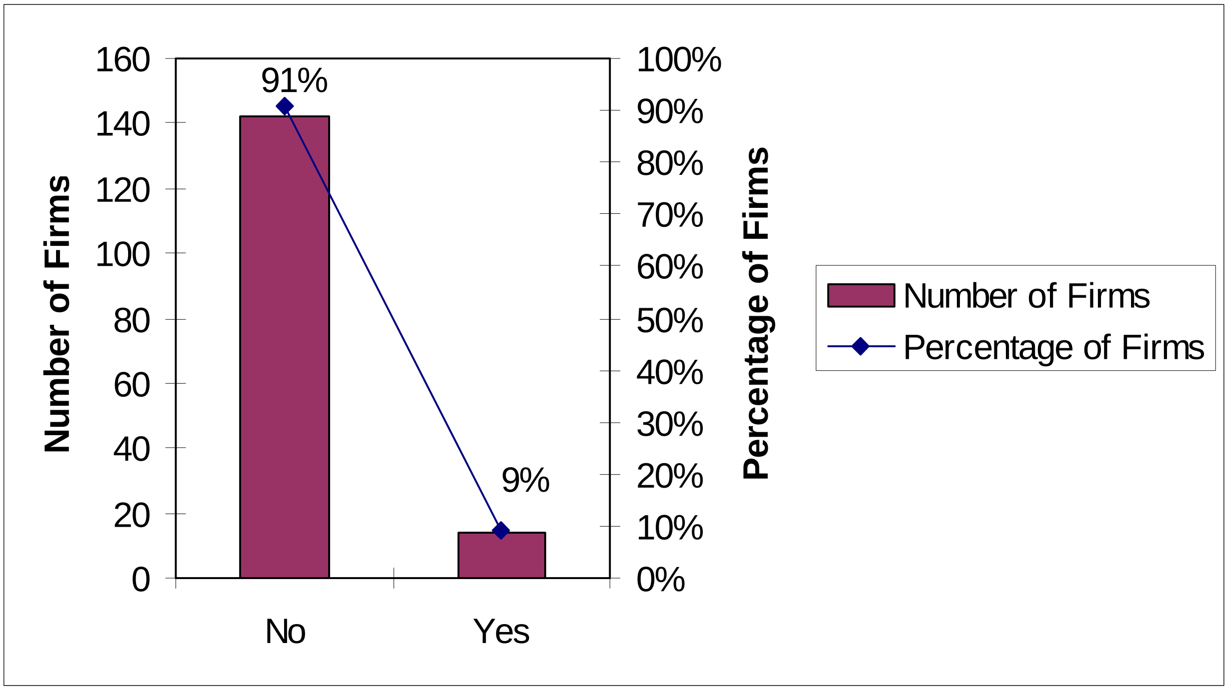

Figure 8. **Response to "Within the last year have you been denied or had difficulty with intermodal service?" in the intermodal survey. - 156 firms responding.**

Figure 9 shows responses to the question "what in the most important barrier to using intermodal service in North Dakota or the region." As the figure shows, "High Rates" was checked most often, followed by the distance to terminals. In many cases, a long distance to intermodal terminals can eliminate the logistics cost savings associated with intermodal container service in comparison to truck service.

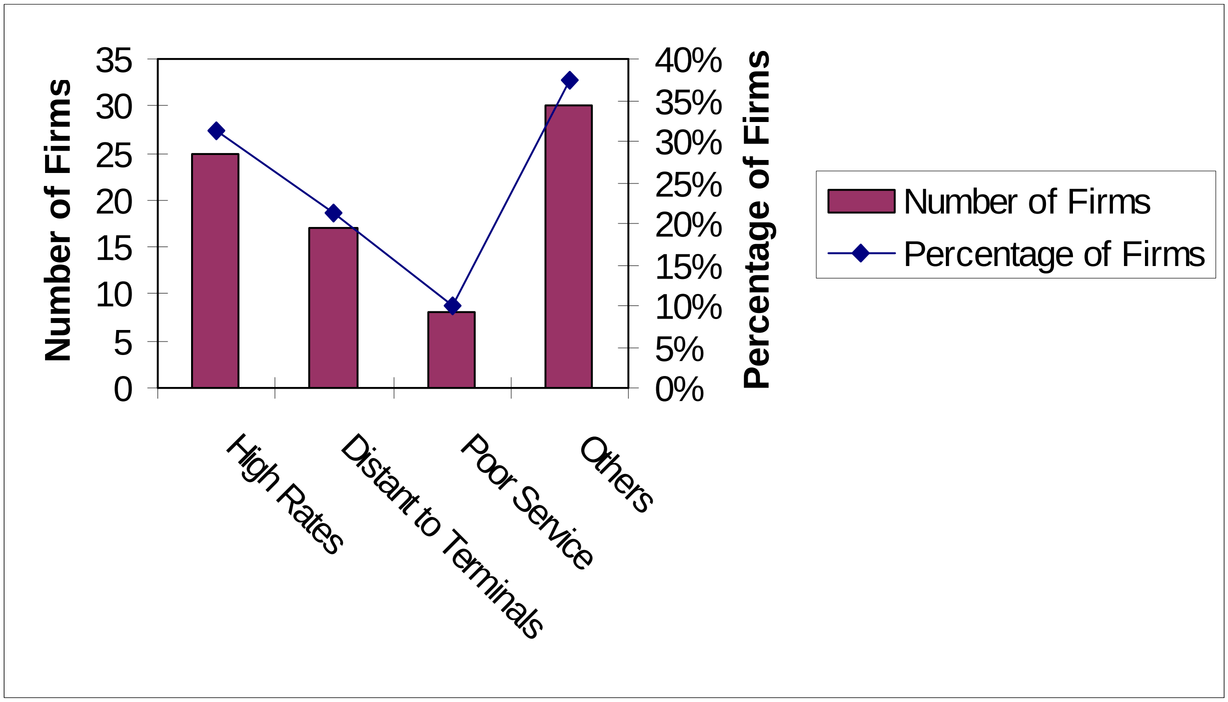

Figure 9. **Response to "In your opinion what is the most important barrier to using intermodal service in North Dakota or the region?" in the intermodal survey. - (2002)**

Before examining the potential traffic for a new intermodal facility, its costs, and potential locations, it is useful to examine the potential benefits of the intermodal transportation option to an individual shipper in more detail. The following section of this report presents a short case study that estimates transportation charges and transit times using truck and truck-rail intermodal service for North Dakota products. In addition, a case study comparing North Dakota transportation charges to major competitors is included.

SHORT CASE STUDY OF TRUCK VS. INTERMODAL CONTAINER SHIPMENT

As highlighted previously, truck offers several advantages over rail in transporting manufactured products that have high values. Advantages include faster and more reliable transit times, customer accessibility, and product security. However, the transportation charges associated with trucking are higher than rail for all but the shortest of movements.

Because of the advantages of truck in terms of service and rail in terms of transportation charges, it is possible to obtain transportation that has better service characteristics than rail, but lower charges than truck by combining the modes in intermodal container service. Another advantage of intermodal container service is increased ease of shipping manufactured products internationally. In fact, containers are the primary mode used to ship products internationally. This section of the report provides a brief case study that compares transportation charges and transit times for shipping internationally via intermodal container from a local intermodal facility and shipping by truck to a port where manufactured products are loaded into containers for shipment to the final foreign destination.

For the case studies, we choose three products: sugar, dry pasta, and excavators, based on the importance of such products to North Dakota manufacturing and data availability. To perform the case studies, we examine major U.S. export destinations for such products. Figures 10 through 12 show the top 10 non-U.S. destinations for sugar, dry pasta, and excavators, respectively.[13] As the figures show, Canada, Mexico, and Japan are major destinations for U.S. sugar and pasta, while Canada, Belgium, and Chile are major destinations for U.S. excavators. Based on these destinations, we choose Japan for our case studies of sugar and pasta, and

[13] All product definitions are based on the International Harmonized System (HS) Code.

Belgium for the case study of excavators. These locations are chosen due to a desire to examine transportation charges and transit times for an overseas container movement.

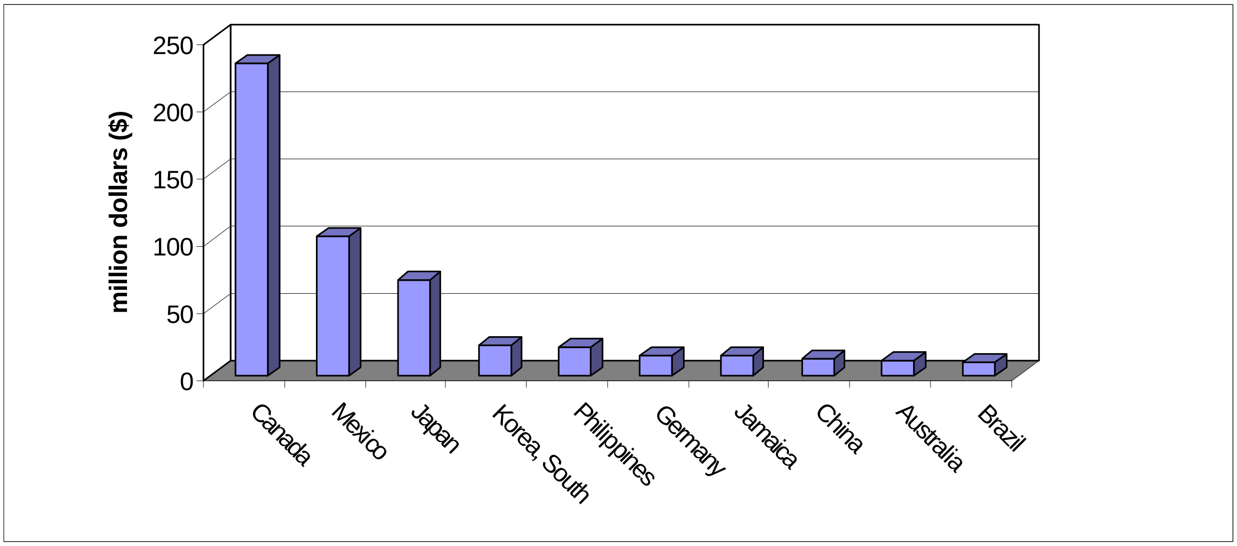

Figure 10. **Top 10 Non-U.S. Destinations for Sugar and Sugar Confectionery (HS17)**
(Source: Statistics of Canada & the U.S. Census Bureau)

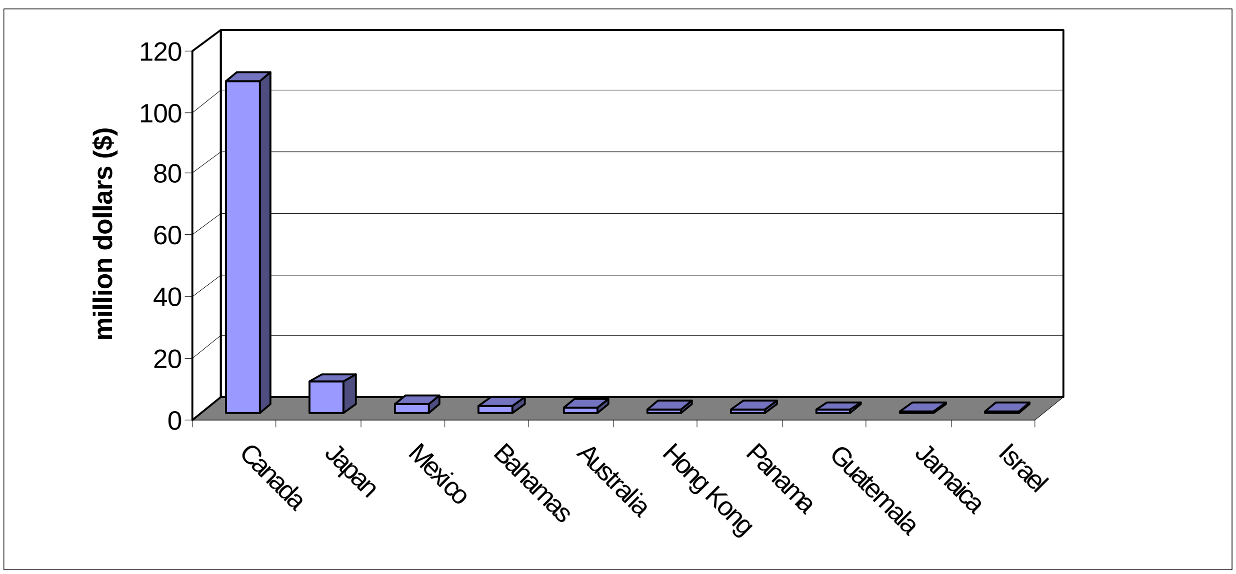

Figure 11. **Top 10 Non-U.S. Destinations for Pasta (HS1902)**
(Source: Statistics of Canada & the U.S. Census Bureau)

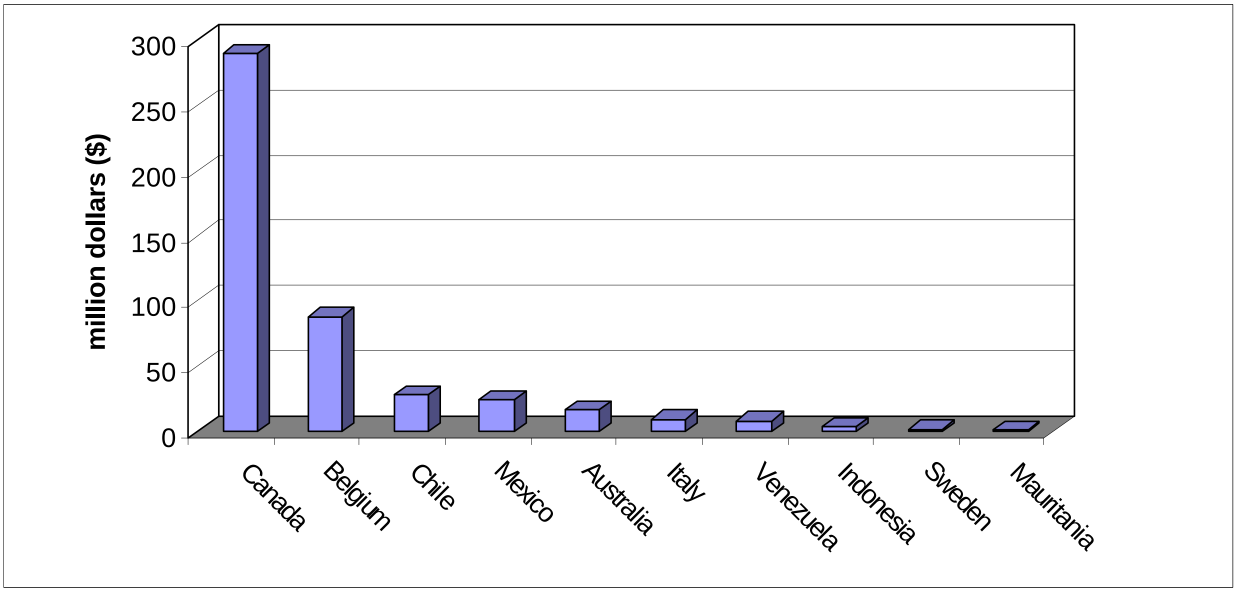

Figure 12. **Top 10 Non-U.S. Destinations for Mechanical Shovels and Excavators (HS842952)** *(Source: Statistics of Canada & the U.S. Census Bureau)*

For the case studies, we surveyed local trucking companies and container companies to get rates for drayage, shipping to major ports, and shipping in containers to final destinations. Average rates obtained from the transportation companies were used in the case studies.

The first case study examines the shipment of sugar from Drayton, ND, (American Crystal Sugar Co.) to Kobe, Japan. Even though American Crystal Sugar currently does not ship sugar to Japan, it is a major market for U.S. sugar - and one that might be tapped with improved transportation options. Table 7 shows the estimated transportation charges and transit times to the shipper per ton as a result of shipping by truck, by container through Dilworth, and by Container through Minneapolis. As the table shows, the estimated transportation charges for shipping sugar to Kobe using an intermodal container from Dilworth or Minneapolis are lower than shipping by truck to Tacoma, transloading into a container, and then shipping it by ocean to Kobe.[14] However, the estimated transit time is one-third higher using a container.

An interesting finding shown in Table 7 is that the transportation charge using Minneapolis is cheaper than using Dilworth, even though Dilworth is much closer to Drayton than Minneapolis. This occurs as the lower rate from Minneapolis to Kobe more than offsets the increased drayage necessary to Minneapolis. Potential reasons for this rate disparity include: increased competitiveness in the Minneapolis to Kobe market, more excess capacity of containers in Minneapolis, and higher costs associated with serving a lower density facility like Dilworth.

[14]It is important to note, though, that this case study uses current trucking and container rates. Since container rates are now quite low, this may not be reflective of long run rate relationships.

Table 7. Estimated Transportation Rates and Transit Times of Truck and Intermodal Container for Sugar

Origin & Destination	**Cost per Ton ($) and Transit Time (days and hours)**		
Drayton, ND to Kobe, Japan	**Truck (Van Trailer)**	**Intermodal 40'Container via Minneapolis**	**Intermodal 40'Container via Dilworth**
Inland Drayage (Drayton, ND to Minneapolis, Minn.)		$33.06 (via truck)	
Container Rate (Minneapolis to Kobe)		$142.76 19 days (via rail and ship)	
Inland Drayage (Drayton to Dilworth)			$28.41 (via truck)
Container Rate (Dilworth to Kobe)			$175.70 19 days (via rail and ship)
Inland Truck (Drayton to Tacoma, Wash.)	$143.76		
Transloading truck to container (at Tacoma)	$5.90 2 hours		
Ocean Freight (Tacoma to Kobe)	$84.19 13 days		
Total Est. Transportation Rate per Ton	**$233.85**	**$175.82**	**$204.11**
Total Est. Transit Time	**15 days**	**20 days**	**20 days**

Table 8 shows the second case study - shipping dry pasta from Carrington, ND (Dakota Growers Pasta Co.) to Kobe, Japan. The table shows similar results to those for sugar. These include a lower estimated transportation charge using a container as compared to a truck, and a longer transit time. Again, the Minneapolis location's lower container rate more than offsets higher drayage associated with reaching that location.

Table 8. Estimated Transportation Rates and Transit Times of Truck and Intermodal Container for Dry Pasta

Origin & Destination	Cost per Ton ($) and Transit Time (days and hours)		
Carrington, ND to Kobe, Japan	**Truck (Van Trailer)**	**Intermodal 40'Container via Minneapolis**	**Intermodal 40'Container via Dilworth**
Inland Drayage (Carrington to Minneapolis, Minn.)		$32.61 (via truck)	
Container Rate (Minneapolis to Kobe)		$135.94 19 days (via rail and ship)	
Inland Drayage (Carrington to Dilworth, Minn.)			$12.39 (via truck)
Container Rate (Dilworth to Kobe)			$167.31 19 days (via rail and ship)
Inland Truck (Carrington to Tacoma, Wash.)	$120.10		
Transloading truck to container (at Tacoma)	$5.62 2 hours		
Ocean Freight (Tacoma to Kobe)	$80.17 13 days		
Total Est. Transportation Rate per Ton	**$205.89**	**$168.55**	**$179.70**
Total Est. Transit Time	**15 days**	**20 days**	**20 days**

The final case study comparing truck and intermodal container charges from North Dakota is for transporting excavators to Antwerp, Belgium. Table 9 shows this comparison.

Table 9. Transportation Rates and Transit Times of truck and intermodal container for Mini Excavators

Origin & Destination	**Cost per Ton ($) and Transit Time (days and hours)**		
Bismarck, ND to Antwerp, Belgium	**Truck (Van Trailer)**	**Intermodal 40'Container via Minneapolis**	**Intermodal 40'Container via Dilworth**
Inland Drayage (Bismarck, ND to Minneapolis, Minn.)		$39.30 (via truck)	
Container Rate (Minneapolis to Antwerp)		$139.10 13 days (via rail and ship)	
Inland Drayage (Bismarck to Dilworth, Minn.)			$18.20 (via truck)
Container Rate (Dilworth to Antwerp)			$139.10 13 days (via rail and ship)
Inland Truck (Bismarck to Norfolk, Vir.)	$158.23		
Transloading truck to container (at Norfolk)	$5.9 2 hours		
Ocean Freight (Norfolk to Antwerp)	$73.21 13 days		
Total Est. Transportation Rate per Ton	**$237.34**	**$178.40**	**$157.30**
Total Est. Transit Time	**15 days**	**14 days**	**14 days**

As Table 9 shows, the intermodal container charges are lower than truck charges, and the estimated transit times also are lower. In this case, shipping by container from Dilworth ends up being cheaper than from Minneapolis.

Two additional case studies are performed comparing transportation charges for pasta and excavators from North Dakota by intermodal container and truck to those charges realized by major competitor locations. To identify major competitor locations, employment numbers are examined at facilities producing dry pasta and excavators by state. Figures 13 and 14 show these numbers for 2000.

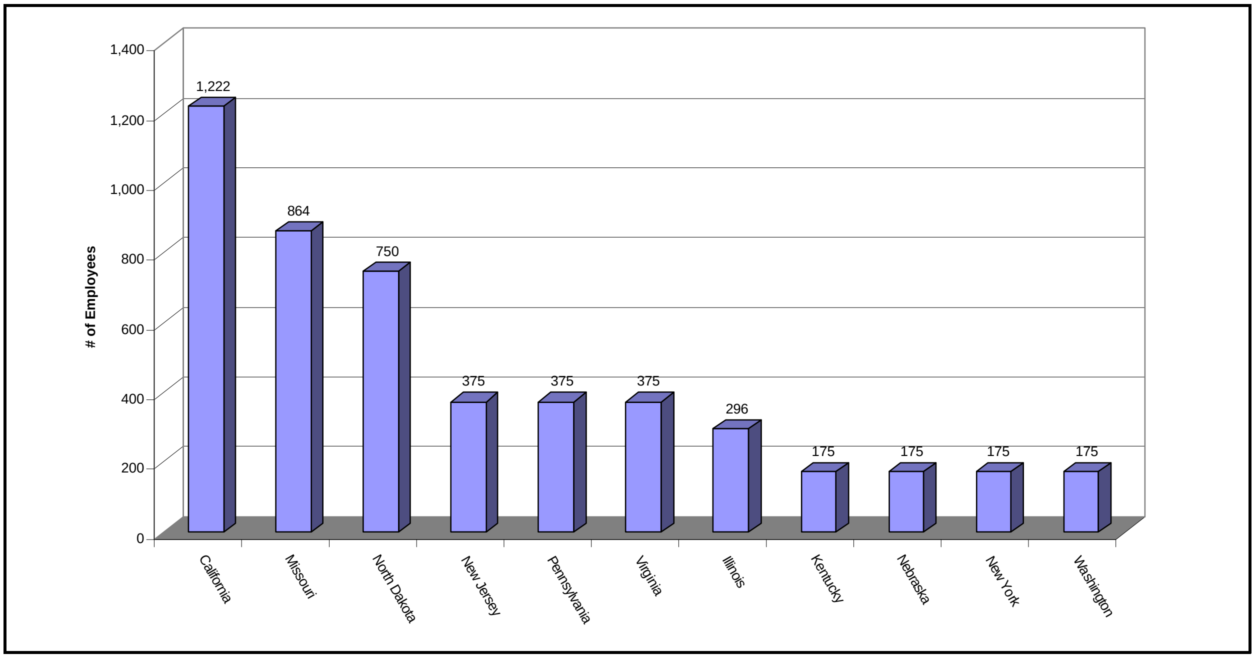

Figure 13. Estimated Number of Employees in Dry Pasta Manufacturing for Top States - March 2000
Source: U.S. Census Bureau, County Business Patterns
Note: The number of employees is estimated at the midpoint where ranges are given.

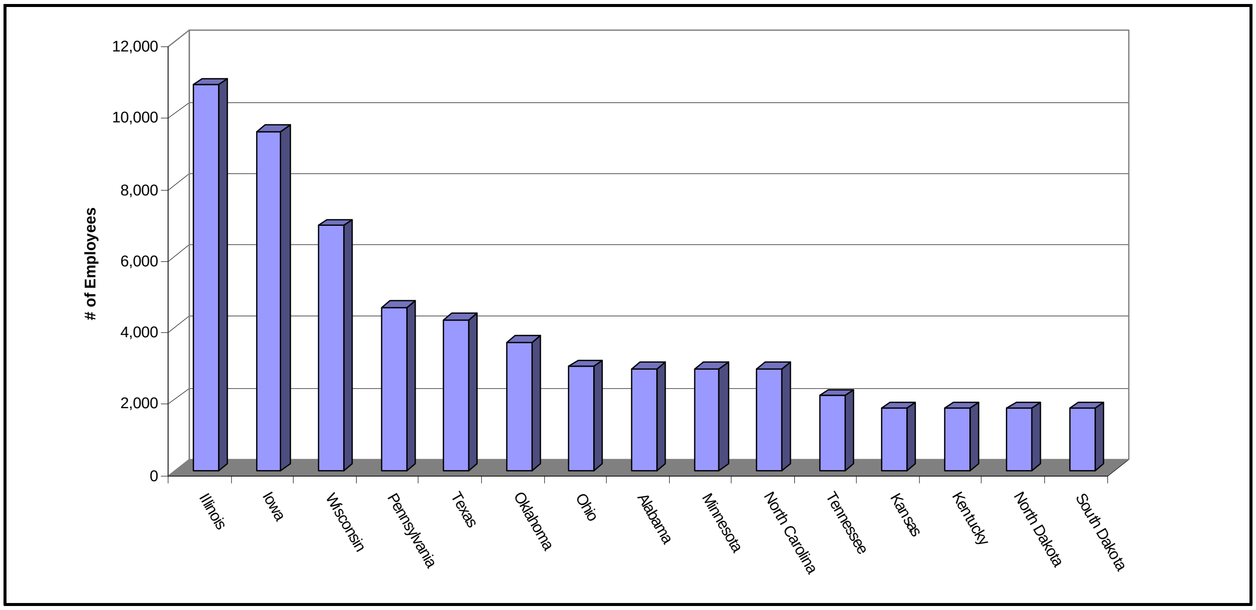

Figure 14. Estimated Number of Employees in Construction Machinery Manufacturing for Top States - March 2000
Source: U.S. Census Bureau, County Business Patterns
Note: The number of employees is estimated at the midpoint where ranges are given

Based on these competitor location states, we choose specific locations in states by locating the major firms in each industry. For pasta, the destinations of Salinas, Cal. and Excelsior Springs, Mo. are examined. For excavators, we examine Dubuque, Iowa, and East Peoria, Ill.

Table 10 shows estimated transportation charges and transit times for transporting dry pasta from Carrington, Salinas, and Excelsior Springs to Kobe, Japan. As the table shows, Salinas realizes the lowest transportation rate, whether transporting by truck or container, due to a close proximity to the Port of Oakland. It also realizes the lowest transit time. In comparing

Table 10. Transportation Rates and Transit Times from 3 Origins for Dry Pasta

Cost per Ton ($) and Transit Time (days and hours) to Kobe, Japan	Origin		
	Carrington, ND	**Salinas, Cal.**	**Excelsior Springs, Mo.**
Truck			
Inland Truck (Carrington, ND to Tacoma, Wash.)	$120.10		
Inland Truck (Salinas to Oakland, Cal.)		$8.64	
Inland Truck (Excelsior Springs to Oakland)			$162.67
Ocean Freight (Tacoma to Kobe)	$80.17 13 days	$80.17 13 days	$80.17 13 days
Transloading van trailer to container	$5.62 2 hours	$5.62 2 hours	$5.62 2 hours
Total Est. Transportation Rate per Ton	**$205.89**	**$94.43**	**$248.46**
Total Est. Transit Time	**15 Days**	**14 Days**	**15 Days**
Intermodal 40'Container			
Inland Drayage (Carrington to Minneapolis, Minn.)	$32.61 (via truck)		
Container Rate (Minneapolis to Kobe)	$135.94 19 days (via rail and ship)		
Inland Drayage (Salinas to Oakland)		$8.64 (via truck)	
Container Rate (Oakland to Kobe)		$80.17 13 days (via rail and ship)	
Inland Drayage (Excelsior Springs to Kansas City, Mo.)			$2.52 (via truck)
Container Rate (Kansas City to Kobe)			$128.10 19 days (via rail and ship)
Total Est. Transportation Rate per Ton	**$168.55**	**$88.81**	**$130.62**
Total Est. Transit Time	**20 Days**	**14 Days**	**20 Days**

Carrington with Excelsior Springs, Carrington realizes a lower rate when transporting by truck and then transloading onto container, but realizes a higher rate when transporting via container from a nearby intermodal facility. This is partially due to Excelsior Springs' closer proximity to an intermodal container facility. Moreover, the costs of shipping via container from a nearby intermodal facility are much cheaper from Carrington and Excelsior Springs than by truck. The competitiveness of Carrington and Excelsior Springs relative to Salinas improves with the intermodal container shipping option.

Table 11 shows estimated transportation charges and transit times for transporting excavators from Bismarck, Dubuque, and Peoria to Antwerp, Belgium. As the table shows, Peoria realizes the lowest transportation charge using either mode. However, the difference in transportation charges between the Bismarck location and competitors is reduced by the intermodal option. This suggests that intermodal container shipping improves the competitive position of the Bismarck location.

While these case studies are specific to locations and commodities, they suggest that intermodal container shipping presents an important option for North Dakota shippers. They also suggest that such an option may increase the competitive position of North Dakota shippers.

Table 11. Transportation Rates and Transit Times from 3 Origins for Excavators

Cost per Ton ($) and Transit Time (days and hours) to Antwerp, Belgium	Origin		
	Bismarck, ND	**Dubuque, Iowa**	**Peoria, Iil.**
Truck			
Inland Truck (Bismarck to Norfolk, Vir.)	$158.23		
Inland Truck (Dubuque to Norfolk)		$100	
Inland Truck (Peoria to Norfolk)			$91.59
Ocean Freight (Norfolk to Antwerp)	$73.21 13 days	$73.21 13 days	$73.21 13 days
Transloading truck to container	$5.9 2 hours	$5.9 2 hours	$5.9 2 hours
Total Est. Transportation Rate per Ton	**$237.34**	**$179.11**	**$170.7**
Total Est. Transit Time	**15 days**	**14 days**	**14 days**
Intermodal 40'Container			
Inland Drayage (Bismarck to Dilworth, Minn.)	$18.20 (via truck)		
Container Rate (Dilworth to Antwerp)	$139.10 13 days (via rail and truck)		
Inland Drayage (Dubuque to Chicago, Iil.)		$16.60 (via truck)	
Container Rate (Chicago to Antwerp)		$110.09 11 days (via rail and truck)	
Inland Drayage (Peoria to East Peoria, Iil.)			$0.25 (via truck)
Container Rate (East Peoria to Antwerp)			$110.09 11 days (via rail and truck)
Total Est. Transportation Rate per Ton	**$157.30**	**$126.69**	**$110.34**
Total Est. Transit Time	**14 days**	**12 days**	**12 days**

The following sections of this report examine potential traffic volumes for an intermodal facility located in North Dakota or its surrounding region, the costs of operating an intermodal facility, an analysis of specific regional characteristics regarding the potential for an intermodal facility, and funding alternatives for a potential intermodal container facility.

POTENTIAL TRAFFIC FOR AN INTERMODAL CONTAINER FACILITY

Perhaps the most important factor in determining viability of an intermodal container facility is the potential traffic that would use such a facility. The amount of potential traffic for a facility provides three important pieces of information: (1) it provides a measure of the benefit of such a facility - a larger amount of potential traffic means larger total savings in logistics costs for regional manufacturers and specialty agricultural producers, and (2) it provides an indicator of whether a new facility would generate enough business to become a profitable and viable venture, and (3) it may provide an indicator of the quality of service and level of rates that might be charged for such a facility, as railroads are able to produce higher quality intermodal services at lower costs with larger shipment volumes. One difficulty in estimating potential traffic is that the amount of traffic depends on rates and service levels, and these are unknown for a new facility.

In an attempt to identify potential intermodal container traffic for a new facility, we asked a series of “revealed preference” style questions to manufacturers and specialty agricultural producers in our survey. Specifically, we asked how many containers they would ship at various rates and distances from an intermodal container facility. Unfortunately, only 11 companies responded to this question. Consequently, we developed an alternative methodology to estimate the potential intermodal container traffic that could be generated from a new facility. The following paragraphs describe the methodology, and present the estimated potential traffic by region.

As highlighted in a previous section of the report, intermodal container truck-rail transportation offers at least two distinct advantages: (1) it allows combining the better service characteristics associated with truck transportation with the lower rates associated with rail transportation, and (2) it increases the ease of shipping products internationally. Obviously, these advantages of intermodal container transportation are not equally valued for all types of products. Shippers of products with low values do not desire the improved service characteristics intermodal container transportation provides over rail enough to pay the rate premium required, while shippers of products with high values do not value the rate savings of intermodal container service enough to offset the service improvements associated with truck transportation. Similarly, some types of products require containers for shipping internationally, while others do not.

To gain insight into the types of products where intermodal container truck-rail transportation is desirable, we examined the nationwide *Commodity Flow Survey*. The U.S. Bureau of Transportation Statistics and the U.S. Census Bureau develop the *Commodity Flow Survey* every 5 years. The *Commodity Flow Survey* is an estimate of traffic volumes, values, and distances by transportation mode, origin, and destination obtained through a survey of a sample of manufacturing, wholesale, mining, and other establishments in the U.S. Figure 15 shows the percent of U.S. shipments moving in truck-rail combinations by commodity for 1997. As the figure shows, several commodities, such as motorized vehicles, chemical products, machinery,

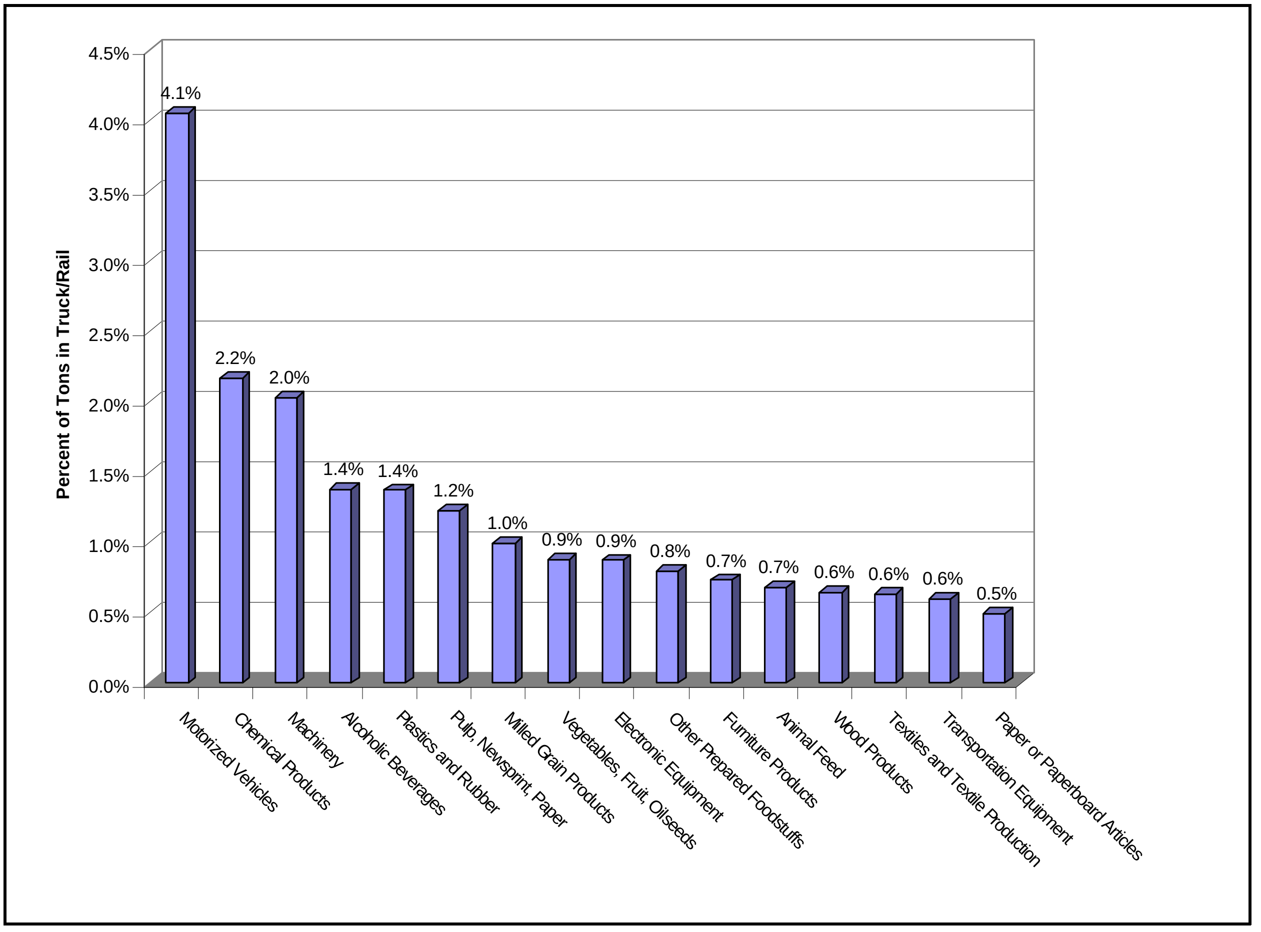

Figure 15. **Percent of U.S. Tons Moving in Truck-Rail Combinations , 1997 (For Commodities with the Largest Truck-Rail Percentages)**
Source: U.S. Bureau of Transportation Statistics and U.S. Census Bureau. Commodity Flow Survey, 1997.

alcoholic beverages, plastic and rubber products, newsprint, and milled grain products, use intermodal truck-rail combinations for at least 1 percent of their shipments. Other products, such as electronic equipment, furniture products, and wood products, rely on truck-rail combinations for at least a half of one percent of their shipments.

While this provides insight into the types of commodities that rely most heavily on intermodal truck-rail transportation, it still does not provide an estimate of the percentage of such commodities that would move intermodally with a new intermodal container facility in North Dakota. The reason is that these nationwide averages reflect a combination of the percentages shipped intermodally where such an option is available and where such an option is not available. A better idea of the percentages of various commodities likely to move intermodally with a

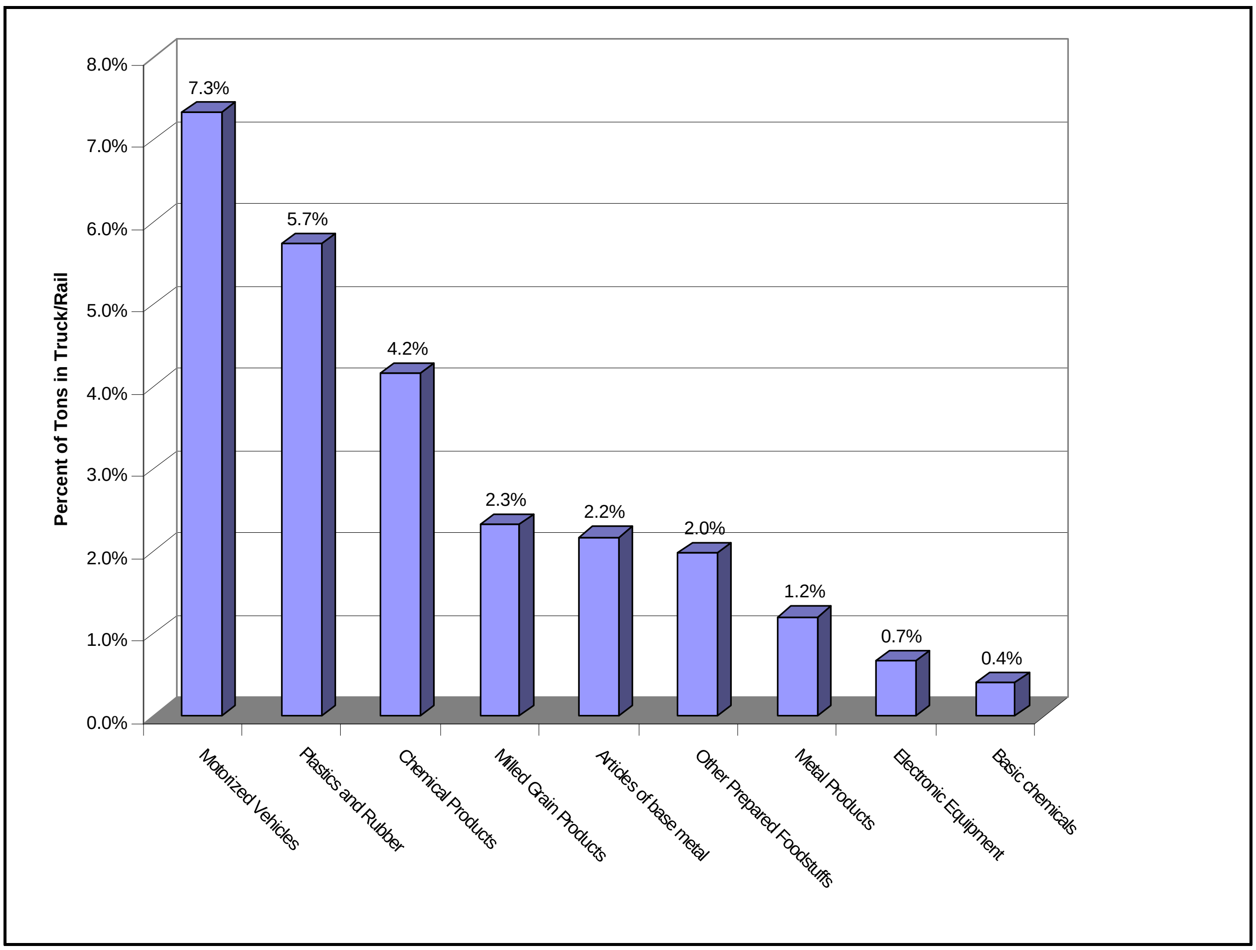

Figure 16. Percent of Illinois Tons Moving in Truck-Rail Combinations, 1997 (For Commodities with the Largest Truck-Rail Percentages)
Source: U.S. Bureau of Transportation Statistics and U.S. Census Bureau. Commodity Flow Survey, 1997.

container facility that provides adequate service may be obtained by examining such percentages in a region where an intermodal container facility currently provides adequate service. Figure 16 shows the percent of Illinois transportation tonnage that moved by truck-rail combinations in 1997. Illinois is a state with a good intermodal container truck-rail facility in Chicago, providing more insight into the commodities that move via such an option where it is available.

It might be argued that the percentages for Illinois may overstate those that would occur in North Dakota because the level of service occurring at a North Dakota facility is unlikely to approach the level occurring in Chicago. However, on the other hand, the percentages of traffic traveling by truck-rail combinations for the state of Illinois as a whole are likely to be much smaller than those in the Chicago area, meaning that the percentages understate those likely to occur in regions with a competitive container facility. Since these effects offset each other to a certain extent, the Illinois percentages serve as a reasonable proxy for percentages of various commodities in North Dakota regions that would move by the truck-rail option if such a facility were located in those regions.

The Illinois rail-truck percentages, the U.S. rail-truck percentages, and the North Dakota area estimated tons of outbound traffic by region and commodity are used to estimate the potential number of containers originating at intermodal facilities located at alternative locations within the North Dakota area.[15] Specifically, estimated outbound tons by commodity and region for manufactured products are multiplied by the percent of Illinois tons moving by truck-rail for

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[15]The estimated potential containers using this method are only a crude approximation of actual potential containers. However, they are reasonable given the data available. Extreme caution must be used in interpreting these potential containers since no rate and service information are included in their estimation.

the same commodity in 1997, when such percentages are available.[16] When Illinois percentages are not available, the U.S. percentage moving by truck-rail combinations is used. For agricultural products, county tonnages of production are multiplied by the U.S. percent of agricultural tons moving in rail-truck combinations.[17]

Table 12 shows the estimated potential outbound and inbound containers from each of the previously defined regions.[18] As the table shows, the largest amount of potential intermodal container traffic is in the southeast portion of North Dakota. Moreover, other regions in close proximity to southeast North Dakota, including western Minnesota and northeastern North Dakota also include large amounts of potential intermodal container traffic.

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[16]In some cases, the tonnages by the truck-rail combination for specific commodities are not shown in the *Commodity Flow Survey* due to excess sampling variability or to avoid disclosure of confidential information.

[17]The Illinois rail-truck tonnages for agricultural commodities are not shown in the *Commodity Flow Survey* because of excess sampling variability.

[18]These estimated potential outbound containers are expected to occur only in the region where the facility is located, and in other regions in close proximity. For example, if a facility were located in Fargo, container traffic from western North Dakota would be much smaller than indicated by the estimate of potential container traffic from western ND regions.

Table 12. Estimated Potential Container Traffic with a New Intermodal Facility*

Region	Estimated Potential Inbound Containers If Using 20' Container	Estimated Potential Outbound Containers If Using 20' Container	Estimated Potential Inbound Containers If Using 40' Container	Estimated Potential Outbound Containers If Using 40' Container
MN	1,683	7,184	1,530	6,530
MT	140	1,121	127	1,019
ND1	15	439	14	399
ND2	128	1,230	116	1,118
ND3	118	801	108	728
ND4	447	4,080	406	3,709
ND5	116	809	105	735
ND6	289	1,905	262	1,732
ND7	321	1,576	292	1,433
ND8	940	6,025	855	5,477
SD1	40	569	36	517
SD2	643	3,384	585	3,076

* Caution must be used in interpreting these estimated potential container volumes, as they are not based on an expected rate and service level.

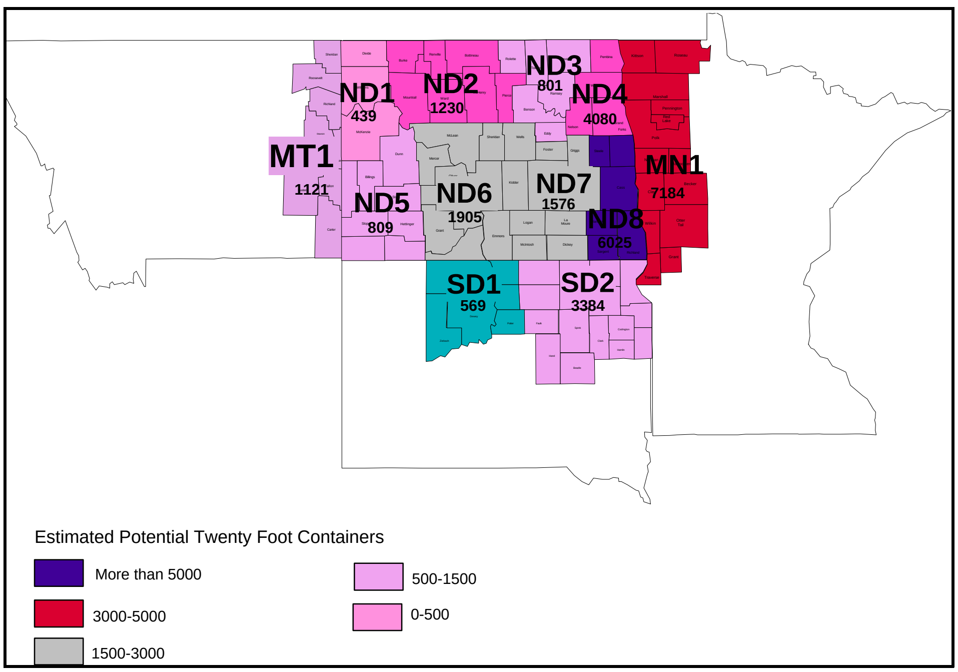

Figure 17. Estimated Potential Container Traffic with a New Intermodal Facility.

The following section of this report examines costs associated with operating an intermodal facility, providing insight into the traffic volumes where such a facility might be feasible.

TRUCK/RAIL CONTAINER INTERMODAL TERMINAL COSTS

An economic engineering model is developed to simulate costs for an intermodal facility. This model is developed to provide decision makers with an estimate of start-up and annual costs. It also provides insight into traffic volumes needed to make such a facility feasible.

The model is developed to evaluate costs for intermodal facilities with varying sizes, equipment configurations, equipment types, and traffic levels. This provides a range of investment levels and unit costs for decision making purposes.

FACILITY ASSUMPTIONS

The assumed facility is 80 acres with 5,000 feet of track, two powered switches, and two internal switches. To fence the perimeter of 80 acres on three sides requires 3,960 feet of fence. It is assumed that 40 acres of the 80 would be paved. There is a need for six work lights and six reefer hookups. A 1,500 square foot building would be built for office and storage space. This facility would need one lifter, one hustler, two chassis, and no forklifts. There would be a manager and four yard employees. Table 13 shows the initial assumptions along with possible options.

Table 13. Assumptions and Options for the Hypothetical Intermodal Facility

Land acres	80	Cost per acre	$2,000.00
Feet of track	5,000	Cost per foot of track	$100.00
No. of powered switches	2	Cost of powered switches	$130,000.00
No. of fence feet	2,640	Cost of fence per foot	$10.00
Acres of pavement	40	Cost per acre	$10,000.00
No. of work lights	6	Cost of lights	$10,000.00
No. of reefer hookups	6	Cost of reefer hookup	$2,000.00
Square feet of building	1,500	Cost per square foot	$50.00
Feet of water line	1,000	Cost per foot	$10.00
Feet of sewer line	1,500	Cost per foot	$20.00
No. of lifters	1	Cost of lifter	$500,000.00
No. of hustlers	1	Cost of hustlers	$50,000.00
No. of forklifts	0	Cost of Forklifts	$25,000.00
No. of Chassis	2	Cost of Chassis	$5,000.00
Facility Estimated Useful Life (Years)	20	Equipment Estimated Useful Life (Years)	15
Tax rate	5%	Insurance	.5%
Interest rate	8%	Estimated Facility Life	20 Years
Maintenance and repair	Variable		

Table 14 shows the estimated investment expenditure for the base case facility. As the table shows, a base case facility capable of handling 50,000 lifts per year is estimated to cost in excess of $2 million.

Table 14. Investment for the Hypothetical Intermodal Facility

Land	$160,000
Track	$500,000
Powered Switches	$260,000
Internal Switches	$160,000
Fence	$39,600
Building	$75,000
Office Equipment	$6,000
Lighting	$60,000
Reefer Hookups	$12,000
Water Line	$15,000
Sewer Line	$30,000
Equipment (1 lifter, 1 hustler, 2 chasis)	$560,000
Total	$2,037,600

Table 15 shows the estimated annual fixed and variable costs for the base case intermodal facility, handling 50,000 lifts per year. Estimated fixed costs include facility and equipment depreciation, return on investment, taxes, insurance, maintenance, management, building expenses, and accounting expenses. Variable costs include worker wages and benefits, and fuel. As the table shows, it is estimated that such a facility would cost approximately $500,000 per year to operate and maintain.

Table 15. Annualized Costs for the Hypothetical Intermodal Facility

Fixed Costs	
Facility Depreciation	$51,104
Equipment Depreciation	$29,867
Taxes, Insurance, Maintenance and Repair, Return on Investment	$207,156
Management	$45,800
Building Expense (Electricity, Heat, Insurance, etc.)	$7,365
Accounting	$2,500
Variable Costs (All variable costs assume 50,000 lifts per year)	
Wages	$91,600
Workman's Comp. and Social Security	$10,992
Benefits	$6,412
Fuel	$20,800
Total	$470,596

While these base case estimates are not exact, they represent a reasonable approximation of what such a facility would cost to maintain and operate. It is possible to reduce costs somewhat by using used equipment or by using existing track.

In addition to estimating costs of maintaining and operating the facility, an estimate of the costs of maintaining and operating a facility per lift is provided. This will be useful in making an assessment of the traffic levels necessary to make such a facility feasible. Table 16 provides an estimate of the total costs per lift for the base case facility at various lift volumes. As the table shows, the total estimated costs per lift decrease with increased volume.

Table 16. Number of Lifts and Fixed, Variable, and Total Estimated Costs per Lift

Lifts/YR	Fixed Costs/lift	Varible Cos/lift	Total Costs/lift
2,000	$171.90	$2.60	$174.50
4,000	$85.95	$2.60	$88.55
6,000	$57.30	$2.60	$59.90
8,000	$42.97	$2.60	$45.57
10,000	$34.38	$2.60	$36.98
12,000	$28.65	$2.60	$31.25
14,000	$24.56	$2.60	$27.16
16,000	$21.49	$2.60	$24.09
18,000	$19.10	$2.60	$21.70
20,000	$17.19	$2.60	$19.79
22,000	$15.63	$2.60	$18.23
24,000	$14.32	$2.60	$16.92
26,000	$13.22	$2.60	$15.82
28,000	$12.28	$2.60	$14.88
30,000	$11.46	$2.60	$14.06
32,000	$10.74	$2.60	$13.34
34,000	$10.11	$2.60	$12.71
36,000	$9.55	$2.60	$12.15
38,000	$9.05	$2.60	$11.65
40,000	$8.59	$2.60	$11.19
42,000	$8.19	$2.60	$10.79
44,000	$7.81	$2.60	$10.41
46,000	$7.47	$2.60	$10.07

Some insight into the types of volumes that would be necessary to support such a facility might be obtained by comparing an average revenue per lift to the costs per lift.[19] Leeper, et. al (1996) estimate that the lift revenues at Dilworth, MN are in the range of $10 to $15. If these numbers are put in current dollars using the GDP Implicit Price Deflator, the range is $10.94 to $16.41 in 2001 prices. At the high end of the revenue range, this would suggest that a facility may be feasible with as few as 13,000 loaded containers per year, and at the low end of the

[19]It is important to note that these cost estimates and average revenue estimates are reasonable estimates given the information we have. However, the point where average revenue per lift is equal to cost per lift from this model should not be considered as a solid break-even point. Rather, the numbers are illustrative of a range of traffic where such a facility may be feasible.

revenue range it would suggest that a facility would need 21,000 lifts per year to be feasible.[20] This is consistent with correspondence with the BNSF suggesting that most of the facilities they serve have at least 20,000 loaded containers per year.

As shown in the previous section, the intermodal traffic potential is at best at the minimum desired by the BNSF. However, a facility located in the eastern portion of the state may be able to generate this amount of traffic from nearby regions. Given the potential difficulty in generating a large amount of traffic for such a facility, any new potential facility likely would need to provide other types of services besides intermodal container service. It is important to remember, though, that these numbers are for one specific type of facility, with specific assumptions regarding the costs of different inputs. It may be possible to configure a facility in a way that results in lower costs per lift. The following section examines potential locations for a new intermodal container facility in North Dakota focusing on the factors that make such facilities successful.

LOCATION ANALYSIS

Many of locational factors enhance the viability of an intermodal container facility. Locational factors contributing to the likely success of an intermodal container facility include, but are not limited to: (1) potential container volume, (2) the availability of multiple railroad alternatives, (3) location on an intermodal rail line, (4) location on the National Highway System,

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[20]Recall that one container generally requires two lifts.

and (5) the availability of accessorial services such as a fuel stop at the location. Each of these factors are discussed briefly in the following paragraphs.[21]

The importance of potential container volume is obvious. Although an intermodal facility could eventually diversify to a point where intermodal container traffic is only a small part of the facility's overall operation, initial success of a facility is heavily dependent on container volume. A previous section of the report suggested that under specific conditions, 13,000 to 21,000 containers might be enough to enable a facility to break even.

Multiple railroad alternatives also enhance the likely success of an intermodal facility. The volume of container and non-container traffic depends heavily on the rates and service provided by the railroad serving the facility. With multiple railroad alternatives, carriers have an incentive to provide lower rates and better service due to a continual threat of losing traffic to a competitor. Because the benefits of intermodal container traffic to individual shippers increase with lower rates and better service, areas with multiple railroad alternatives also are likely to have more container traffic, ceteris paribus. Moreover, the lower rates and better service provided in such areas also are likely to enhance their potential for growth in other areas besides intermodal container traffic (e.g. warehousing facilities, manufacturing, etc.).

As discussed in a previous section, facilities that are on an existing railroad intermodal line are likely to be more successful than those that are not. In fact, when asked what operational

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[21]These factors were developed from a review of literature related to the development of intermodal container facilities, from site visits at intermodal facilities in Billings and Butte, Mont., and Dilworth, Minn., and from discussions with the BNSF. Unfortunately, we were unable to obtain direct input from the Canadian Pacific Railroad in this study. CP Rail chose not to provide guidance or answer any questions regarding desirable locations or operational characteristics that would fit an intermodal terminal location.

characteristics are important to an intermodal facility, BNSF stated that location on an intermodal line was the key factor. Intermodal container traffic on non-intermodal lines is likely to give way to grain traffic, coal traffic, or some other type of traffic when conflicts occur. As a result, the service provided to shippers of products in intermodal containers may be worse on non-intermodal lines. Because the quality of service is an important determinant of intermodal container volume, areas that are not on intermodal lines are likely to have less container traffic than those on intermodal lines, holding other factors constant.

Another important locational factor for an intermodal container facility is direct access to the National Highway System, which is defined in 23 CFR 470 A as:

> *The National Highway System shall consist of interconnected urban and rural principal arterials and highways (including toll facilities) which serve major population centers, international border crossings, ports, airports, public transportation facilities, other intermodal transportation facilities and other major travel destinations; meet national defense requirements; and serve interstate and interregional travel.*

Because of the stated importance of the National Highway System to the nation, roads making up this system may be maintained at high levels into the forseeable future. Because intermodal container facilities use the highway system to pick up and drop off containers at shippers' sidings, a high quality highway system enhances the desirability of a location for a potential intermodal facility.

Finally, the availability of accessorial services to the railroad also may enhance the potential success of an intermodal container facility. Accessorial services, such as locomotive fueling, provide a benefit to the railroad from stopping the train in addition to obtaining the intermodal container traffic. This may be particularly important in areas where the potential container volume is low.

Although not quantifiable, the availability of complementary transportation services, such as international air service, and express package and LTL terminals, as well as business services can also increase the likely success of a new intermodal container facility. In particular, one of the benefits of an intermodal container facility may be to attract firms that may benefit from the lower logistics costs offered with such a facility. The addition of an intermodal facility is likely to have a greater impact on attracting new businesses in locations that may offer a variety of transportation and business services. Because the availability of such services is not quantifiable, they are not analyzed further. The following paragraphs will explore various potential locations for an intermodal facility in North Dakota in terms of these criteria.

Table 17 shows the first 5 criteria for cities in each of the eight defined regions in North Dakota, along with each region's ranking in terms of current freight volume.[22] As the table shows, the largest volumes of potential container traffic are in the eastern and central portions of the state. However, a potential alfalfa pelleting facility in northwest North Dakota (Tioga) may significantly raise the potential traffic volume of the northwest region.[23]

In terms of multiple railroad options, several cities have access to competing railroads. In Minot, Bowbells, Carrington, Valley City, Enderlin, or Fairmount a facility may be able to locate

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[22]Volume ranks are for the region where the city is located. This may not represent the true volume rank of the potential city, since each city is likely to draw volume from outside of the defined region. Volumes for select cities are presented later in this section.

[23]According to the plant manager, the facility would generate 10,000 containers per year with an intermodal facility in close proximity.

at the junction of two competitors, enhancing railroad incentives to provide reliable service at low rates. However, it is important to note that the discipline provided by competition may be much different when two Class I railroads are at a location than when one Class I railroad is competing with a short line. The quality of service provided by a short-line carrier is only as good as the service provided to it by its Class I partner. Because of the revenue sharing associated with a short-line origination of container traffic, the connecting Class I may be reluctant to provide the same level of service to container movements originating on their short-line partner's line as they would if it originated on their own line. For this reason, a facility located at the junction of a Class I railroad and a competing short line may not be able to realize the benefits of competing railroads to the same extent as facilities located at the junction of two Class I railroads.

While a location on two competing railroads can provide an advantage in terms of rates and service, it is likely that this advantage is much greater when the location is on both railroads' intermodal lines. As mentioned previously, intermodal container traffic originated on non-intermodal lines is unlikely to receive the same level of service realized on intermodal lines, as such traffic will give way to coal, grain, or other traffic when conflicts occur. Thus, the role of competition in encouraging railroads to provide better service and lower rates is likely to be greater when the intermodal container traffic on each carrier's line takes priority over other traffic. Table 17 shows that Minot is the only location in North Dakota where two competing railroads' intermodal lines intersect. This suggests that even though the Minot region does not

Table 17. Locational Characteristics of Alternative Potential Intermodal Container Facility Sites in North Dakota

North Dakota Region	Potential Outbound COFC Volume Rank [24]	CurrentTotal Volume Rank (All Modes - Inbound and Outbound) [3]	Multiple Railroad Alternatives	Accessorial Services	Intermodal Line	Located on National Highway System
ND 1 Williston	8	7	No	No	Yes (BNSF)	Yes
ND 1 Tioga	8	7	No	No	Yes (BNSF)	No (1 mile)
ND 2 Minot	5	4	Yes (BNSF)(CP)	Yes (Fuel Stop for BNSF)	Yes (BNSF)(CP)	Yes
ND 2 Bowbells	5	4	Yes (BNSF)(CP)	No	No	Yes
ND 3 Devils Lake	7	6	No	No	No	Yes
ND 4 Grand Forks	2	2	No	No	No	Yes
ND 5 Dickinson	6	8	No	No	No	Yes
ND 6 Bismarck/Mandan	3	3	No	Yes	No	Yes
ND 7 Carrington	4	5	Yes (RRVW)(CP)	No	Yes (CP)	Yes
ND 7 Jamestown	4	5	No	No	No	Yes
ND 7 Valley City	4	5	Yes (BNSF)(CP)	No	Yes (CP)	Yes
ND 8 Casselton	1	1	No	No	No	Yes
ND 8 Fargo/Dilworth	1	1	No	Yes (Fuel Stop for BNSF)	Yes (BNSF)	Yes
ND 8 Hankinson	1	1	Yes	No	No	No (2 miles)
ND 8 Enderlin	1	1	Yes (RRVW)(CP)	No	Yes (CP)	No (20 miles)
ND 8 Fairmount	1	1	Yes (RRVW)(CP)	No	Yes (CP)	No (10 miles)

[24]Potential COFC and current total volume ranks do not correspond to the city, but to the defined economic region. Potential COFC volume for specific cities are presented subsequently.

rank high in terms of potential COFC volume as estimated by the percentage of various commodities likely to use an intermodal container option, the region would rank much higher if potential volume were estimated based on likely rates and service characteristics.[25]

As discussed previously, a location on the National Highway System should enhance intermodal truck-rail connections of a potential new facility. As Table 17 shows, most of the cities examined have locations on the National Highway System.

Finally, in terms of accessorial services, Minot, Bismarck, and Fargo all have fuel stops for the BNSF railroad. This provides an additional benefit to the railroad from stopping at these locations, enhancing the likelihood of frequent service.

While Table 17 provides a great deal of useful information regarding the characteristics of various potential locations for an intermodal container facility, it does not provide potential volume information specific to each location. Rather, it provides volume information for the region where the city is located. Because each city is likely to draw traffic from outside its defined economic region, this does not provide a realistic assessment of potential traffic for specific cities.

To correct this problem, we estimate potential outbound COFC traffic volume for three specific cities in North Dakota, using a 100-mile, 150-mile, and 200-mile radius from each city.[26] [27] Traffic volumes are estimated for Fargo, Minot, and Valley City - as each presents a unique

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[25]Unfortunately, the data to estimate potential volume in this way are not available.

[26]Glassheim and Nagel (2002) state that the "intermodal transportation option is economically feasible for a shipper, when that firm or producer is a 'reasonable distance' from an intermodal terminal – typically 100-miles or less."

[27]Potential TOFC containers are estimated using the same procedure described previously.

situation in terms of a potential intermodal container facility. The Fargo area is chosen due to its location in a region that has high potential COFC volumes and its close proximity to other regions with high potential COFC volumes, its location on two interstate highways, its location on an intermodal line, and the fact that it currently serves as a fuel stop for the BNSF railroad. Minot is chosen due to its unique characteristics of being the only location in North Dakota with two competing intermodal lines, its location on the national highway system, and its current fuel stop for the BNSF. Valley City is chosen due to its close proximity to high potential COFC volumes, its location at the intersection of two competing railroads, and its location on the National Highway System. It should be noted that even though two Class 1 railroads intersect at Valley City, there is a vertical separation and no interaction takes place between the two railroads. Figure 18 shows the three cities and the locational characteristics they provide.

Table 18. Cities Chosen for Further Analysis and Locational Factors.

City	Accessorial Services	Competition CP and BNSF	Intermodal Line	Located on National Highway System
Fargo	Yes (Fuel Stop for BNSF)	No	Yes (BNSF)	Yes
Valley City	No	Yes (BNSF)(CP)	Yes (CP)	Yes
Minot	Yes (Fuel Stop for BNSF)	Yes (BNSF)(CP)	Yes (BNSF)(CP)	Yes

Table 19 shows each cities estimated potential outbound and inbound container volume.[28] A previous section of the report suggested that under specific conditions, 13,000 to 21,000 containers may be enough to make a new intermodal container facility viable.

Table 19. Estimated Potential 20' Containers

City	Estimated Potential Twenty foot Containers					
	100-mile radius Outbound	Inbound	**200-mile radius** Outbound	Inbound	**200-mile radius** Outbound	Inbound
Fargo	16,021	3,229	20,428	3,884	22,962	4,248
Valley City	15,225	2,757	21,153	4,172	23,282	4,329
Minot	3,391 (13,391)*	488	5,907 (15,907)*	1,022	13,573 (23,573)*	2,186

* Assumes 10,000 containers loaded by the Tioga alfalfa pelleting facility.
** Within the literature containers are mostly measured in TEUs (20 foot equivalent unit).
*** 40' containers may be loaded instead of 20' containers. Estimated potential 40' containers can be obtained by multiplying the above estimates by .909.

[28]For Minot, this is based on a reported 10,000 potential containers from the new alfalfa pelleting facility in Tioga.

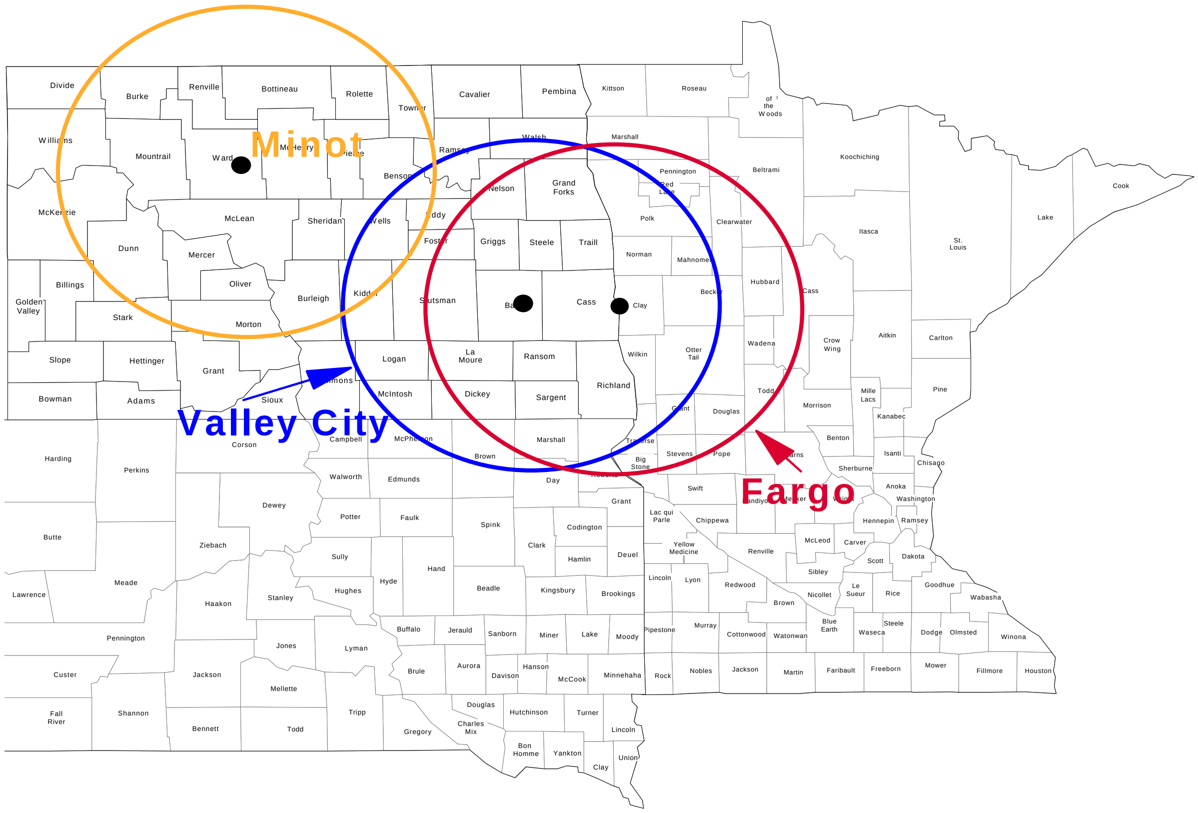

Figure 18. **100-Mile Radius Around Three Cities (Fargo, Valley City and Minot) to Estimate Potential Twenty Foot Containers with a New Intermodal Terminal.**

In looking at each community separately, Fargo offers the highest estimated potential outbound container volume, is on an intermodal line, offers refueling to the BNSF, and has direct access to two interstate highways. However, Fargo does not have multiple railroad options. Nonetheless, the community represents a potentially viable location for an intermodal container facility.

One important discussion point related to Fargo is that a facility already exists in Dilworth, Minn., a location that is within 3 miles of Fargo. However, several problems exist with the current facility, and these problems are unlikely to be resolved at the current location. Problems include a lack of space for expansion into other areas such as warehousing, unavailability of equipment, and congestion. Moreover, the facility is privately owned and operated and is not in North Dakota. Therefore, the ability to use state and local economic development tools for this facility - tools that may enhance the facility’s chances for success - is limited.

Valley City also ranks high in potential container volume, but not as high as Fargo for the 100-mile radius analysis. While the city has railroad alternatives (BNSF and CP), it is located on only one intermodal line. As suggested previously, competition is not likely to have a big effect on rates and services in cases where the location is not on two intermodal lines. Thus, based on the stated criteria, Valley City does not appear to have advantages over Fargo. However, a more remote or rural site may be desirable for loading and unloading of containers where it would not interfere with other railroad operations, and where more space is available. The increased rurality of Valley City compared to Fargo may be an advantage. As stated previously, there is no interaction between the Class 1 railroads at Valley City.

Finally, Minot has a large amount of potential COFC volume if the estimate of 10,000 potential containers out of the new Tioga alfalfa pelleting facility is correct. Moreover, Minot has one advantage that the other communities analyzed do not have as it is located on two competing intermodal rail lines. To the extent that such competition acts to discipline railroad rates and service, such a location may have a higher amount of potential container volume than estimated. Other advantages of Minot are the same as Fargo and Valley City, including a location on the National Highway System and the availability of a fuel stop for the BNSF. Finally, the BNSF stated that Minot would cause the least amount of disruptions to its operations, as intermodal trains currently stop there to change crews and some intermodal switching occurs there. The ability to attract the necessary amount of traffic still remains a concern in Minot.

The following section shows the expansion of the draw areas for COFC. The estimates of potential containers for three cities can be expended to 150 and 200-mile radius. (Figure 19 and 20).

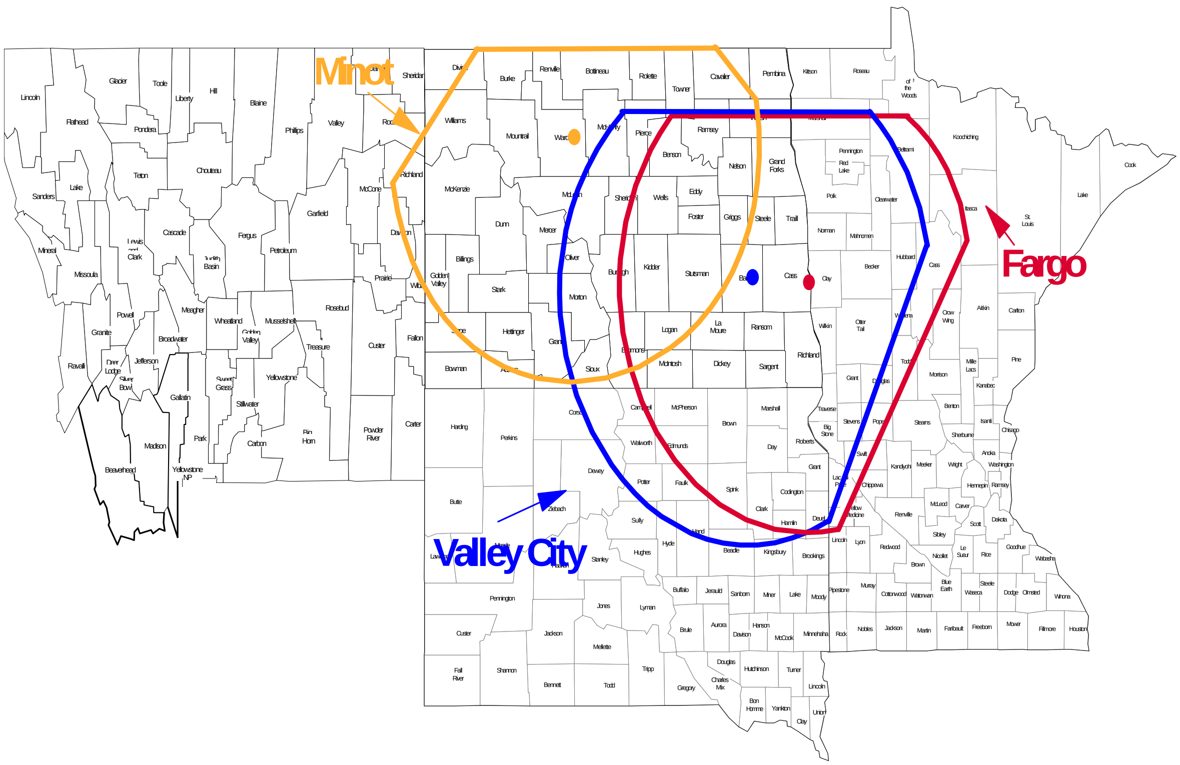

Figure 19. 150-Mile Radius of Three Cities (Fargo, Valley City, and Minot) to Estimate Potential Twenty-Foot Containers with a New Intermodal Terminal.

Potential manufacturing and grain tons were measured to provide total potential 20' container volumes. However, this study has excluded areas located closer to other intermodal facilities, such as Minneapolis, Winnipeg, and Regina. Because shippers are likely to use closer intermodal facilities, it is rational to exclude these areas.

According to the analysis, using the 200-mile radius, Valley City was found to have the largest container volume among the three cities at an estimated 21,153 containers (Table 3). Unlike the results of the 100-mile radius, Fargo had the second largest container volume at an

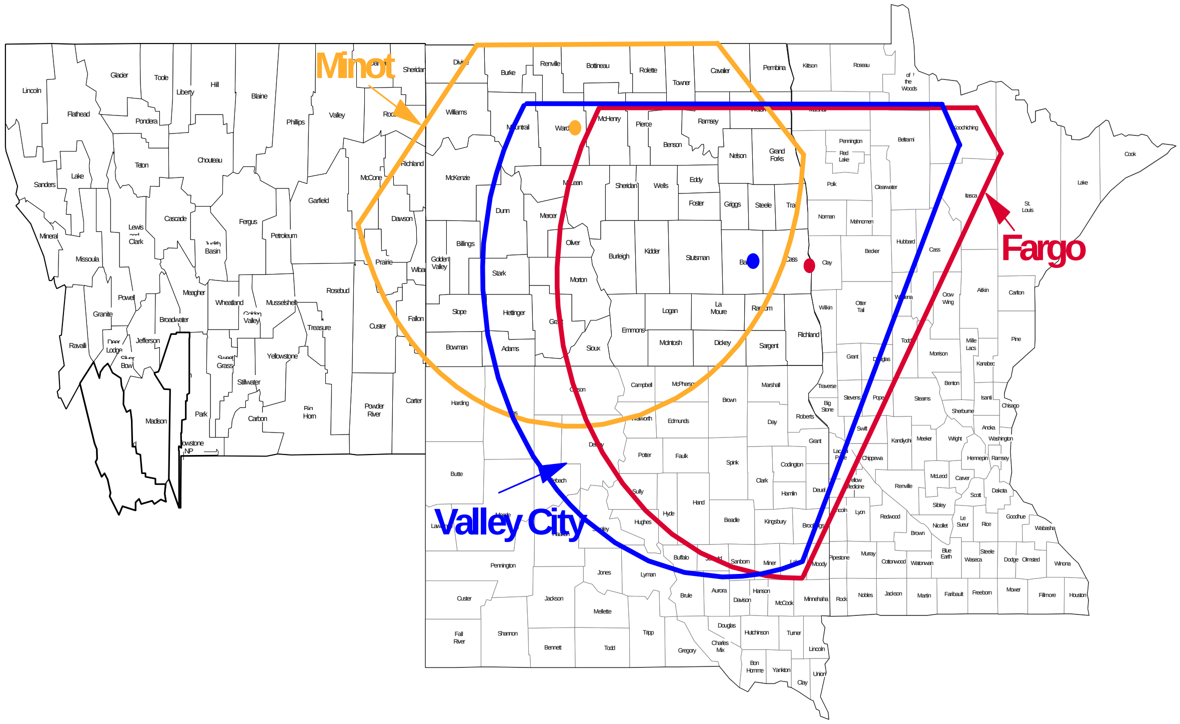

Figure 20. **200-Mile Radius of Three Cities (Fargo, Valley City, and Minot) to Estimate Potential Container Volume.**

estimated 20,428 containers. The reason for the lesser volume at Fargo was because the circle was closer to the intermodal facility located in Minneapolis thereby excluding some of the area. For the 200-mile radius, Minot showed the largest container volume at an estimated 23,573 containers (Table 3). This estimate included 10,000 containers loaded by the Tioga alfalfa pelleting facility. Again, Valley City had the second largest volume estimate at 23,282 containers.

In summary all three communities offer some type of advantage not realized by the other two. A complete feasibility analysis may require better data to estimate potential volumes and capital/operation cost estimates for a specific type of facility.[29]

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[29]Because survey respondents did not reply to the “revealed preference” style questions it was difficult to obtain an idea of potential container volumes at a high confidence level.

HIGHWAY IMPACTS OF AN INTERMODAL LOADING FACILITY

An intermodal loading facility in North Dakota should result in positive highway maintenance implications. Anywhere a facility would be built would result in less total truck traffic because the facility would divert traffic away from truck. A switch to intermodal or a diversion of intermodal freight to a facility in North Dakota would remove freight from the highway system. However, there would be a localized effect similar to other loading facilities, such as a grain terminal or other large manufacturer or food processor. Without specific information on a facility it is difficult to analyze highway impacts. However, a general estimation of impacts could be analyzed.

Marginal highway maintenance costs can be developed from two sources. The Federal Highway Administration's *Federal Highway Cost Allocation Study* estimates the marginal pavement cost of an 80,000-pound five-axle truck mile on a rural interstate highway of 12.7 cents. The U.S. Department of Transportation (USDOT) *Comprehensive Truck Size and Weight Study* presents a range of unit costs that show how marginal pavement costs vary by highway type. The relationships developed in the USDOT study can be used to adjust the FHWA marginal pavement costs for principal and minor arterial highways. Doing this results in estimated marginal pavement costs per truck mile on principal arterial and minor arterial highways of 30.5 cents and 73.7 cents, respectively.

It could be estimated that the freight needed to provide sufficient volume at a facility would be between 13,000 and 21,000 containers annually. It is likely that these volumes currently move out of state to an intermodal facility or are trucked directly to coastal ports. Therefore, highway implications would be a reduction in net impacts as result of constructing an intermodal loading facility. However, there would be localized impacts of increased highway maintenance costs if the facility is on a collector or county road. The following section of the report examines potential funding possibilities for an intermodal container facility.

FUNDING

Funding is one of the main obstacles in constructing an intermodal facility. North Dakota statutes and Federal transportation funding rules limit the way highway funding can be appropriated in the state. This section will review transportation planning and funding possibilities for a rural intermodal transportation terminal.

North Dakota Statute 24-02-37 states that the State Highway Fund must be applied to highways. Specifically, it says:

> *1. Except for investment income as provided in subsection 3, the fund must be applied in the following order of priority.*
>
> *a. The cost of maintaining the state highway system.*
>
> *b. The cost of construction and reconstruction of highways in the amount necessary to match, in whatever proportion may be required, federal aid granted to this state by the United States government for road purposes in North Dakota.*
>
> *c. Any portion of the highway fund not allocated as provided in subdivisions a and b may be expended for the construction of state highways without federal aid or maintenance of such state highways.*

The statute prevents the North Dakota DOT from using these funds to build an intermodal facility. One option that could be used to fund a facility in the state would be to establish a port authority statute. Port authority is described next.

Port Authority

An important element of intermodal container facility success in Montana and many other states has been from establishing port authority. Such authority may serve as a means for funding an intermodal facility. “The term port authority refers to a state or local government that owns, operates, or otherwise provides wharf, dock, and other terminal investments at ports” (Coyle et.al., 1994). Ports can be municipal airports or other public transportation systems moving people and goods. Many cities, counties, regions, and/or states have built terminal facilities to promote transit and efficient freight transportation using port authority. In the case of freight, the port authority may operate portions or all of the facility or lease facilities to private firms. Often, the port authority has taxing authority to provide funding for constructing and operating a facility. Many states, counties, and or municipalities have engaged using port authority as a tool for providing shipping options for existing and or new development.

Although North Dakota does not have laws allowing for Port Authority, such a law could provide a method for cities, counties and/or regions to access the tax base for funding and/or maintaining a intermodal container facility or terminal. However, the initial capital investment may need to be come from the state’s general fund or a low interest loan from the Bank of North Dakota. A more complete description of Port Authority is provided in Appendix 6.

North Dakota Department of Transportation’s Strategic Transportation Plan

While current state statutes limit the ability to fund an intermodal facility, and no Port Authority law exists, the ND Department of Transportation’s Strategic Transportation Plan provides several references to changing statutes to allow more flexibility in the use of transportation funds. In the plan, the NDDOT expresses an interest in identifying the need for an intermodal facility, identifies a desire to strategically prioritize transportation resources, and identifies a need to promote public/private partnerships to bring about transportation initiatives. All of these suggest the potential for a more flexible transportation funding environment in the future, possibly providing the means for an intermodal facility.

An interesting aspect of the NDDOT's Strategic Transportation Plan is its discussion of public/private partnerships. Our interview with BNSF revealed a willingness to work with public agencies in a public/private partnership. This may be a desirable option for funding such a facility, since such a commitment from the public and private sectors may enhance the potential for success. A detailed review of the North Dakota Statewide Strategic Transportation Plan is in Appendix 6.

The following sections review national transportation funding initiatives - TEA 21 and USDA Rural Development Funding - examining their applicability to funding an intermodal facility in North Dakota.

TEA 21

Although TEA 21 has stated goals of promoting intermodalism, empowering state and local officials, promoting innovative financing, and strengthening partnerships, it does not allow the use of highway funds for building an intermodal container facility. Much of the flexibility included in TEA 21 is for congestion and pollution mitigation projects, such as light-rail, transit systems, and intelligent transportation projects.

TEA 21 does include two loan/loan guarantee programs, although one of the programs would not be available to North Dakota. The first loan program is entitled the Transportation Infrastructure Finance and Innovation Act of 1998 (TIFIA). This however is not practical for an intermodal facility in North Dakota because of the minimum project cost. That is, it must cost at least $100 million or 50 percent of the state's annual apportionment of federal state aid funds, whichever is less. An intermodal facility project would cost much less than the threshold outlined in the TIFIA requirements.

Another loan program is the Railroad Rehabilitation and Improvement Financing Program (RRIF). This program can be used to: acquire, improve, or rehabilitate intermodal or rail equipment or facilities, including track, components of track, bridges, yards, buildings, and shops; refinance outstanding debt incurred for purposes listed above; develop or establish new intermodal or railroad facilities. Eligible borrowers include railroads, state and local governments, government sponsored authorities, and joint ventures that include at least one railroad (Federal Railroad Administration, www.fra.dot.gov/rdv/finance/rrif.htm). This program may provide an option for a city or region looking at borrowing funds for an intermodal terminal, possibly in conjunction with other funding such as port authority. A longer description of TEA 21 is in Appendix 6.

2002 Farm Bill- Northern Great Plains Regional Authority-Section 6028

A section of the farm bill authorizes a Northern Great Plains Authority in the sates of Iowa, Minnesota, Nebraska, North Dakota, and South Dakota. "The Authority is expected to develop a series of comprehensive coordinated plans for economic development of the region. The Authority may approve grants to states and public and nonprofit entities for projects including transportation and telecommunication infrastructure projects, business development and entrepreneurship, and job training. Extends the program but no funds are provided."

The main reason for the authority is to provide economic development for the Northern Great Plains regions. Even though no funding has been provided, possibility exists for funding in the future. This Regional Authority may provide an avenue for funding an intermodal terminal facility.

USDA-Rural Development Funding

A variety of USDA Rural Development programs exist, each focusing on a specific segment of rural America, and are aimed at improving economic development in rural areas. However, most of these programs are geared towards planning and technical assistance. Many of the programs are geared toward specific segments of agriculture, limiting those who can apply.

One USDA Rural Development Program that may potentially be used for an intermodal container facility is the Value-added Agriculture Product Market Development Grant (VADG) program, authorized in 2000 and amended in the 2002 Farm Bill. Eligible recipients of such grants include independent producers and cooperatives, and producer groups, such as commodity promotion groups. Recipients of the grants can use them to develop business plans, feasibility studies, and to acquire working capital to operate a value-added venture. The program mentions the importance of product segregation explicitly - an area where containerization is important. The maximum grant is $500,000, but smaller grant requests receive priority. Profitable use of technology and uses of biomass also receive priority (Rural Business Cooperative Service, www.rurdev.usda.gov/rbs/coops/vadg.htm). One of the most difficult obstacles to using these funds may be creating an organization that is eligible for the funds.

North Dakota Agriculture Products Utilization Commission

Another funding source may be the North Dakota Agriculture Products Utilization Commission (APUC). APUC’s mission is “to create new wealth and jobs through the development of new and expanded uses of North Dakota agricultural products.” APUC provides

North Dakota agricultural producers and ag-related business owners funding to pursue development activities. The grant programs include; basic and applied research grants, marketing and utilization grants, cooperative marketing grants and farm diversification grants. APUC accepts grants on a quarterly basis. The projects are judged by the directors to determine if the project meets the eligibility requirements.

The aforementioned programs represent some possible funding opportunities for an intermodal terminal. One of largest barriers to funding such a terminal is the inflexibility of federal and state transportation funds. At the federal and state levels, increased flexibility in transportation funds would go a long way in providing a funding opportunity for an intermodal container facility.

Another action the state could take would be to establish a statute describing rules for the formation of a Port Authority. Using the Montana example, one could allow North Dakota counties, cities, and/or regions to share in an economic development project that adapts the port authority concept and uses it as an avenue to construct and operate an intermodal terminal.

SUMMARY

This report examined the potential role of a relatively newer form of transportation - intermodal truck-rail container transportation - in the state's expanding manufacturing and value-added agricultural base. Specifically, the report explored the general advantages of intermodal container transportation, examined the factors that make intermodal container transportation successful, estimated the costs of building and operating intermodal facilities, evaluated the characteristics of various locations that are desirable for an intermodal facility, estimated potential traffic volumes and other characteristics of various North Dakota locations where such a facility might be located, and explored various funding options for an intermodal facility. This was done using several secondary data sources along with surveying firms in North Dakota and the surrounding region. The surrounding region included border counties in Minnesota, South Dakota and Montana.

In examining the advantages of intermodal container transportation for shippers, it is apparent that many of the advantages are the result of an ability to combine the best characteristic of two modes. Because of the advantages of truck in terms of service and rail in terms of transportation charges, it is possible to obtain transportation that has better service characteristics than rail, but lower charges than truck by combining the modes in intermodal container service. Another advantage of intermodal container service is increased ease of shipping manufactured products internationally.

In examining factors that make intermodal transportation successful, we found several factors contributing to the likelihood of success, including: (1) a high volume of container traffic, (2) the availability of multiple railroad alternatives, (3) location on an intermodal rail line, (4) location on the National Highway System, and (5) the availability of accessorial services such as a fuel stop at the location. Because traffic levels in North Dakota are not likely to reach those of major U.S. intermodal terminals, a new intermodal facility in North Dakota would likely need to coordinate other transportation and logistics services at the facility to promote success. An example of the Port of Montana shows how a diverse set of services can make an intermodal facility successful.

In estimating potential volumes for an intermodal facility, we found that there appears to be largest potential container volume in eastern North Dakota and western Minnesota. We estimate that more than 16,000 containers might be loaded in a facility in Fargo with good intermodal service.[30] Other areas of the state also be able to load significant container volumes, as well. We estimate that more than 13,000 containers might be generated out of the Minot area if traffic projections given by a new alfalfa processing facility are correct

To estimate costs of a new intermodal facility, we developed an economic-engineering model. The model showed decreases in costs per container with increased container volume, reflecting a spreading of fixed costs over more volume. Although the model is based on specific assumptions, we used the model to provide insight into the types of volumes that would be necessary to support such a facility. Leeper, et. al (1996) estimate that the lift revenues at Dilworth, Minn. are in the range of $10 to $15. If these numbers are put in current dollars using the GDP Implicit Price Deflator, the range is $10.94 to $16.41 in 2001 prices. These numbers suggest that a facility may be feasible with between 13,000 and 21,000 containers per year

The location analysis showed that the largest volume potential for a new intermodal

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[30]Potential container volumes are estimated based on the proportion of various products moving in containers where good intermodal service exists. Actual container volumes would depend on rate levels and service levels available.

facility would be in the southeast portion of the state - an area that has points on the BNSF's intermodal line. However, in terms of other characteristics, the Minot region ranks high. Minot is served by two Class I railroads, is at a fuel stop, and is on two intermodal lines. Moreover, Tioga (with the alfalfa plant) is about 60 miles from Minot. Of the other sites considered, most do not provide characteristics necessary for a facility. However, a more remote or rural site may be desirable for loading and unloading of containers where it would not interfere with railroad operations. The cars could then be moved to a desirable location for connecting with an intermodal train where the Class I already performs other function. Other functions could also be performed at the site, such as warehousing or providing a just-in-time function for manufacturing. Light assembly or packaging also present possibilities. Bulk storage of fertilizers or chemicals could also provide opportunity.

In examining funding options for a new facility, we found several potential sources and problems associated with each. One of largest barriers to funding and intermodal container facility is that federal and state transportation funding rules limit the way highway funding can be appropriated in the state. Specifically, a North Dakota Statute prevents state highway funds from being used for non-highway purposes. Moreover, allocated federal highway funds cannot be used to construct an intermodal container facility. Relaxation of state and federal rules limiting funding flexibility may enhance opportunities for funding such a facility.

Another action the state could take would be to establish a statute describing rules for the formation of a Port Authority. Using the Montana example could allow North Dakota counties, cities, and/or regions to share in an economic development project that adapts the port authority concept and uses it as an avenue to construct and operate an intermodal terminal.

FINAL COMMENTARY

Final determination as to whether or not a facility is built in North Dakota is up to the leadership of both public and private sectors. The information in this report provides a basis for discussing the pros and cons of constructing an intermodal terminal. Cooperation among state and local government leaders along with business leaders can bring about a plan for increasing the transportation options for the shippers of the state.

A multi-faceted terminal serving many different interests and filling niche transportation demands may provide opportunities for existing and potential new businesses to diversify and grow in the state and surrounding region. The trend of increased production of identity preserved agricultural products and a growing viable manufacturing sector requires additional logistical and transportation options be considered.

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APPENDIX 1
North Dakota Economy

Historically, North Dakota has been a significant part of the U.S. economy, especially the agricultural and agri-food economy. The state's abundance in natural resources, low labor costs, and competitive tax structure has allowed the state to enjoy an important position in the national economy. In 1999, the state produced nearly $17 billion worth of goods and services (measured as Gross State Product), and with nearly 450,000 workers.

However, while the state has shown a growth in payroll employment that exceeds the national average,[1] its growth in output of goods and services has lagged behind the nation. From 1980 to 1999, North Dakotas real output of goods and services has increased by an average percentage rate of 1.6 percent compared to a national average growth in the output of goods and services of 3.2 percent.[2] North Dakota growth has caught up somewhat with national growth during the past decade, but still lags behind. From 1990 to 1999, real North Dakota output of goods and services increased by an average of 2.7 percent annually, while the national output of goods and services increased by an average of 3.4 percent annually.

This portion of the North Dakota strategic freight analysis will describe the North Dakota economy, with a focus on the state's manufacturing sector. This description will provide insight into the dependence of the state on various economic sectors, the changing roles of industries in the state's economy, the characteristics of firms in various North Dakota industries, the regional composition of the state's economic activities, and the potential logistics and transportation needs to foster future economic growth in the state.

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[1]According to a report prepared by the North Dakota Department of Economic Development and Finance, the state's payroll employment increased by 20 percent in the 1990s compared to a national average growth of 24 percent. See *The Economic Performance and Industrial Structure of the North Dakota Economy*, May 2000.

[2]The real output of goods and services is defined as the inflation adjusted gross state product. GSP is the value of outputs in goods and services produced in the state. For an individual industry, GSP can be thought of as an industry's value added. It is the industry's value of output produced minus the value of intermediate inputs used. This is obtained from the U.S. Bureau of Economic Analysis.

The first part of this section presents general information on the economic activity of North Dakota. We examine the North Dakota economy using selected key indicators, including Gross State Product (GSP), the number of employees, and the nationwide share of North Dakota economic activities. Economic activity in various sectors, such as agriculture, manufacturing, and mining are measured and evaluated by these indicators. This will provide a background for the more specific description of the state's growing manufacturing industry in the following part of the report.

Figure 1 shows real N.D. Gross State Product (GSP) and the state's share of national GSP from 1980 to 1999. As the figure shows, the state's output in goods and services has been increasing over time from approximately $12 billion (in 1996 prices) in 1980 to nearly $17 billion (in 1996 prices) in 1999. However, as the figure also shows, this growth in real GSP has not kept pace with the national average. In 1980, North Dakota GSP accounted for about .28 percent of the nation's GSP, while today it accounts for approximately .18 percent of the nation's GSP.

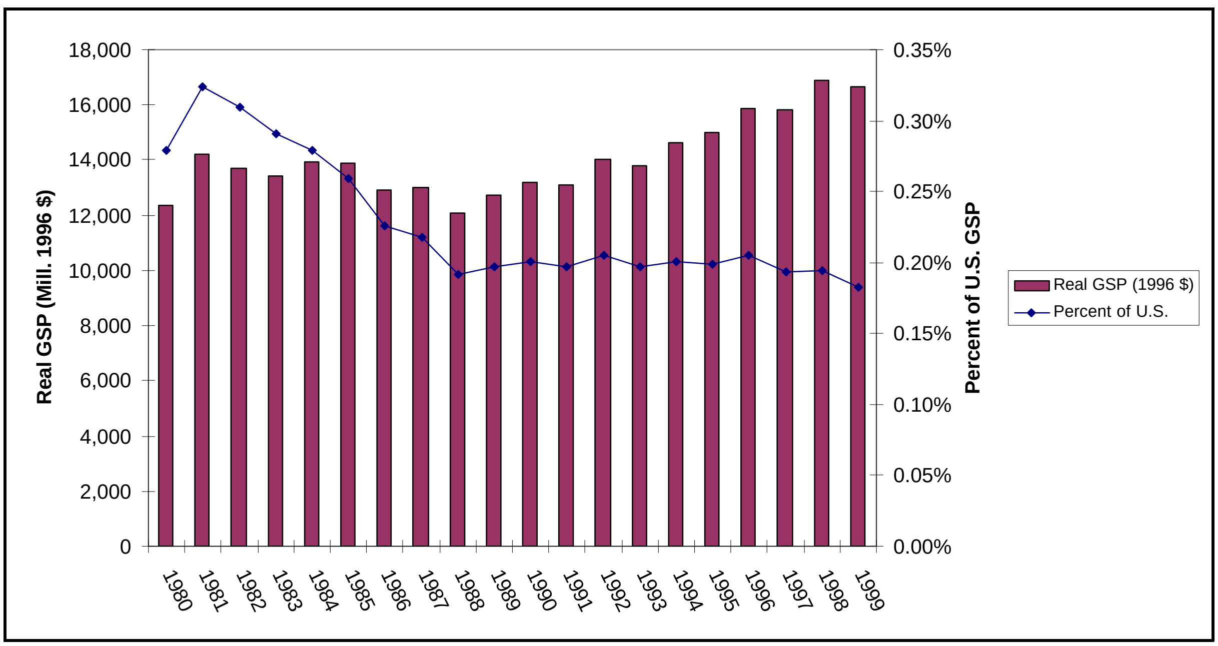

Figure 1: Real North Dakota Gross State Product - 1980-1999 (Chained Dollar 1996 Values - Source: U.S. Bureau of Economic Analysis)

A similar picture is shown with North Dakota employment over time. Figure 2 shows that while North Dakota employment grew at an average rate of 1.2 percent per year from 1980 to 1999, its share of national employment fell from .31 percent to .27 percent over the same time period. Moreover, while the state's growth rate in employment during the 1990s of 1.9 percent slightly exceeded the national growth rate of 1.8 percent, its growth rate has fallen behind the national rate since 1994.

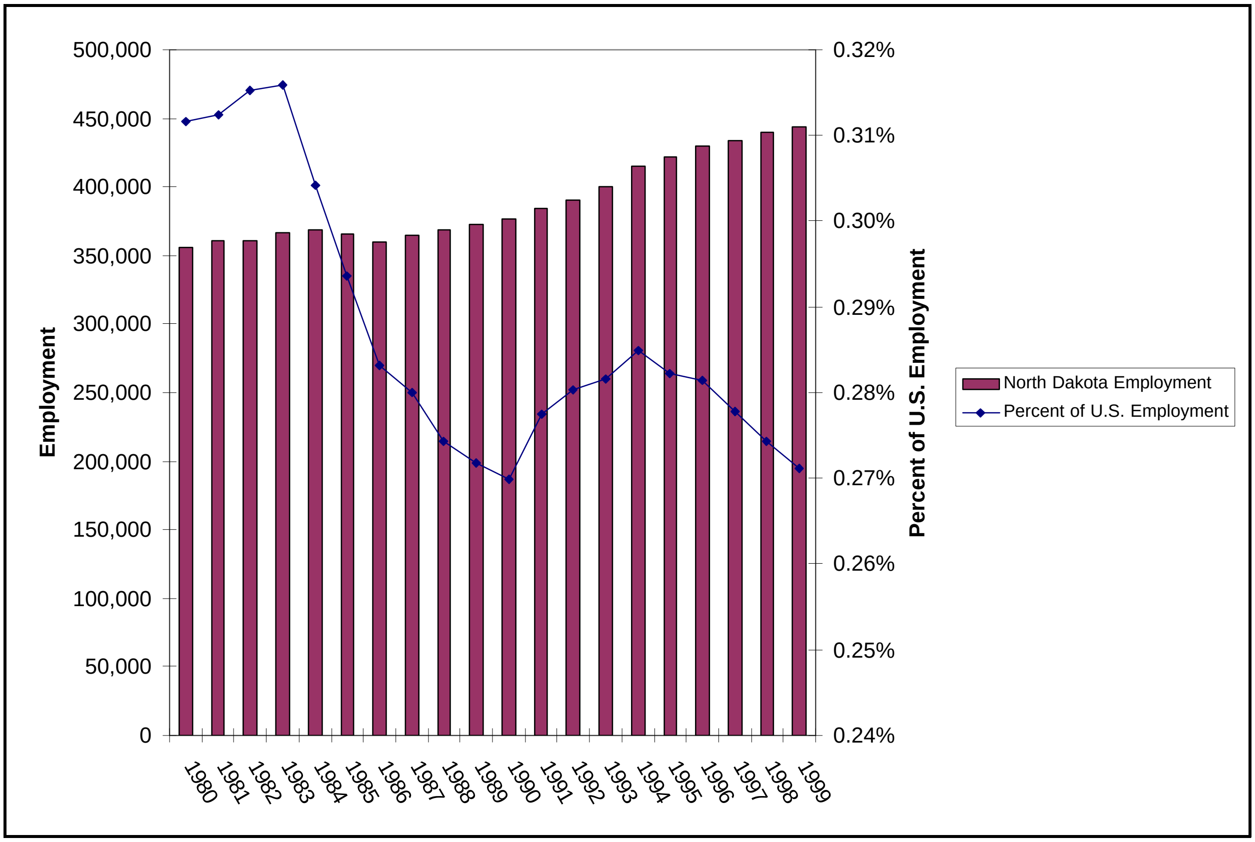

Figure 2: North Dakota Employment - 1980-1999 (Source: U.S. Bureau of Economic Analysis)

In addition to the overall growth trends in output and employment, a great deal can be learned by examining composition of economic activity in the state. One way to broadly examine the composition of economic activity in the state is to develop an index of the diversity of economic activity. On the one hand a diverse array of economic activity may shelter a state from downturns in economic activity in any particular sector. For example, a state that relies heavily on agriculture may realize a downturn in overall economic activity if there is a downturn in the agricultural sector, while a state that relies on a variety of industries may be able to offset the downturn in a particular industry with growth in other industries. However, on the other hand, heavy reliance on a particular economic activity may result in greater economic growth due to agglomeration economies. In many cases, concentration of a particular economic activity can result in an increased concentration of skilled labor, increased technology transfer, and more efficient supplier and distribution networks, leading to improved performance of the particular economic sector. A case in point is the success of the high technology industry in the Silicon Valley of California.

To measure diversity of the North Dakota economy, we use Herfindahl indexes of the shares of state GSP and employees in various broadly-defined industries. The Herfindahl index is measured as follows:

$$H = \sum_i S_i^2$$

$$where: \quad S_i = share\ of\ GSP\ (or\ employment)\ attributable\ to\ one\ industry$$

This index ranges between zero and one, with an index closer to zero representing more diversity.

Herfindahl Indexes of GSP by the industries from 1980 to 1999 are shown in Figure 3. As the figure shows, the Herfindahl index of diversity of broad industries for North Dakota has ranged from .11 to .12, indicating a reliance on many industries.

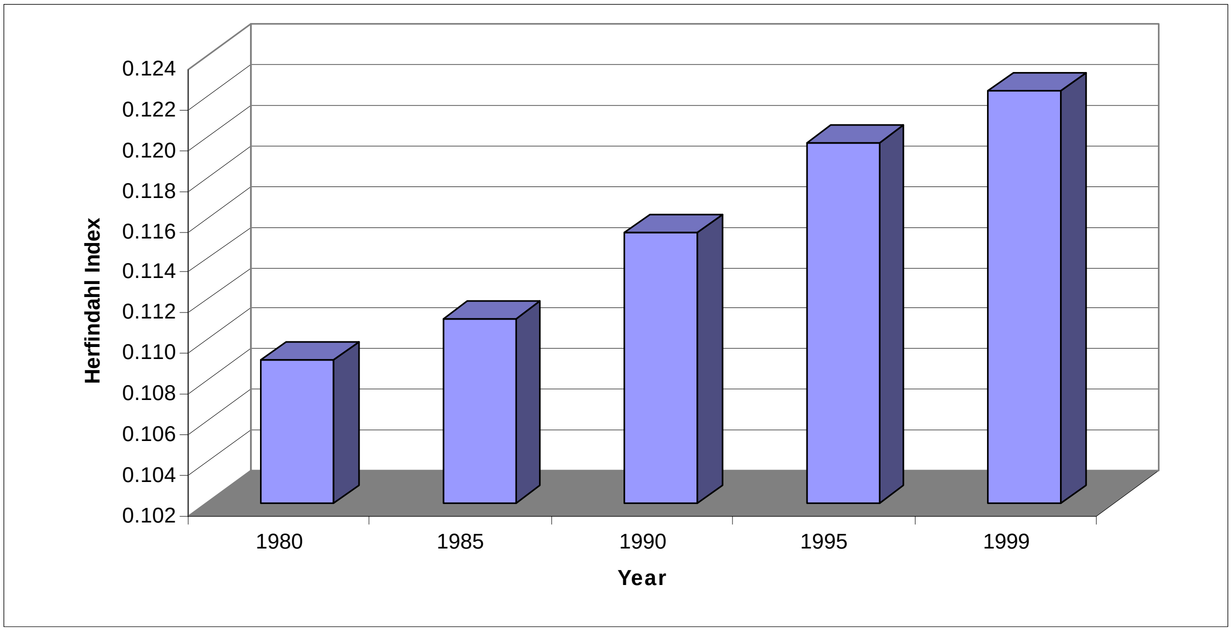

Figure 3: **Herfindahl Index of Diversity for Broadly-Defined North Dakota Industries - Using GSP (Source: Authors' Calculations - Data from Bureau of Economic Analysis)**

Figure 3 also shows that this index has been increasing slightly over time. This would appear to suggest that North Dakota's economy is becoming less diverse over time, therefore relying more on specific industries. However, in the case of North Dakota this index defined with GSP can be misleading. Historically, the state has relied heavily on the agricultural sector, an industry with low product values relative to other industries. As economic activity shifts away from agriculture and into an industry with higher valued products, the index will increase due to the larger-revenue industry representing a greater share of the state's economic activity.

This phenomenon also is apparent in examining the diversity indexes of other states. In 1999, North Dakota's diversity index was the lowest of any state in the United State. The national average diversity index was .145, and North Dakota's was .122. Rather than representing a true advantage in diversity, this index may represent the state's higher reliance on industries with low product values. Because of this problem, we also measure the diversity index using employment.

Figure 4 shows the Herfindahl index of diversity for North Dakota using employment shares from 1980 to 1999.[3] As the figure shows, diversity of the state's economy as measured by employment also is high, with low Herfindahl indexes ranging from approximately .14 in 1980 to .16 in 1999.[4] As in the case when diversity was measured by the share of GSP in various broadly-defined industries, the diversity of the state's economy measured by employment is also higher when compared to the national average (.17 in 1999). These measures suggest that the state's economy is not overly dependent on one or a few industries. This may suggest a more stable economy than nationally, as a downturn in a particular industry is more likely to be offset by other industries. However, the lack of specialization indicated by the low Herfindahl index may also suggest a lack of agglomeration economies and other benefits that would occur with specialization. More insight into the diversity of the state's economy can be obtained by explicitly examining the state's economic activities in broadly-based sectors. Later, the diversity of industries in the manufacturing sector will be examined.

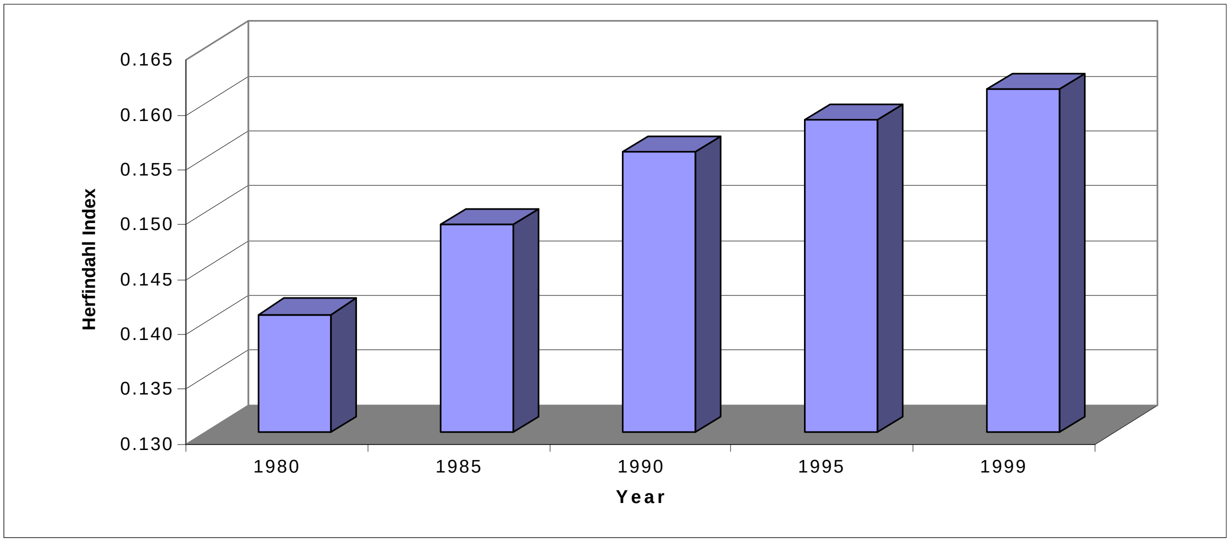

Figure 4: Herfindahl Index of Diversity for Broadly-Defined North Dakota Industries - Using Employment (Source: Authors' Calculations - Data from Bureau of Economic Analysis)

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[3]Some caution must be used in interpreting figures using employment, since it includes full-time and part-time employment. Data related to full-time equivalent employment is not available.

[4]Lower Herfindahl indexes suggest more diversity.

Figure 5 shows the value of goods and services produced by North Dakota industries in 1999, as measured by gross state product. As the figure shows, the largest broadly-defined industries in the North Dakota economy in 1999 were services, government, finance, insurance, and real estate. Services such as restaurants and hotels, automobile repair, legal services, educational services, and social services accounted for 20 percent of the states outputs of goods and services in 1999. Federal civilian and military government activities and state and local government accounted for 15 percent of the states output in 1999, while finance, insurance, and real estate accounted for 14 percent. Other industries accounting for 9 percent or more of the states output included transportation and public utilities, retail trade, wholesale trade, and manufacturing. Construction, agriculture, and mining accounted for 5 percent, 4 percent, and 4 percent of the state’s GSP, respectively.

The small percentage of the state’s output in goods and services accounted for by agriculture is somewhat surprising, given the state’s traditional dependence on agriculture. However, caution must be used in interpreting the role of agriculture in GSP for two reasons. First, since agricultural output is heavily dependent on weather, output for any one year may not

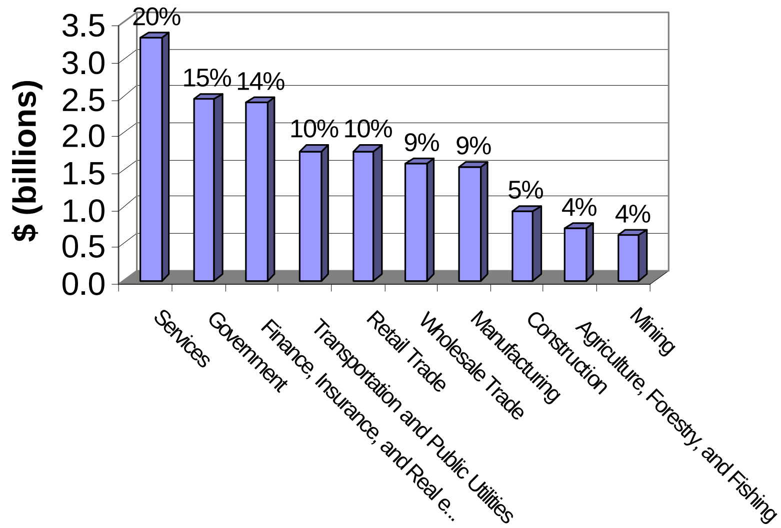

Figure 5: **Share of Gross State Product (GSP) in North Dakota for Broadly-Defined Industries (Source: Bureau of Economic Analysis)**

be reflective of the true significance of agriculture. Second, much of the output of the manufacturing sector uses agricultural output as an input. It might be argued that much of the food manufacturing that occurs in the state would not take place without the high availability of low-priced agricultural commodities in North Dakota. To the extent that such manufacturing would not take place absent local agricultural production, the importance of agriculture to the state's economy may be understated by examining GSP.

Figure 6 shows the share of employment in broadly-defined industries in North Dakota for 1999. As the figure shows, the importance of agriculture in the state's economy using employment as a metric is higher than when using GSP, while manufacturing is lower. This is because of the lower value of agricultural products than manufactured products, suggesting a lower value of output per worker in agriculture than in manufacturing.[5] Similarly, differences in

[5]Differences also may exist due to varying amounts of part-time employment in different industries.

GSP and employment shares in other industries also reflect varying levels of output value per worker.

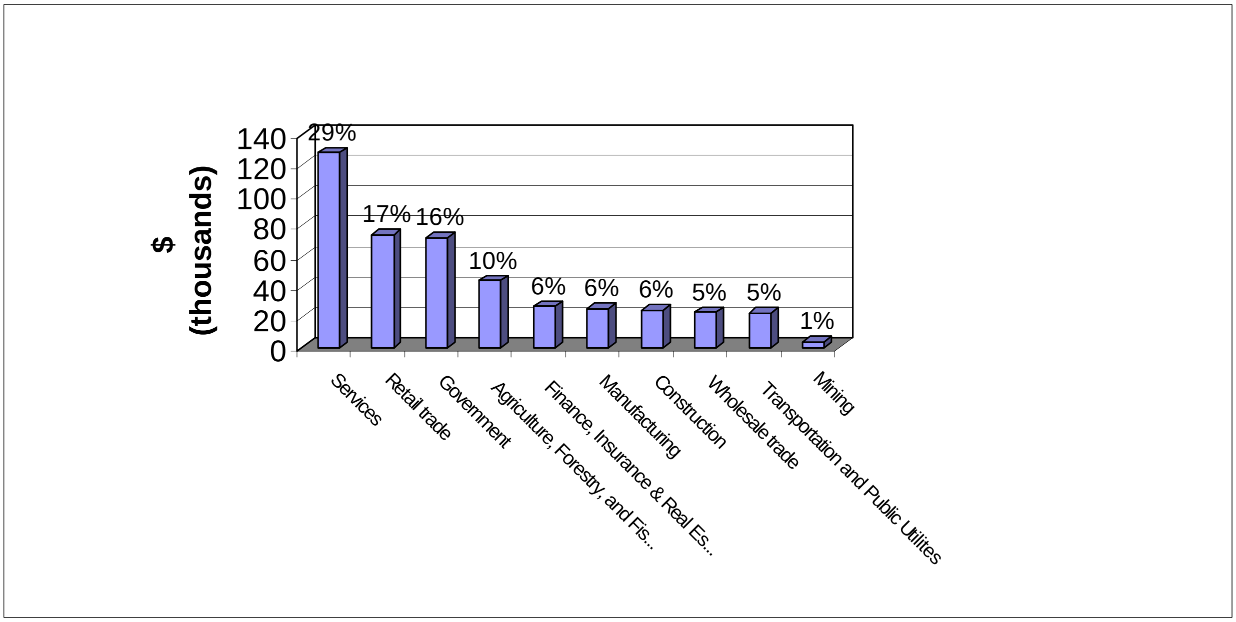

Figure 6: **Share of full-time and part-time employment in North Dakota in 1999 (Source: Bureau of Economic Analysis)**

Figures 7 and 8 show that whether economic activity is measured by output or employment, the trends in the importance of various industries are consistent. Figures 7 and 8 show changes that have occurred in the share of GSP and employment of four broadly-based industries over time, respectively. Agriculture, mining, wholesale trade, and manufacturing are highlighted since these are the industries likely to transport commodities out of the state. As shown in Figure 7, agriculture shares in the state's GSP has declined from approximately 12 percent in 1985 to 4 percent today. Similarly, its share in the state's employment has declined from approximately 15 percent in 1980 to about 10 percent today. Another industry showing a decline in GSP and employment over the past 20 years is mining, with a decline from approximately 16 percent of the state's GSP in 1980 to about 4 percent today, and a decline in employment from more than 2 percent to approximately 1 percent in 1999. Industries that have captured growing shares of the state's output and employment include wholesale trade and manufacturing.

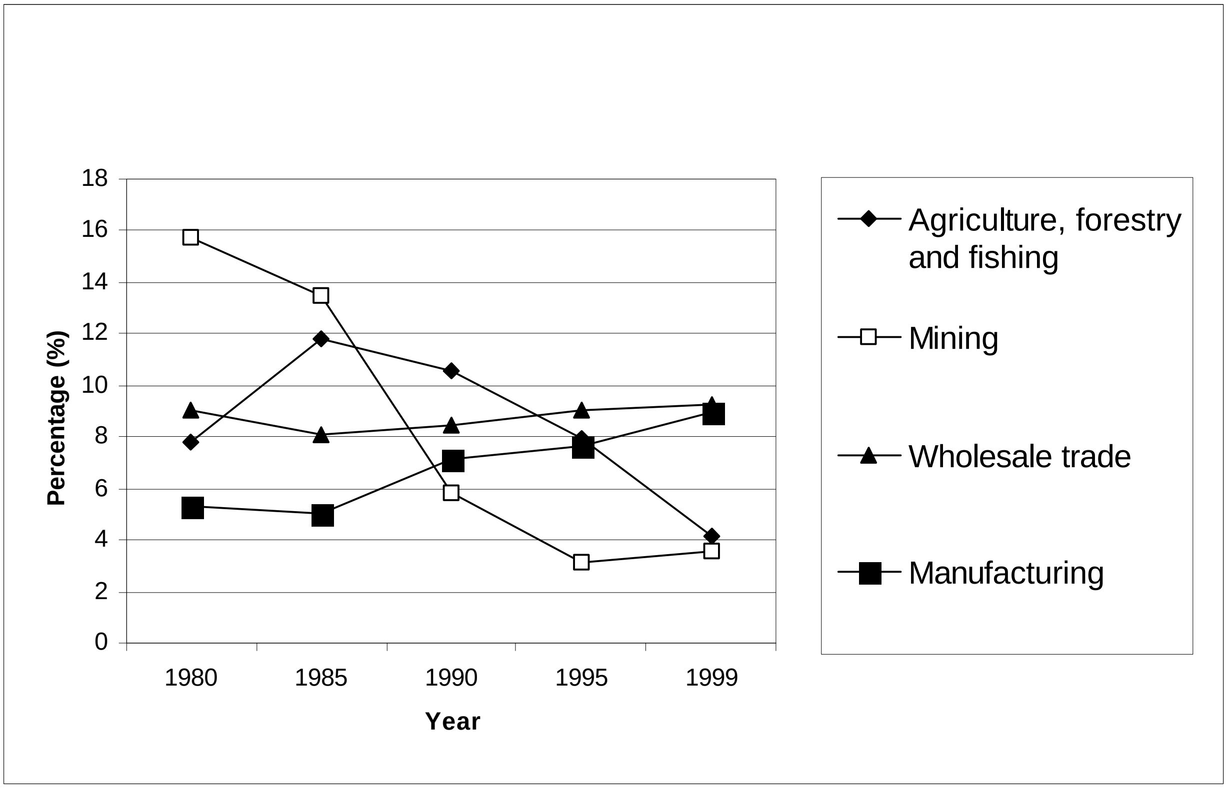

Figure 7: **Share of Gross State Product (GSP) by Broadly-Defined Industry in North Dakota - 1980-1999 (Source: U.S. Bureau of Economic Analysis)**

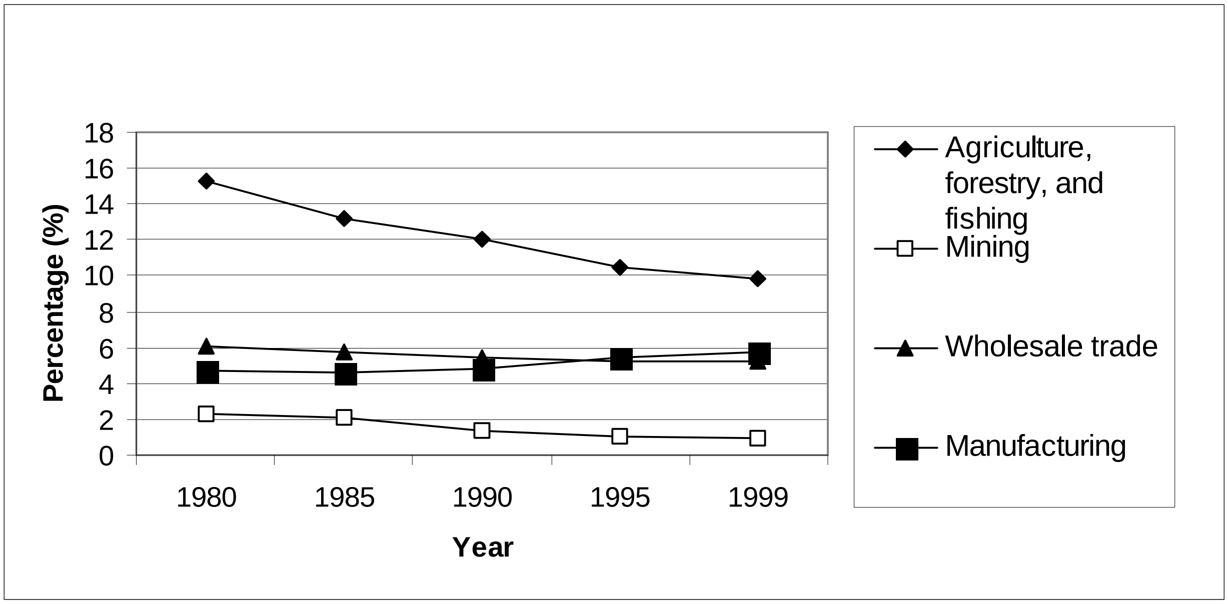

Figure 8: Share of Employment by Broadly-Defined Industry in North Dakota - 1980-1999 (Source: U.S. Bureau of Economic Analysis)

While it is useful to examine the relative share of economic activity that occurs in each sector, additional insight into the importance of various sectors may be obtained by comparing the proportion of economic activity in a particular sector to the proportion of activity in that sector at the national level. A measure that attempts to identify specializations in the local economy by comparing the local economy to a reference economy is the location quotient. The location quotient for a particular economic sector is defined as follows:

$$Location\ Quotient\ (LQ)\ for\ Sector\ i = \frac{\dfrac{Economic\ Activity\ for\ Sector\ i\ in\ ND}{Total\ Economic\ Activity\ in\ ND}}{\dfrac{Economic\ Activity\ for\ Sector\ i\ in\ the\ U.S}{Total\ Economic\ Activity\ in\ the\ U.S.}}.$$

The value of the location quotient provides important information regarding the dependence of a region on a particular economic sector. A location quotient exceeding one suggests that the economic activity for the region of interest (North Dakota in this case) is more dependent on the sector being analyzed than the nation, while a location quotient below one suggests less dependence on that particular sector for the region considered.

Pushing this interpretation further, sectors or industries where the location quotient exceeds one are those that are more likely to be net exporters for the region considered. Traditionally, such sectors or industries are considered to be "basic", in that they draw resources into the community. Those sectors or industries where the location quotient is less than one are less likely to be net exporters. The logic behind these interpretations is that the amount of economic activity for a particular sector in the region is above (LQ>1) or below (LQ<1) the amount expected based on the national economy.

Although the location quotient normally uses employment to define economic activity, we calculate two different location quotients – one using employment and another using gross state product. Location quotients using these alternative measures of economic activity will show two different things: (1) how dependent is North Dakota employment on the sector or industry in question, relative to the nation? and (2) How dependent is the total value of goods and services produced in North Dakota on the sector or industry in question, relative to nationally? Location quotients are calculated for each broadly-defined sector or industry in North Dakota (e.g. agriculture, manufacturing, etc.). Later in this section, location quotients are calculated for specific manufacturing industries (e.g. food manufacturing, industrial machinery, etc.), and for specific regions within North Dakota.

Figure 9 shows the location quotients for nine broadly-defined sectors or industries in North Dakota, using gross state product as the measure of economic activity. As the figure shows, even though the share of GSP accounted for by agriculture and mining appear to be small the North Dakota economy is heavily dependent on its agricultural and mining industries when compared to the nation. Agriculture and mining each contribute approximately three times more to the state's GSP than these sectors do to the nation's GSP. Other industries that have location quotients above one include wholesale trade, transportation and utilities, construction, and retail trade. As discussed previously, we would expect that these industries would be more likely to be net exporting industries. Industries with location quotients below one include services, finance, insurance, real estate, and manufacturing.

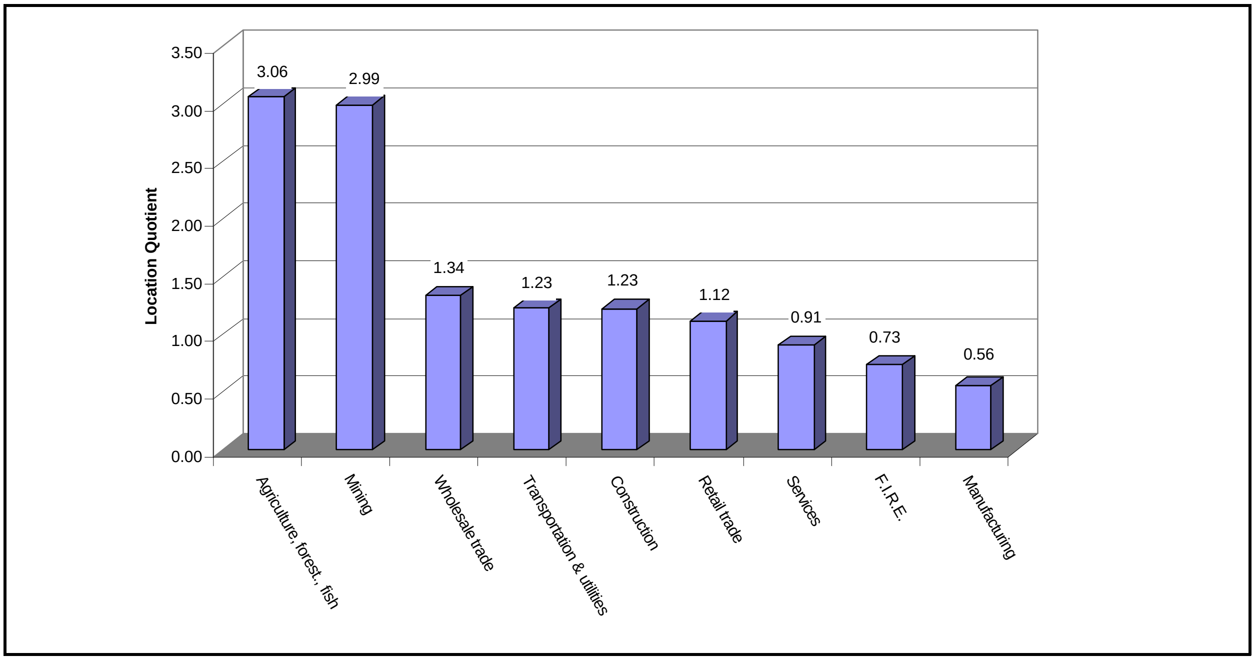

Figure 9: Location Quotient for Broadly-Defined North Dakota Industries Using GSP as the Measure of Economic Activity - 1999 (Source: Authors' Calculations - Data from Bureau of Economic Analysis)

A similar picture is painted by the location quotient that uses employment to define economic activity, as shown by Figure 10. Again, services, finance, insurance, real estate, and manufacturing have location quotients below 1.

Although the manufacturing sector contributes much less to the state's GSP and employment than it does to the nation's income and employment, it's contribution relative to the nation has been growing rapidly over the last 20 years as shown by Figures 11 and 12. In 1980, the state's manufacturing contribution to state income was about one-quarter of nationwide manufacturing's contribution to the nation's income. Today, North Dakota manufacturing makes a contribution to the state's GSP that is more than one half of the nationwide manufacturing contribution to our nation's income. Similarly, Figure 12 shows that the location quotient for manufacturing in North Dakota using employment as the measure of economic activity was .26 in 1980, while it is .49 today.

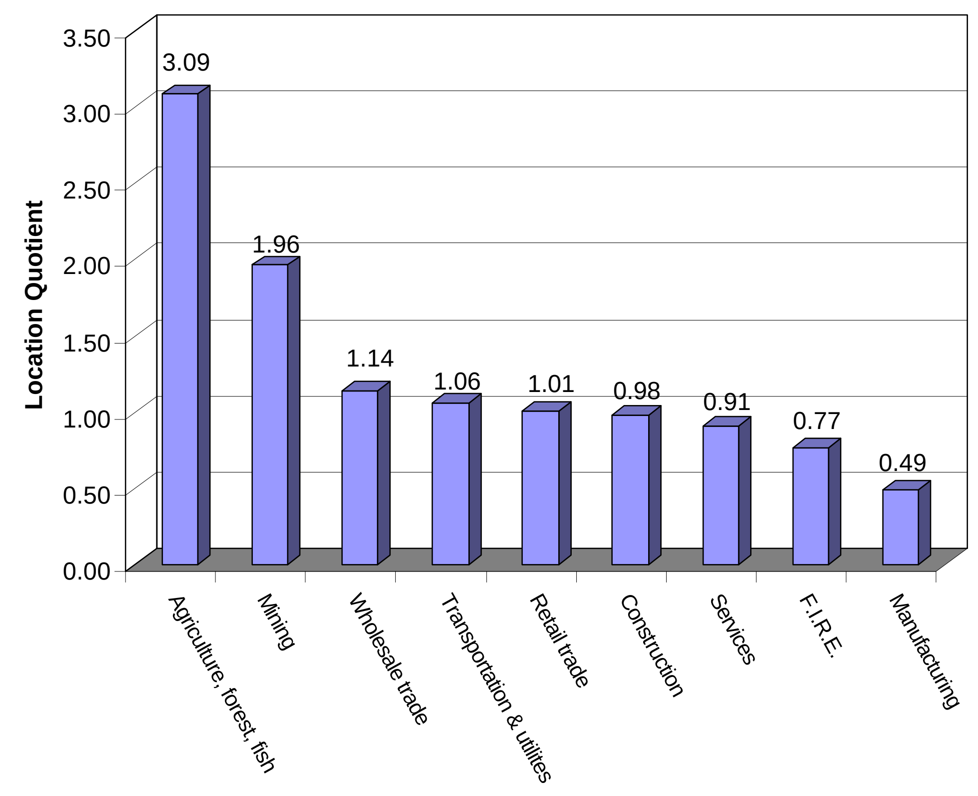

Figure 10: Location Quotient for Broadly Defined North Dakota Industries Using Employment as the Measure of Economic Activity - 1999

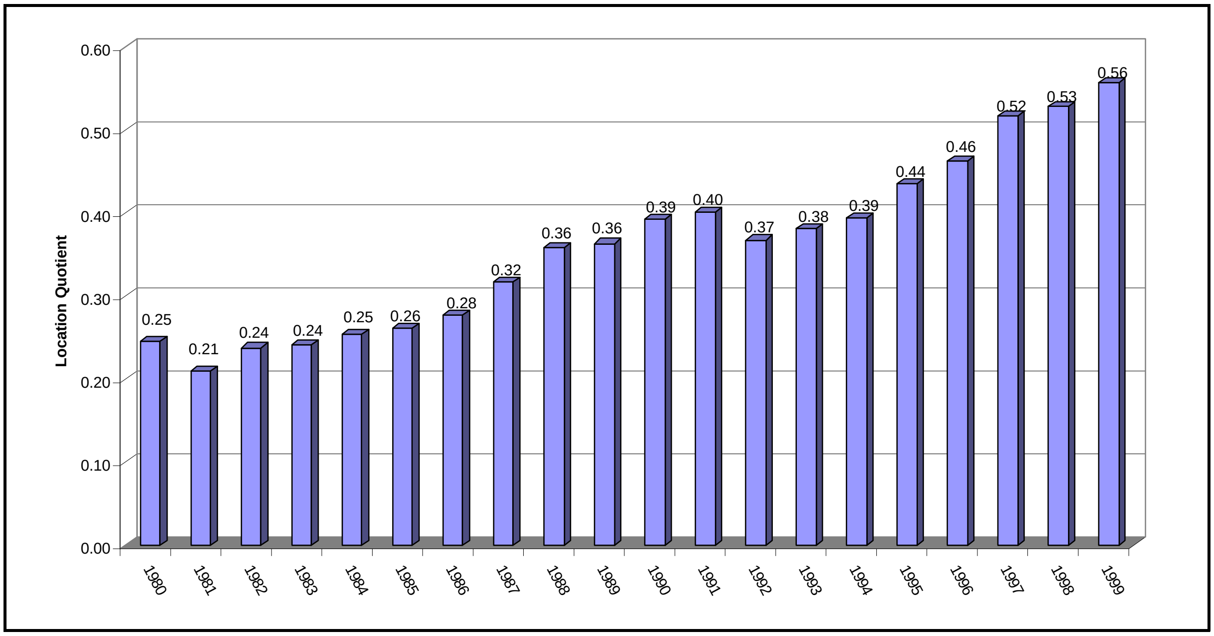

Figure 11: Location Quotient for North Dakota Manufacturing using GSP- 1980-1999

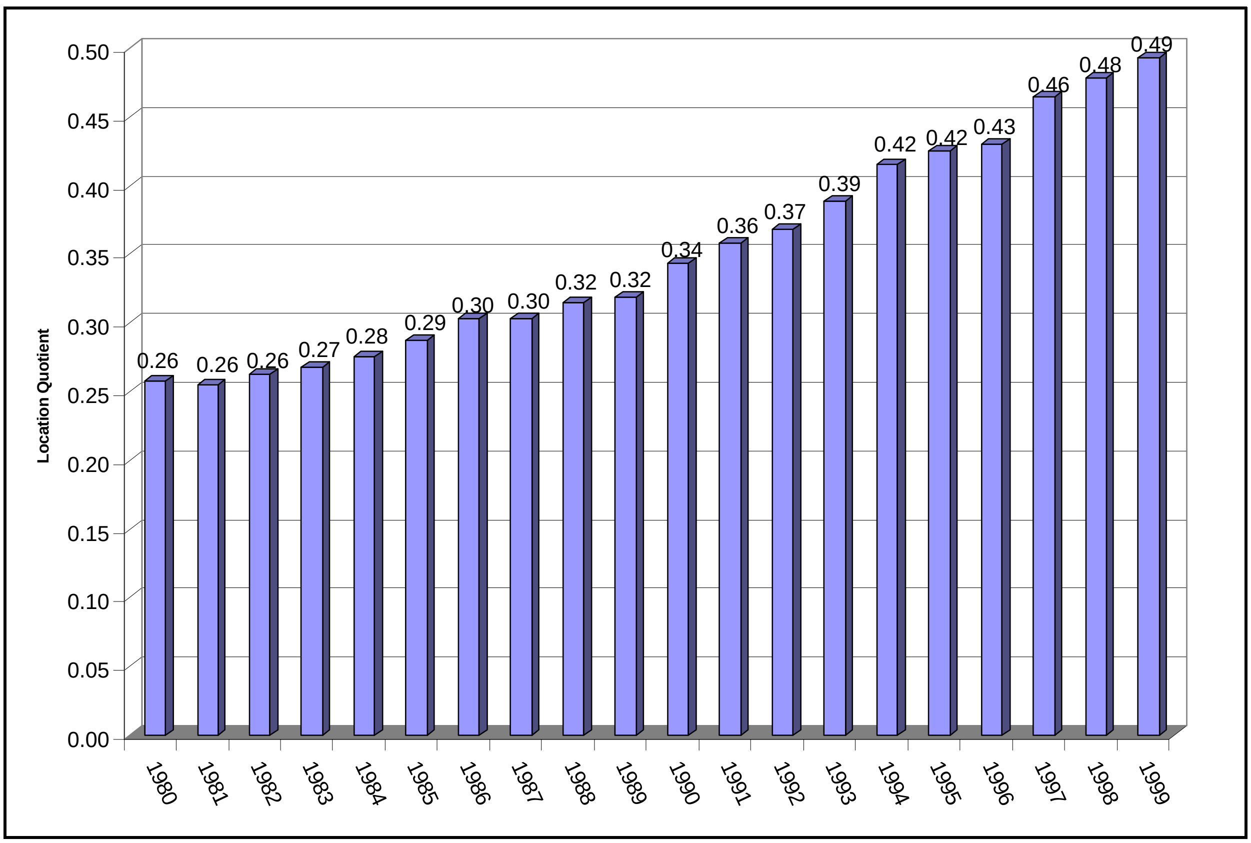

Figure 12: Location Quotient for North Dakota Manufacturing Using Employment - 1980-1999 (Source: Authors' calculations - Data from U.S. Bureau of Economic Analysis)

A final way to examine changing roles of various broadly-defined industries in the economy of North Dakota is to calculate growth rates in such industries. Figures 13 and 14 show the average annual growth rates in inflation-adjusted GSP for the broadly identified industries over the last 20 years and 10 years, respectively. As the figures show, manufacturing has been the fastest growing industry in the state over either of these periods. Over the past 20 years, manufacturing GSP grew at an average annual rate of 6.5 percent, while it has grown at an average annual rate of 7.72 percent over the last 10 years. These growth rates are particularly strong when one considers the average annual growth rate for North Dakota GSP as a whole of 1.6 and 2.65 percent over the last 20 and 10 years, respectively. The following section of the report will examine the state's manufacturing industry in some more detail.

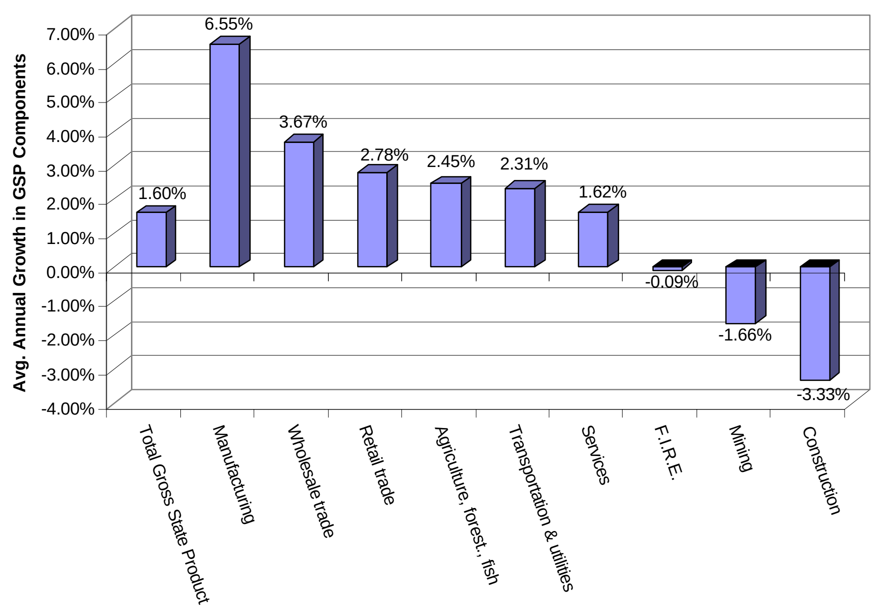

Figure 13: Annual Average Growth Rates in GSP Components for North Dakota - 1980-1999 - (Using Real 1996 Chained Dollar Estimates of GSP Components - Source: U.S. Bureau of Economic Analysis)

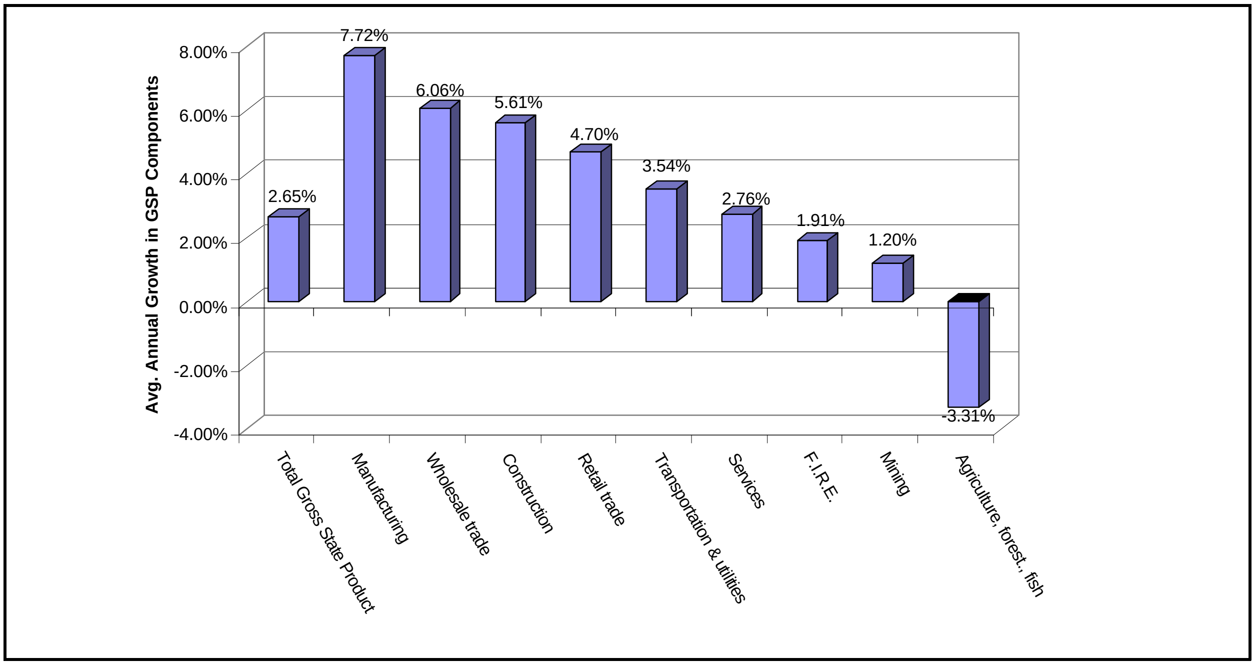

Figure 14: Annual Average Growth Rates in GSP Components for North Dakota - 1990-1999 - (Using Real 1996 Chained Dollar Estimates of GSP Components - Source: U.S. Bureau of Economic Analysis)

North Dakota Manufacturing Sector

Although North Dakota historically has been a state with natural resource extraction and crop production as its primary goods producing industries, manufacturing continually is taking a larger role in the state's economy. As the previous section showed, the growth rate in the North Dakota manufacturing industry has outstripped the growth rates of the other broadly-defined North Dakota industries over the past 20 years.

Moreover, while North Dakota lags behind other states in manufacturing output (ranking 46th out of 50 in manufacturing GSP in 1999), its growth rate in real manufacturing output has been rapid when compared to other states. Figure 15 shows that North Dakota's manufacturing output grew at the seventh highest rate in the nation since 1990, with an average annual growth in real manufacturing GSP of 7.7 percent.

This growth in manufacturing has increased the state's share of U.S. manufacturing output from .07 percent in 1980 to .1 percent in 1999 (Figure 16). Furthermore, North Dakota's manufacturing GSP per capita now ranks 44th in the nation, compared to 47th in 1990. While all of these numbers suggest that North Dakota relies less heavily on manufacturing than most other states, the growth trends suggest that manufacturing will become more important to North Dakota in the future.

This section of the report examines specific industries within manufacturing in North Dakota, providing a glimpse of the industries in which the state specializes, the growth of such industries over time, and North Dakota's economic activity in such industries compared to the rest of the United States.

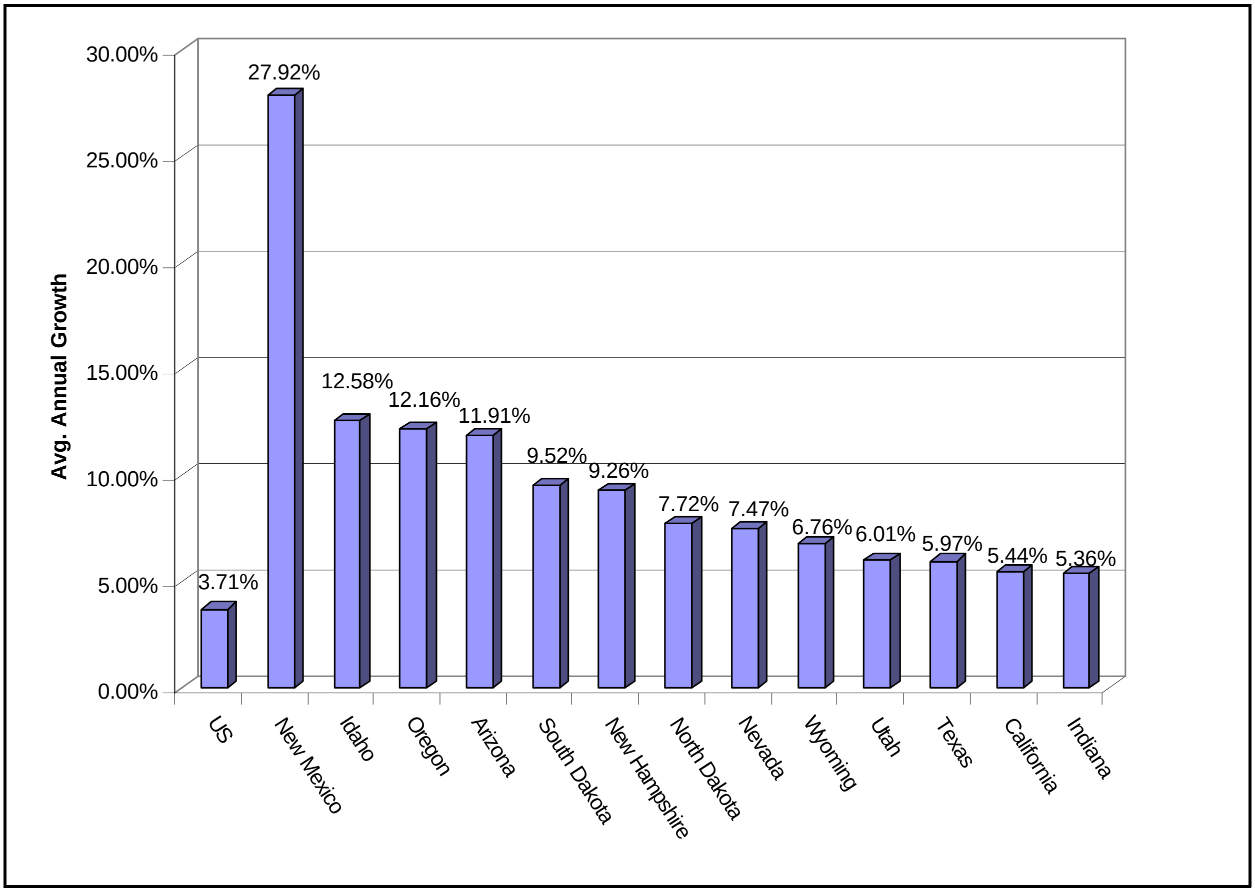

Figure 15: Average Annual Growth in Real Manufacturing GSP - 1990-1999 (Source: U.S. Bureau of Economic Analysis Data - Authors' Calculations)

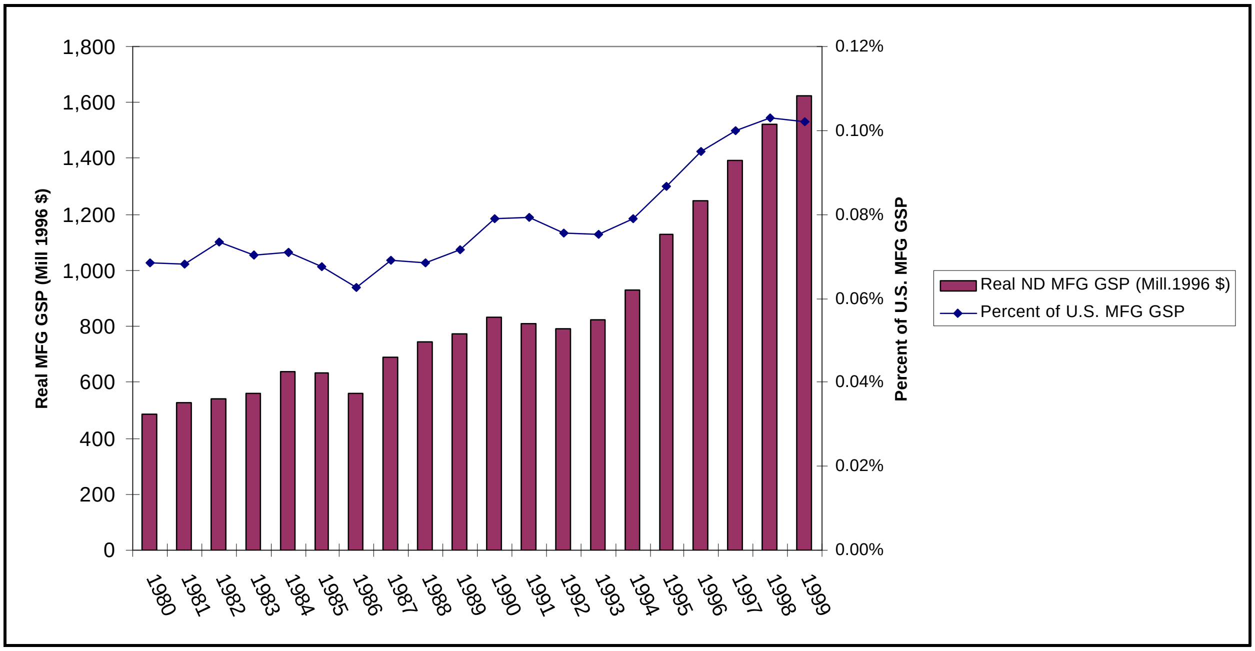

Figure 16: Real North Dakota Manufacturing GSP - 1980-1999 (Real Chained Dollar 1996 Values - Source: U.S. Bureau of Economic Analysis)

One way to broadly categorize manufacturing firm output is by longevity of the products produced. Durable goods are defined as goods that are expected to last for three or more years. Products considered to be durable goods include, but are not limited to: industrial machinery, computers, automobiles, and furniture. Nondurable goods are defined as goods that are expected to last for less than three years. Some nondurable manufactured goods include food products, apparel, chemicals, paper products, and petroleum.

Figure 17 shows the growth in durable manufacturing in North Dakota since 1980. As the figure shows, durable goods manufacturing has grown from $215 million in 1980 to more than $1 billion in output today, in 1996 prices. At the same time, North Dakota's production of durable manufactured goods has increased from .06 percent of the nation's production of such goods to .11 percent.

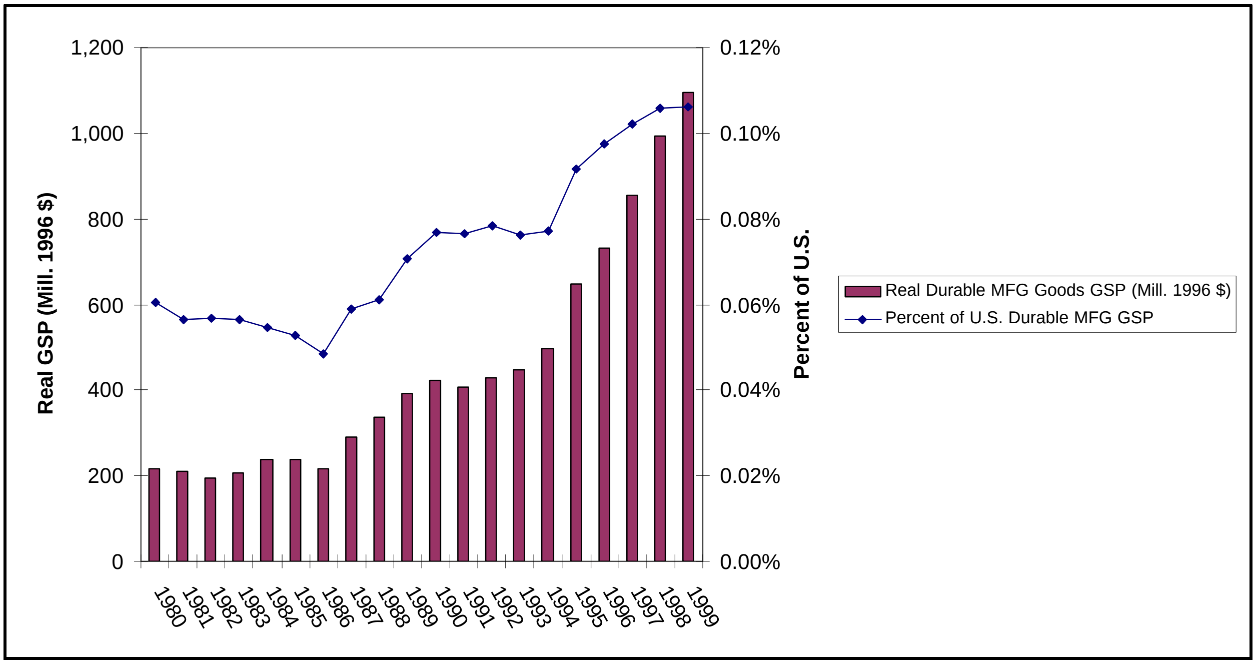

Figure 17: Real North Dakota Durable Goods Manufacturing GSP - 1980-1999 (Real Chained Dollar 1996 Values - Source: U.S. Bureau of Economic Analysis)

Figure 18 shows the growth in North Dakota nondurable goods manufacturing since 1980. As the figure shows, there also has been growth in these goods, although not as large as in durable goods. In 1980, real nondurable manufactured goods output in North Dakota was $283 million, while today it is more than $500 million, in 1996 prices. Nondurable goods output in North Dakota also has increased slightly relative to national output, accounting for .08 percent of national nondurable manufactured goods GSP in 1980 and .10 percent of national nondurable manufactured goods GSP in 1999.

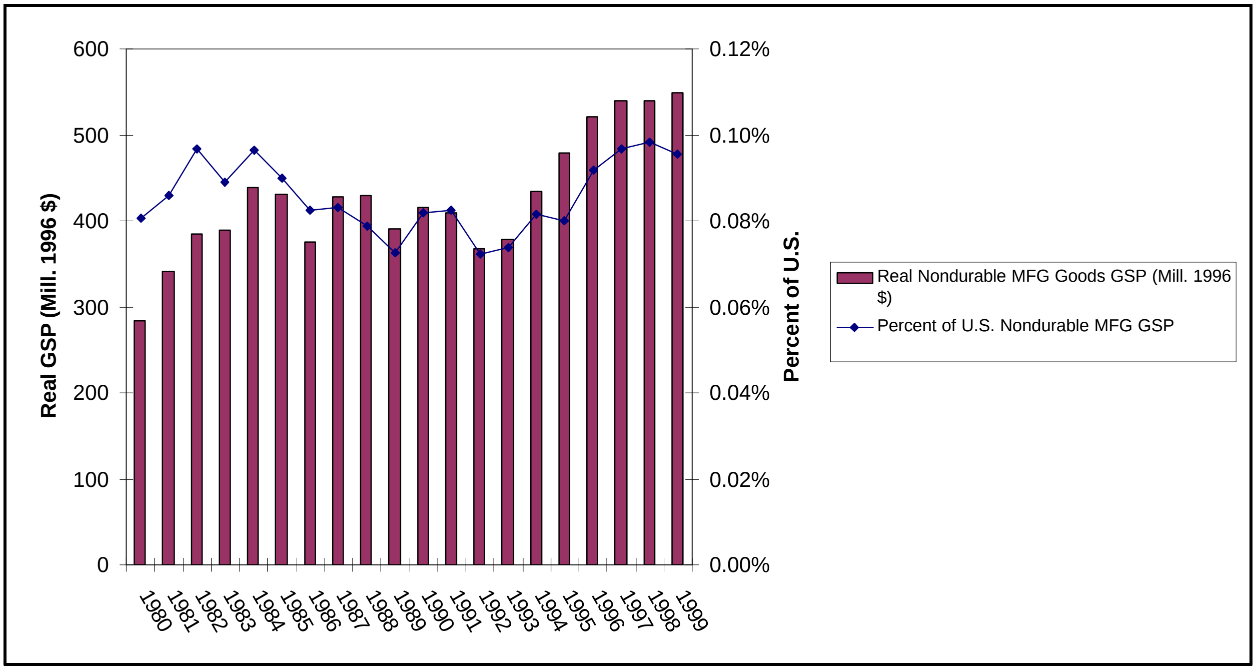

Figure 18: Real North Dakota Nondurable Goods Manufacturing GSP - 1980-1999 (Real Chained Dollar 1996 Values - Source: U.S. Bureau of Economic Analysis)

As shown in the previous section, the diversity of the state's economy can be measured by a Herfindahl Index of the shares of economic activity in different sectors. Similarly, an index of diversity of the state's manufacturing sector can be developed.

Just as varying levels of diversity of the state's overall economy might be viewed as either a positive or a negative, this also is the case for the diversity of the state's manufacturing sector. On the one hand, a diverse manufacturing sector suggests a smaller reliance on any one industry for the overall health of manufacturing in North Dakota. Thus, a downturn in any manufacturing industry is less likely to have a large impact on the state's entire manufacturing sector, the more diverse the manufacturing sector of the state. On the other hand, however, a larger concentration of manufacturing activity in any one sector may result in a more productive manufacturing sector due to a concentration of skilled labor, more technology transfer, and a large concentration of firms servicing such an industry. In essence, a state may gain a comparative advantage in producing a particular set of products.

Figure 19 shows the Herfindahl index of diversity in the manufacturing sector from 1980 to 1999.[6] As the figure shows, the index of diversity has remained between .14 and .18 over the 1980 to 1999 period. This compares to a national diversity index in manufacturing of .07 in 1999. This suggests that the North Dakota manufacturing industry is less diverse than that of the nation. In comparison to other states, North Dakota ranks 38th in manufacturing diversity. States with manufacturing industries that are less than North Dakota is include some that have experienced tremendous manufacturing growth in recent years, as well as some that have experienced low manufacturing growth in recent years.[7] Many of the states with large manufacturing growth rely heavily on electronic equipment manufacturing, including Arizona (44 percent of manufacturing GSP in electric equipment in 1999), Idaho (45 percent), New Mexico (76 percent), and Oregon (53 percent). Some of the states with slow growth in manufacturing rely heavily on chemicals, including Delaware (37 percent of manufacturing GSP in chemicals), Louisiana (39 percent), New Jersey (41 percent), and West Virginia (42 percent). These cases illustrate that a low level of manufacturing diversity can be good if the state is concentrated in growing industries, but can be risky because of potential industry declines.

[6]This Herfindahl index was calculated using the shares of GSP in all manufacturing industries in North Dakota.

[7]Growth rates in broadly-defined industries for all U.S. states from 1992 to 1999 are provided in Beemiller and Downey, 2001.

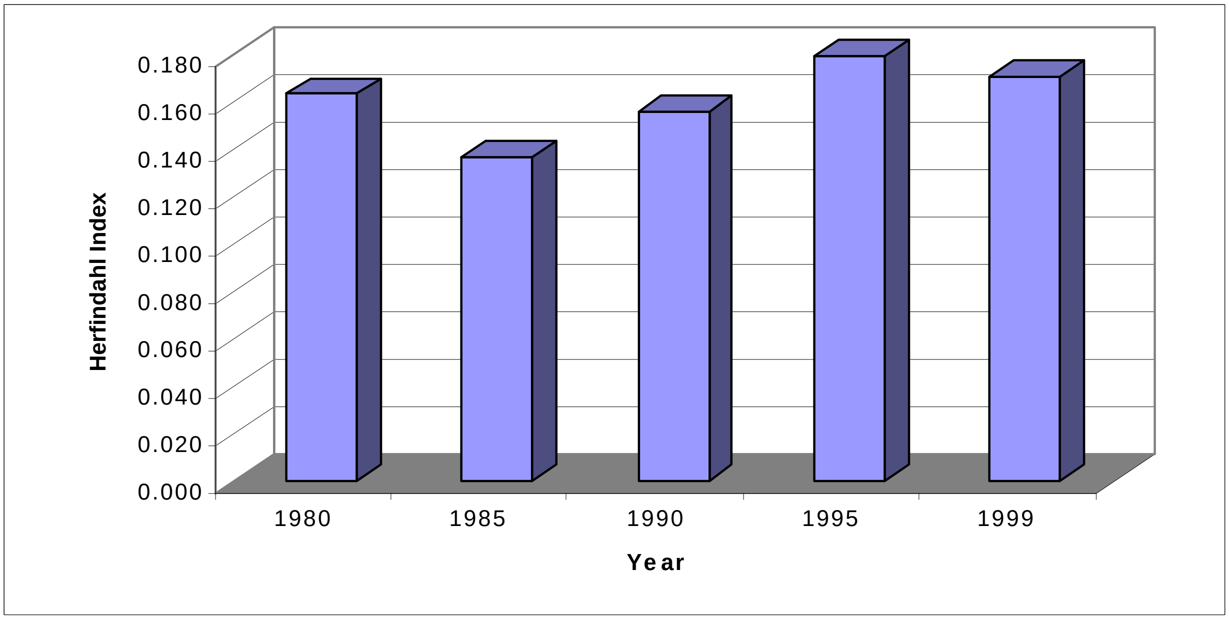

Figure 19. **Herfindahl Index of GSP by 11 manufacturing industries in North Dakota (Souce: U.S Census Bureau)**

Figure 20 shows the output produced by all manufacturing industries in North Dakota in 1999, as measured by Gross State Product. As the figure shows, North Dakota relies heavily on the industrial machinery/equipment and food industries for its manufacturing output. In 1999, these two industries produced more than $800 million of products combined. Other important industries for North Dakota manufacturing include transportation equipment, printing/publishing, lumber/wood products, electronic equipment, petroleum/coal products, and fabricated metal products.

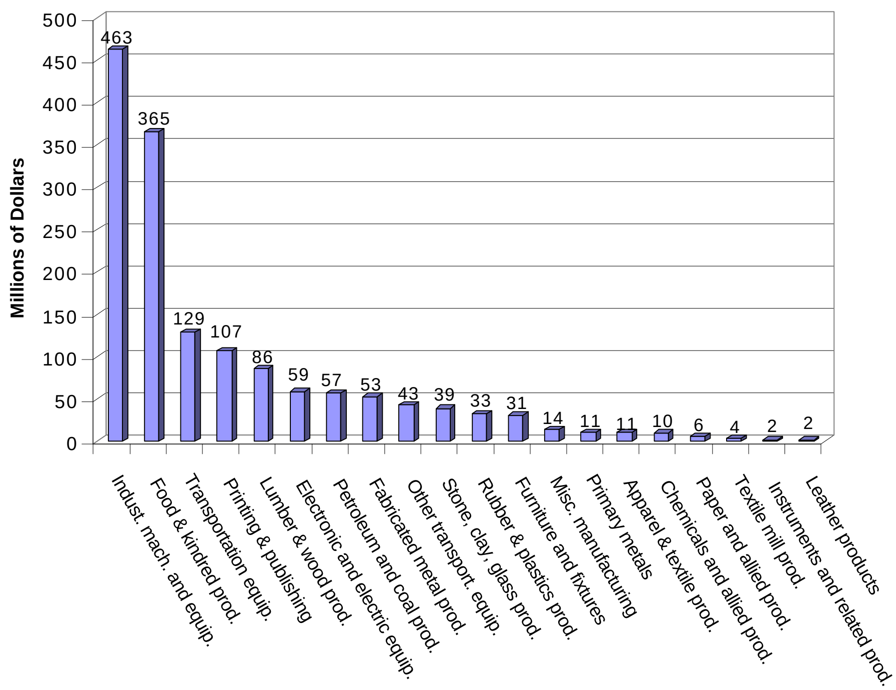

Figure 20: Manufacturing GSP by Industry in North Dakota - 1999 (Source: U.S. Bureau of Economic Analysis)

Figure 21 shows that since 1980, industrial machinery and food products traditionally have combined for roughly half of North Dakota manufacturing GSP.

Additional insight into the importance of various manufacturing industries to North Dakota can be obtained by using the previously defined location quotient. In this case, the location quotient measures the contribution of specific manufacturing industries to the North Dakota economy in comparison to their contribution to the U.S. economy.

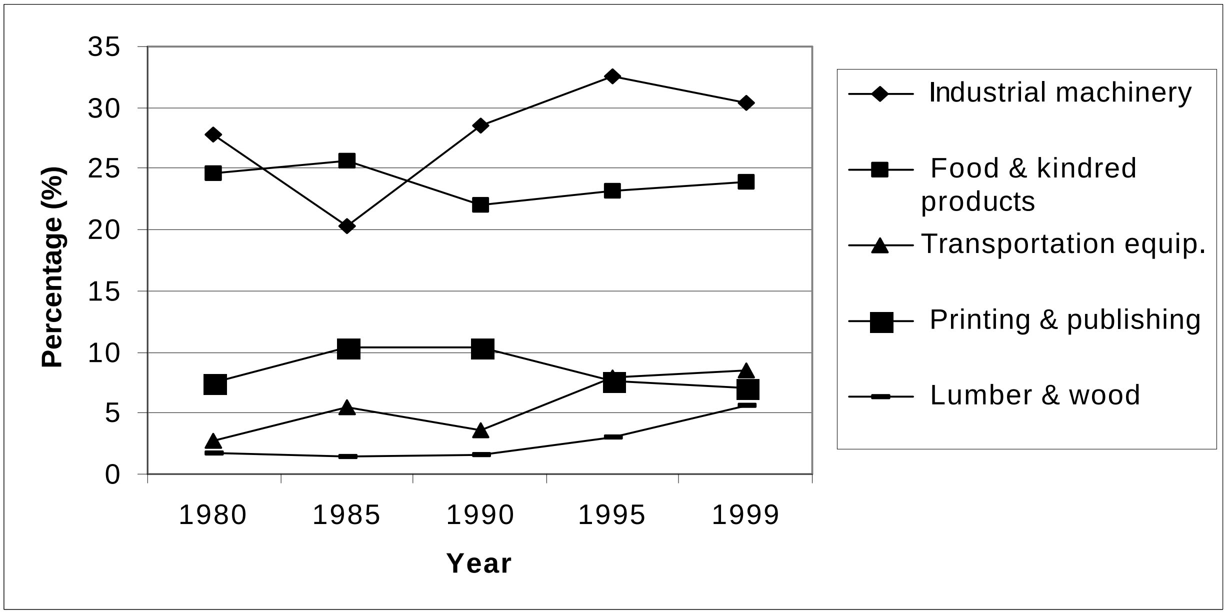

Figure 21: Share of ND MFG GSP for Various Industries - 1980-1999 (Source: U.S. Bureau of Economic Analysis)

Figure 22 shows the location quotients for North Dakota manufacturing industries using gross state product as the measure of economic activity. As the figure shows, the state has specializations in industrial machinery and equipment manufacturing, food and kindred products manufacturing, petroleum and coal products manufacturing, and lumber and wood products manufacturing when compared to the Nation's economic activity. These four industries appear to be strong "basic" industries for the state of North Dakota – that is, industries that are net exporters out of the state.

Other manufacturing industries in the state that contribute at least half to the state's income of the percentage such industries contribute to the national income include furniture and fixtures manufacturing, transportation equipment manufacturing, printing and publishing, and stone, clay, and glass products manufacturing. A number of other manufacturing industries, such

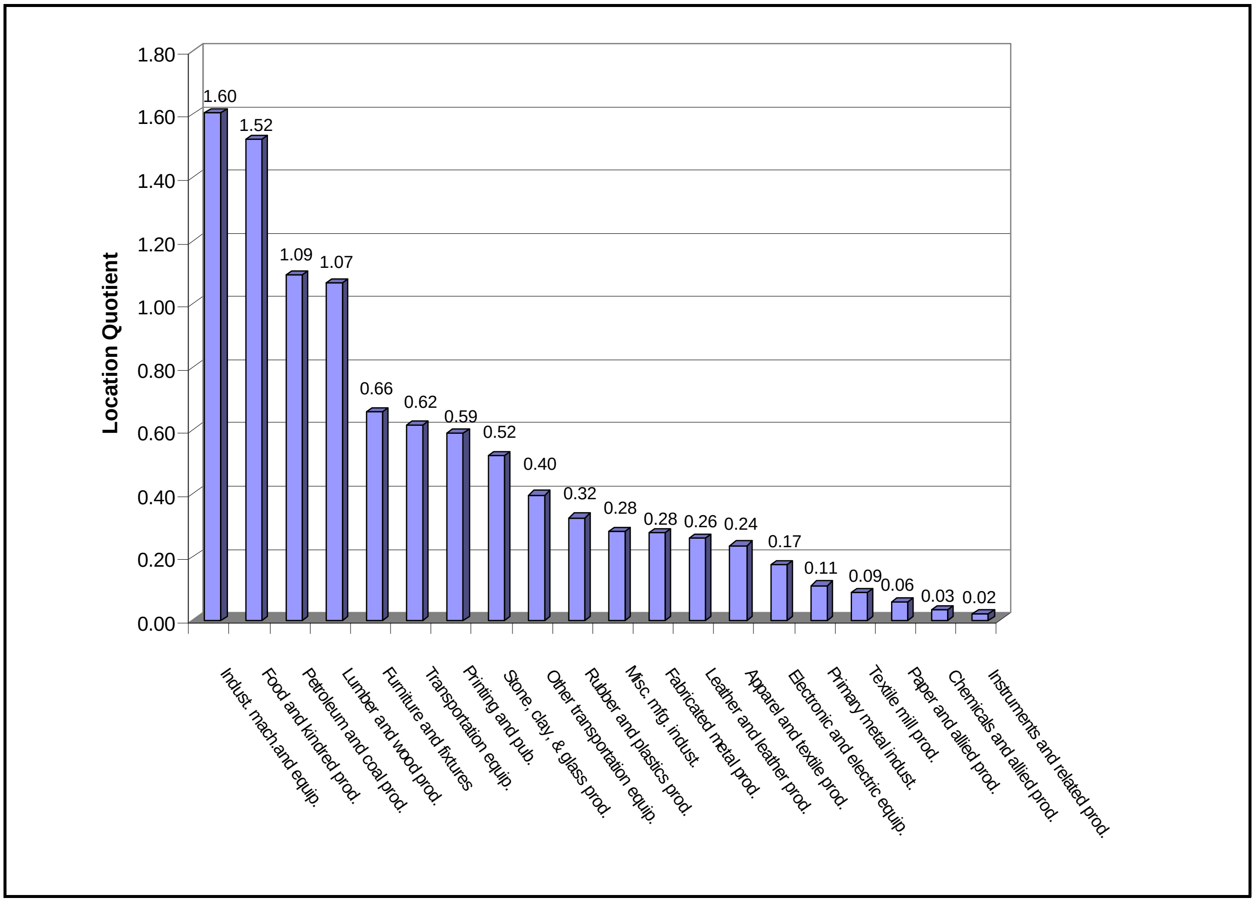

Figure 22: Location Quotient for North Dakota Manufacturing Industries - 1999

as rubber and plastics products manufacturing, fabricated metal products manufacturing, and leather products manufacturing, have location quotients of .4 or less.

Figures 23 through 27 show the changes in the location quotients for the top five manufacturing industries in North Dakota in terms of location quotients in 1999. As Figure 23 shows, the location quotient for industrial machine and equipment manufacturing has grown rapidly over the past 20 years, starting at a value of .52 in 1980 and growing to 1.60 in 1999. This large growth can be attributed to the growth in farm equipment manufacturing from existing firms, and the establishment of several new industrial machine and equipment manufacturers in the state since 1980. Some large firms in this industry that have started operations or expanded operations in North Dakota since 1980 include Bobcat Ingersoll-Rand - a manufacturer of construction equipment, Ag Air Manufacturing - a manufacturer of air seeders, Alloway Industries - a manufacturer of various types of farm equipment, and Compact Technologies - another manufacturer of construction equipment. In total, more than 70 firms in this industry have been established in the state or have opened new operations in the state since 1980.

Figure 23: Location Quotient for Industrial Machinery and Equipment Mfg. in North Dakota - 1980-1999

Figure 24 shows the changes in the food and kindred products manufacturing location quotient between 1980 and 1999. As the figure shows, there also has been a major growth in this industry as a specialization for the state of North Dakota. In 1980, the location quotient for the food and kindred products industry was .67. Today, the location quotient for this industry is in excess of 1.5. The growth in the location quotient for this industry largely reflects the large number of value-added agricultural processing facilities that have been established in the state since 1980. Some of the large firms established in this industry in North Dakota since 1980 include pasta producers, such as Dakota Growers Pasta Co. and Noodles by Leonardo; frozen potato producers, such as J.R. Simplot Co. and Cavendish Farms; frozen bakery products producers, such as Drayton Enterprises and Dakota Brands International; a corn syrup producer - Cargill Corn Milling; vegetable oil producers, such as Northern Sun and A.D.M. Co.; and many others. More than 60 firms in this industry have established business or started new operations in North Dakota since 1980.

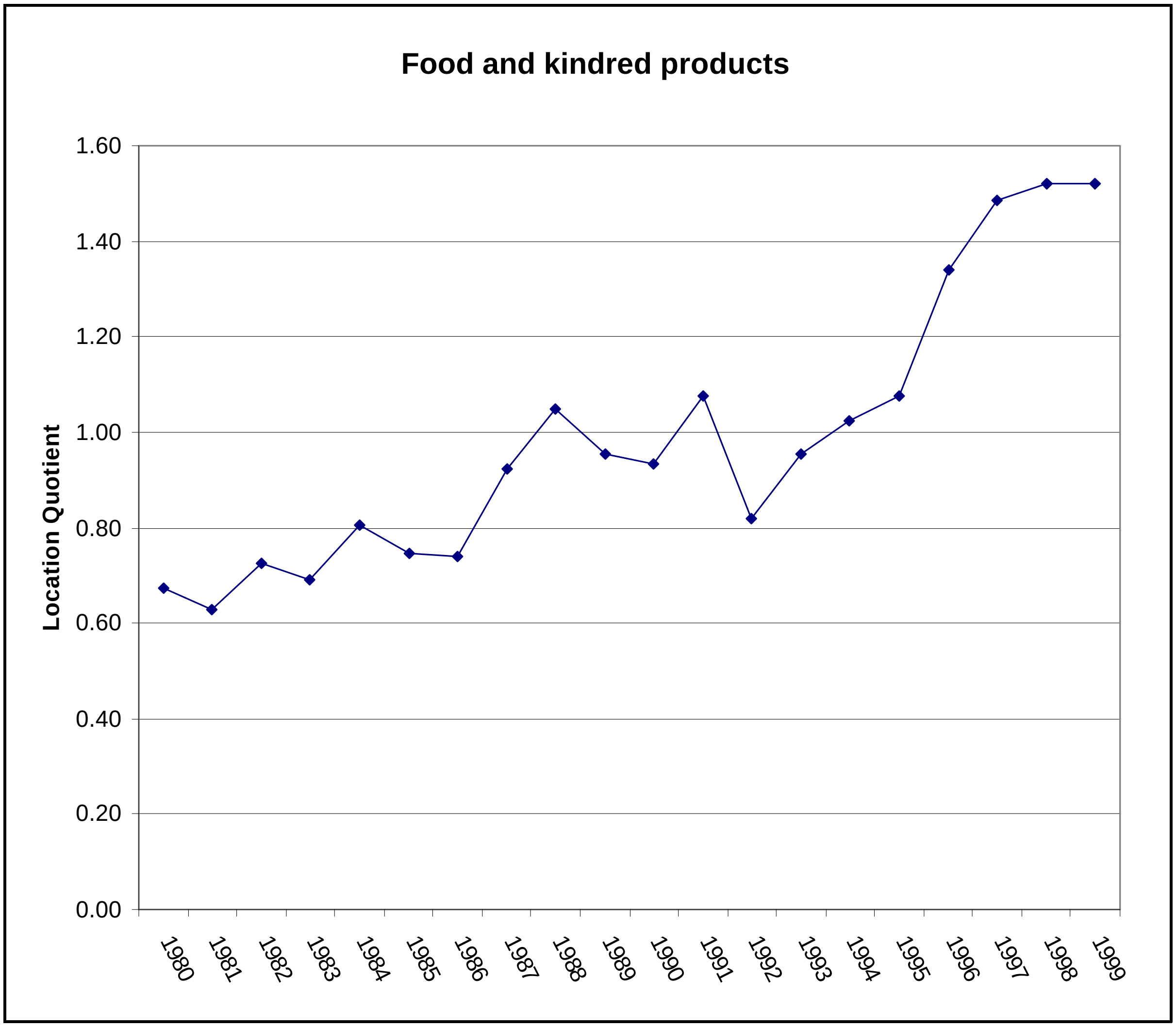

Figure 24: Location Quotient for Food and Kindred Products Mfg. in North Dakota - 1980-1999

Figure 25 shows that the location quotient for petroleum and coal products manufacturers has also been growing over time in North Dakota. This industry had a location quotient of .63 in 1980 and a location quotient of 1.09 in 1999.

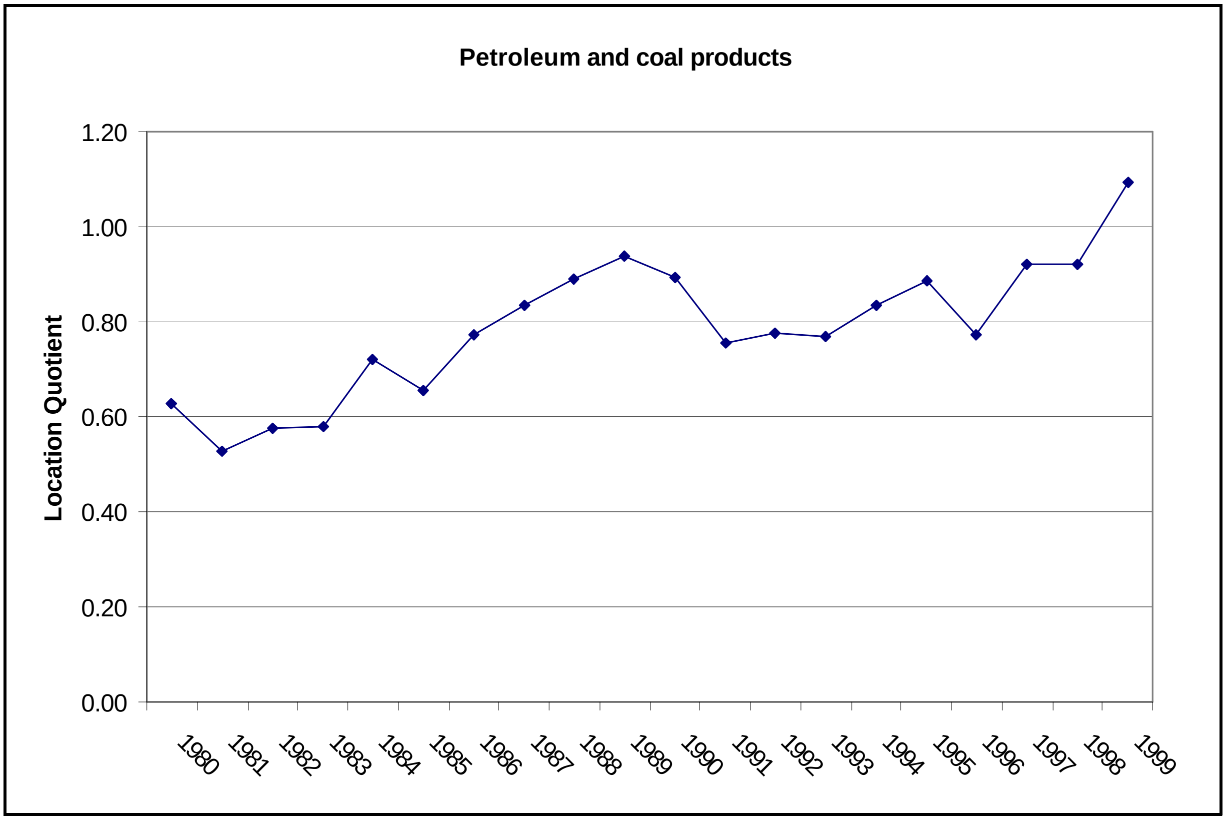

Figure 25: Location Quotient for Petroleum and Coal Products Mfg. in North Dakota - 1980-1999

The growth of the location quotient in lumber and wood products has been one of the largest of any industry in the past 20 years. In 1980, the location quotient for this industry was .13, suggesting that the industry was nearly ten times more important to the national economy than it was to the North Dakota economy. Today, the location quotient for this industry is in excess of 1, suggesting that its contribution to the North Dakota economy is similar in importance to its contribution to the national economy. Interestingly, much of the growth in the relative importance of this industry has occurred since 1994, when its location quotient was .24. Some large firms that have established operations in North Dakota since 1994 include Prime Board Inc. - a manufacturer of particle board, Commercial Group West - a manufacturer of commercial buildings, and Truss Systems - a manufacturer of wooden roof and floor trusses.

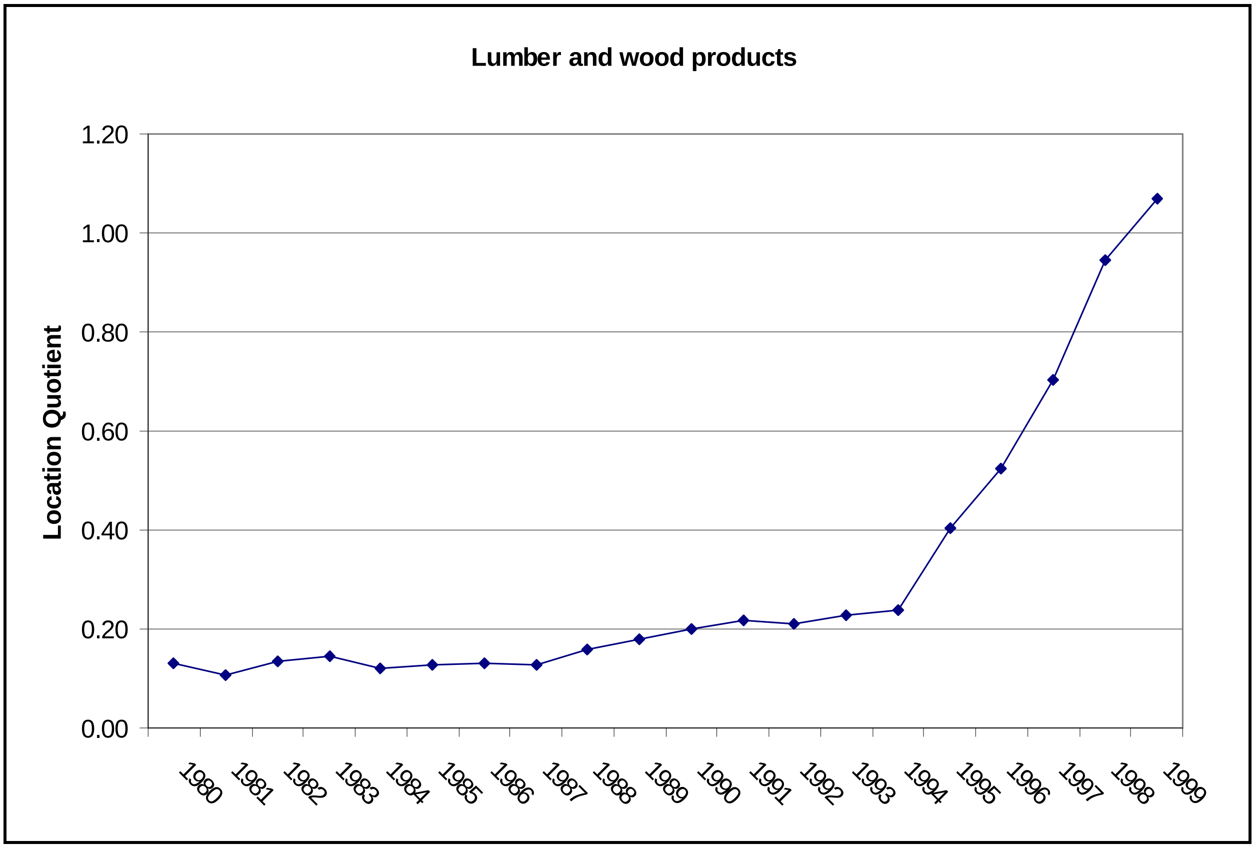

Figure 26: Location Quotient for Lumber and Wood Products Mfg. in North Dakota -1980-1999

Figure 27 shows that the location quotient for furniture and fixtures also has grown since 1980. In 1980, the location quotient for this industry in North Dakota was .17. By 1991, the location quotient had grown to .97, suggesting that this industry was as important to the North Dakota economy as the furniture and fixtures industry was to the national economy. However, by 1999 the location quotient for this industry had dropped to .66. Large firms in this industry that have established themselves in North Dakota since 1980 include American Woods, Inc., a manufacturer of wooden lawn furniture, and Solid Comfort, Inc., a manufacturer of hotel and nursing home furniture.

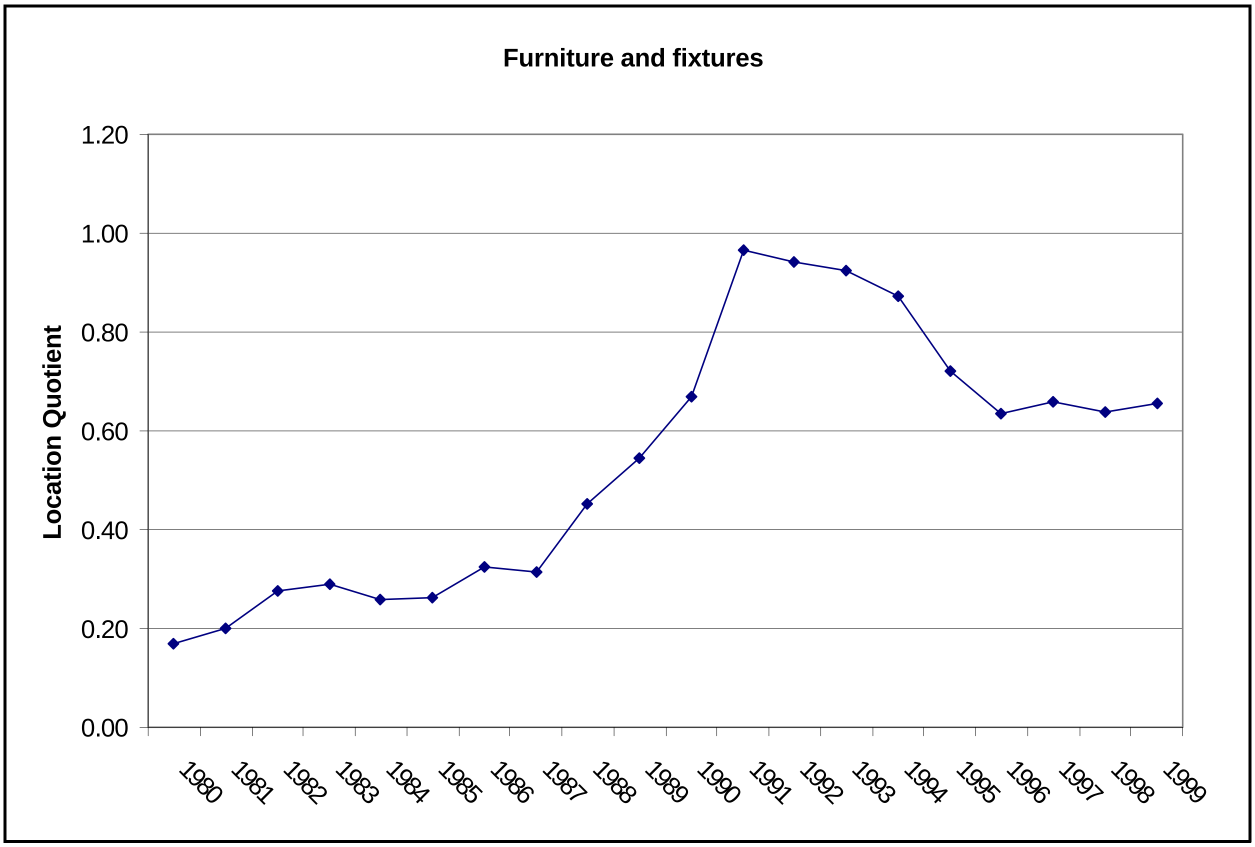

Figure 27: Location Quotient for Furniture and Fixtures Manufacturing in North Dakota - 1980-1999

Although this description of North Dakota manufacturing shows specializations in specific industries, such as food manufacturing and industrial machinery and equipment manufacturing, it does not provide detail about the specific products produced. Ideally, a description of North Dakota manufacturing should include value added or gross state product for specific manufactured products produced. Unfortunately, Gross State Product (GSP) data are not available for specific products.

However, a Manufacturer's News, Inc. database provides detailed data on the types of products produced by North Dakota manufacturing locations and the number of employees working at each location. The number of employees by primary product produced by the firm will provide insight into the amounts of specific products produced by manufacturing in the state. Figures 28 through 31 show the number of employees by primary product produced for four of the top five manufacturing industries in North Dakota, in terms of location quotient.[8]

Figure 28 shows the number of employees by primary product produced at manufacturing locations in the North Dakota industrial machinery industry.[9] As the figure shows, the state has large numbers of employees working at manufacturing locations producing farm machinery and construction machinery. This suggests that a large portion of the state's manufacturing output in this industry is producing these products. Some of the major manufacturers in the state that produce farm machinery and/or construction machinery include Bobcat Ingersoll-Rand, Case Corporation, Crary Company, and Ag Air Manufacturing.

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[8]Petroleum manufacturing is not included, since the companies in this industry produce a similar product.

[9]Product definitions are consistent with the North American Industry Classification System (NAICS) codes.

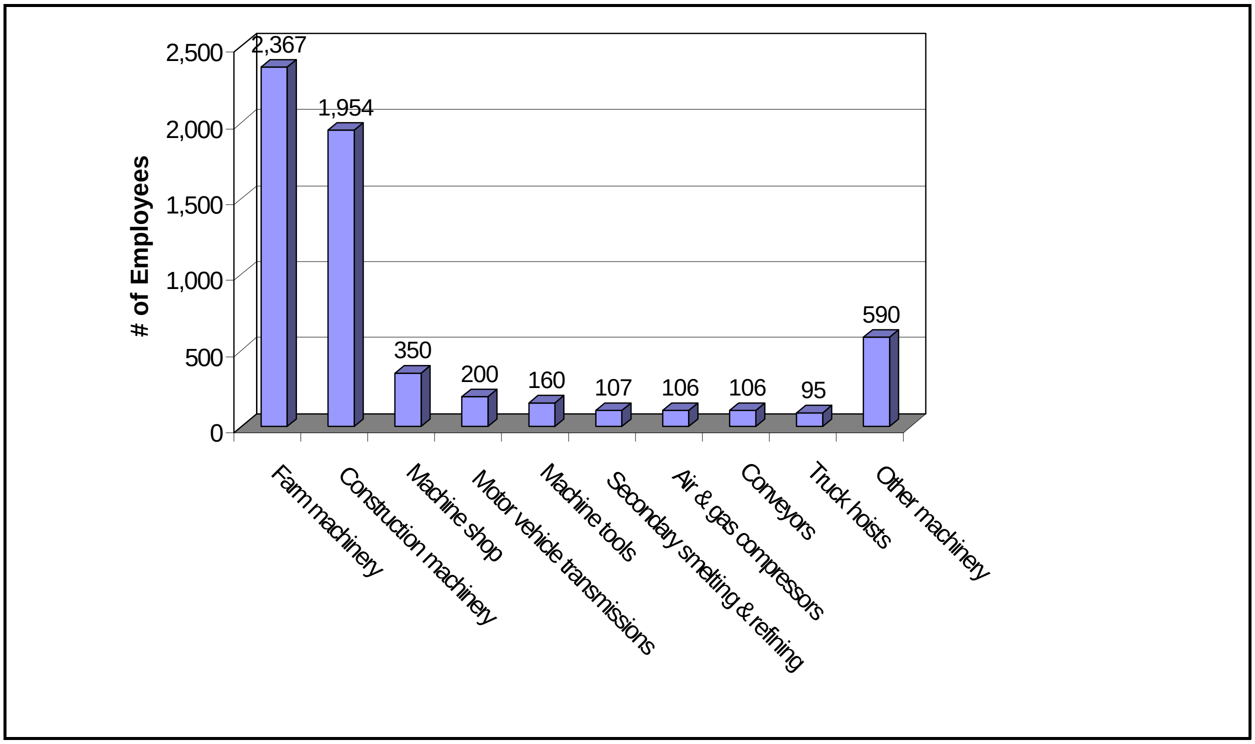


Figure 28: North Dakota Industrial Machinery Workers by Product - 2001 (Source Manufacturer's News, Inc.)

Unlike the industrial machinery manufacturing industry, the food products manufacturing industry in North Dakota is not dominated by a few products. Figure 29 shows that manufacturing locations producing frozen or dried potato products, sugar products, bakery products, meat products, and pasta products all have large numbers of employees. Just as the number of employees in the food manufacturing industry is widely dispersed among products, one would also expect the value of products produced in food manufacturing to be spread among the various products.

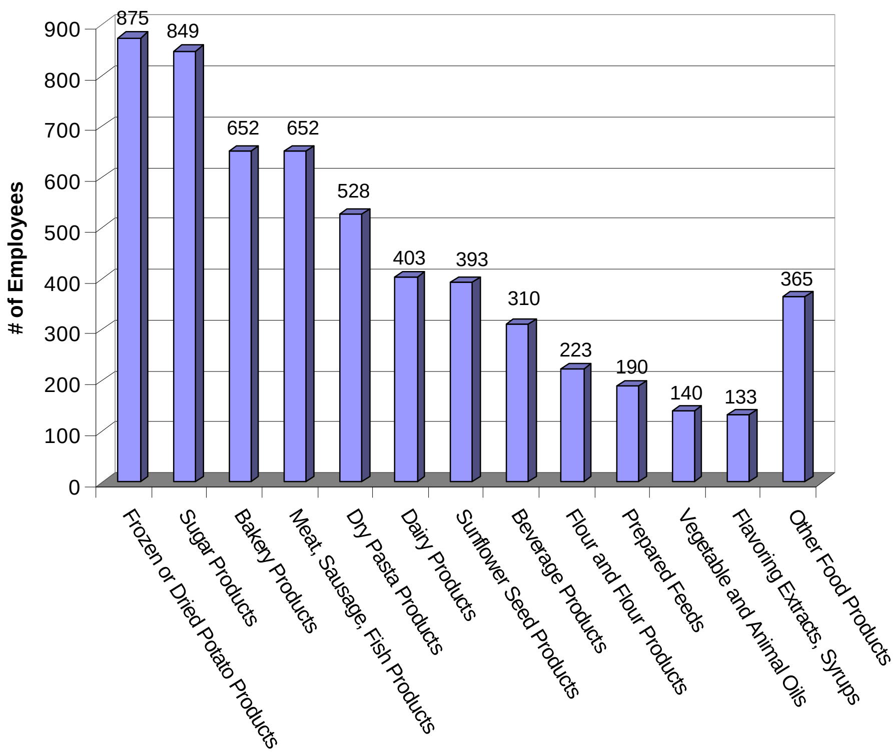


Figure 29: North Dakota Food Manufacturing Workers by Product - 2001 (Source: Manufacturer's News, Inc.)

North Dakota lumber and wood products manufacturing appears to be dominated by a couple of major products, as shown by the number of employees by product in 2001. As Figure 30 shows, more than one-half of the employees in the North Dakota lumber and wood products industry work at locations that specialize in hardwood veneer and plywood or truss manufacturing. Major manufacturing firms specializing in these products include Primewood, Inc. in Wahpeton and Fargo Truss Systems, Inc. in West Fargo.

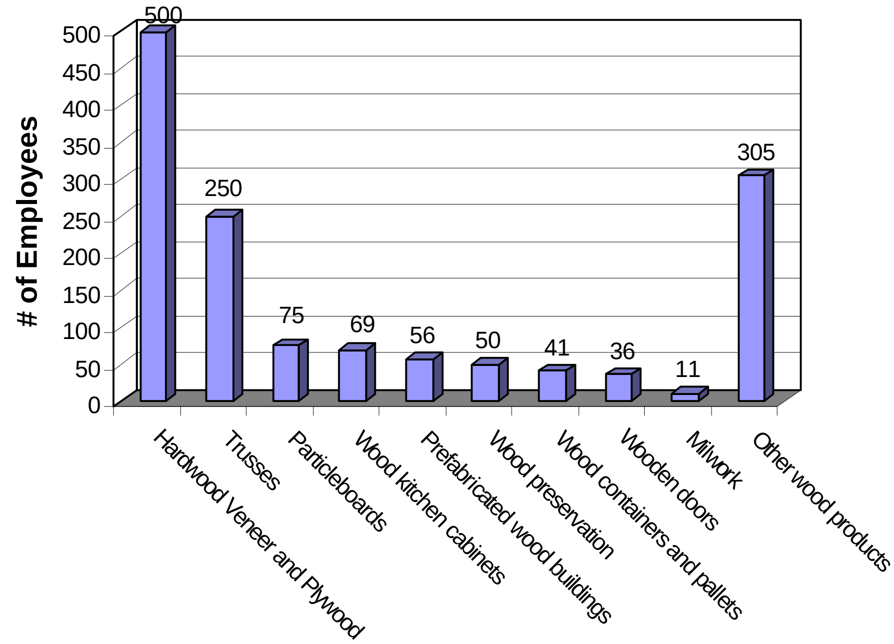


Figure 30: North Dakota Lumber and Wood Products Workers by Product - 2001 (Source: Manufacturer's News, Inc.)

Most North Dakota manufacturing workers in the furniture and fixtures industry work at a location that specializes in one of three products. Figure 31 shows that more than 80 percent of the employees in this industry in North Dakota are at locations that specialize in showcases, nonupholstered household furniture, or institutional furniture. Some major firms producing these products include TMI Systems Design Corp., Solid Comfort, Inc., and American Woods, Inc., in Dickinson, Fargo, and Grand Forks, respectively.

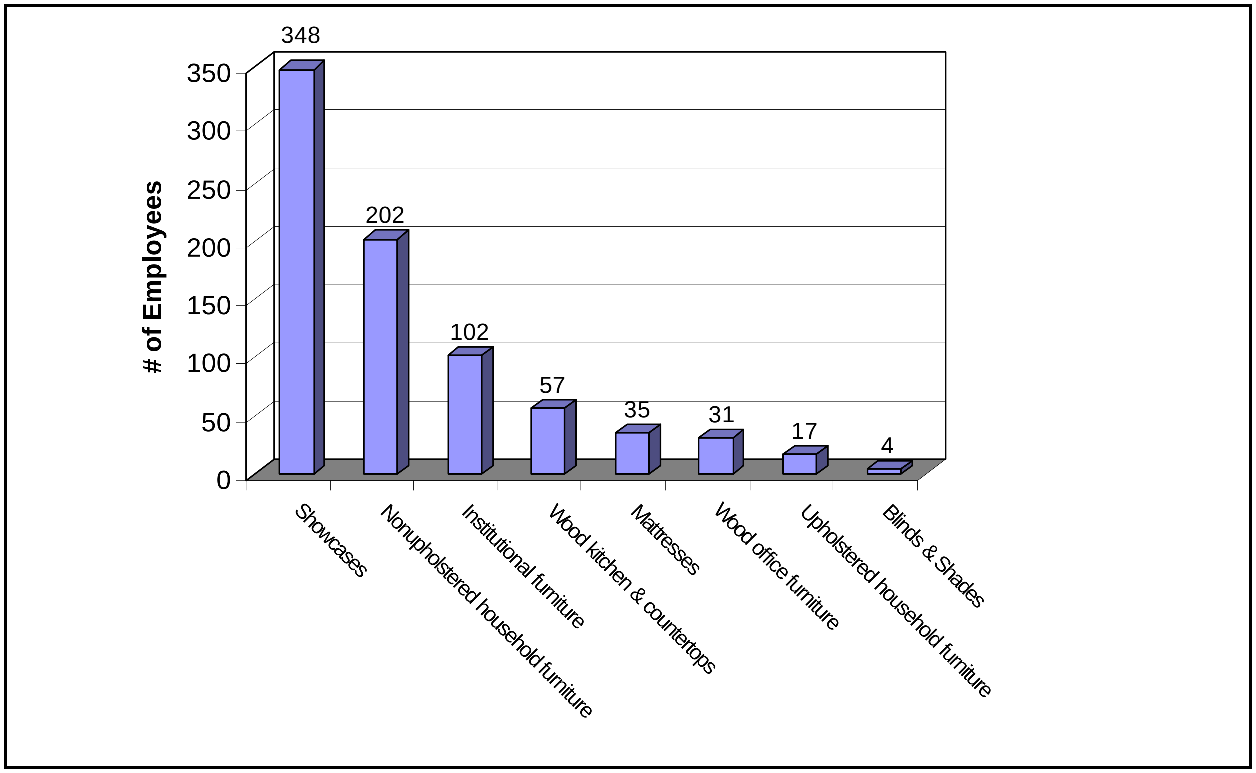


Figure 31: North Dakota Furniture and Fixtures Workers by Product - 2001 (Source: Manufacturer's News, Inc.)

The following section of this report will provide detailed information on the number, and size of manufacturing firms in North Dakota.

Manufacturing Industry Characteristics

The previous section of this report highlighted the growing importance of the North Dakota manufacturing industry, showed major areas of specialization for North Dakota manufacturing, and highlighted employment numbers for specific products within various manufacturing industries to provide insight into the types of products produced by North Dakota manufacturing firms. This section of the report will examine the number of manufacturing firms in North Dakota by industry, and the average size of such firms.

First, an examination of the number of manufacturing firms in the state shows large growth over the past 20 years. Figure 32 shows the number of manufacturing firms in North Dakota from 1980 to 1999. As the figure shows, the number of manufacturing firms in the state has grown from 574 in 1980 to 806 in 1999. This represents approximately a 40 percent increase.

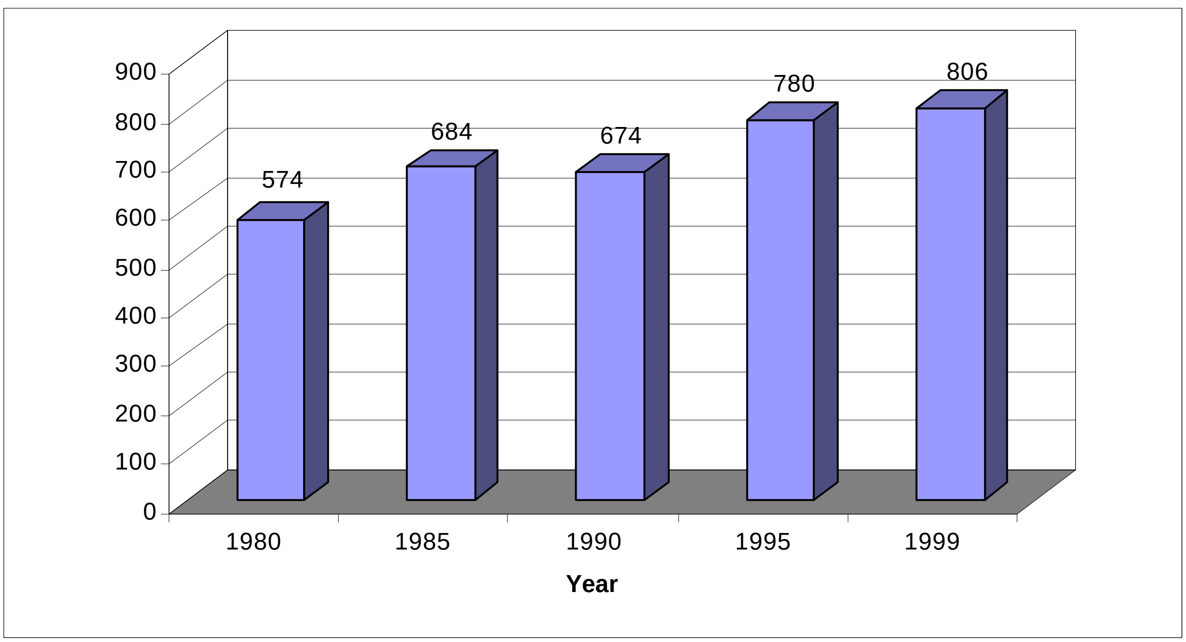


Figure 32: Number of Manufacturing Firms in North Dakota - 1980-1999 (Source: U.S. Bureau of Labor Statistics)

Similarly, manufacturing employment has grown in North Dakota over the past 20 years. Figure 33 shows manufacturing employment in North Dakota between 1980 and 1999.[10] As the figure shows, manufacturing employment has grown from just more than 16,000 in 1980 to more than 24,000 in 1999 - a 50 percent increase.

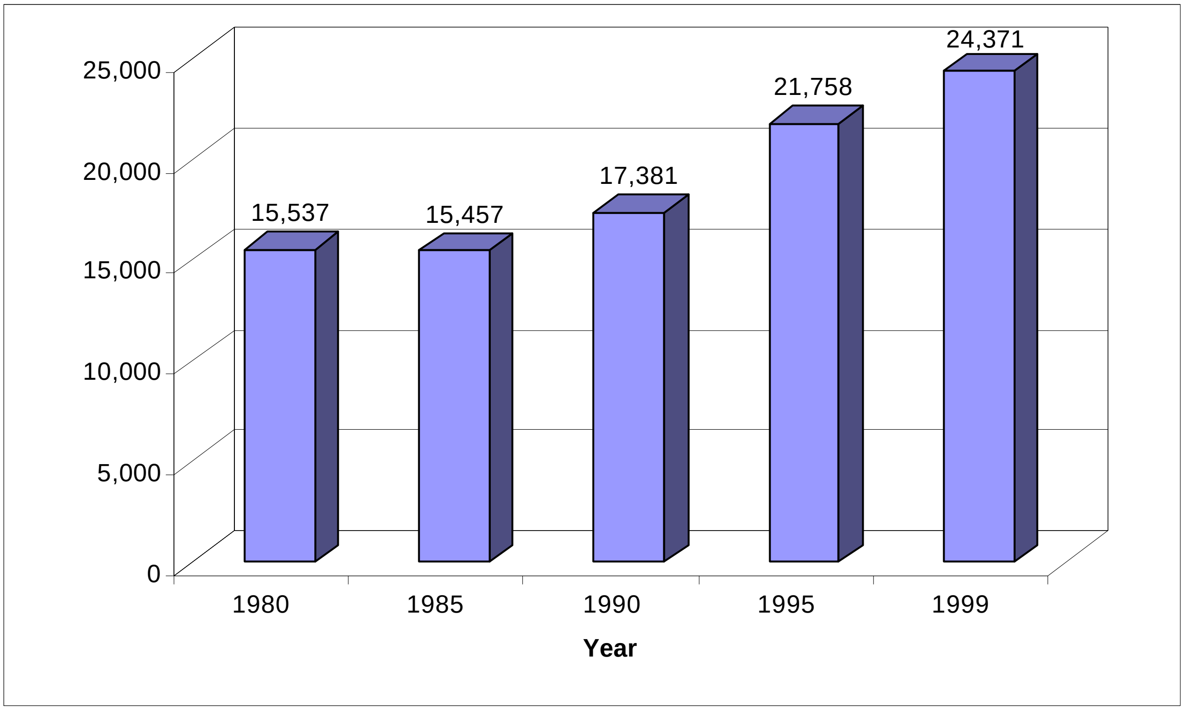


Figure 33: North Dakota Manufacturing Employment - 1980-1999 (Source: U.S. Bureau of Labor Statistics

[10]These employment statistics include only those covered by unemployment insurance. Thus, they may understate actual North Dakota manufacturing employment to some extent.

Figures 34 and 35 show the number of manufacturing locations and the number of manufacturing employees by specific industry. As Figure 34 shows, there are many firms in several industries, including printing and publishing, industrial machinery manufacturing, food products manufacturing, stone/clay/glass products manufacturing, lumber and wood products manufacturing, and fabricated metal products manufacturing.[11]

Figure 35 shows the number of employees by manufacturing industry in North Dakota in 1999. As the figure shows, more than 40 percent of the state's manufacturing employment is in two industries - industrial machinery and food products. Other manufacturing industries with large amounts of employment include printing and publishing, fabricated metals products, electronic equipment, transportation equipment, lumber and wood products, and stone/clay/glass products.

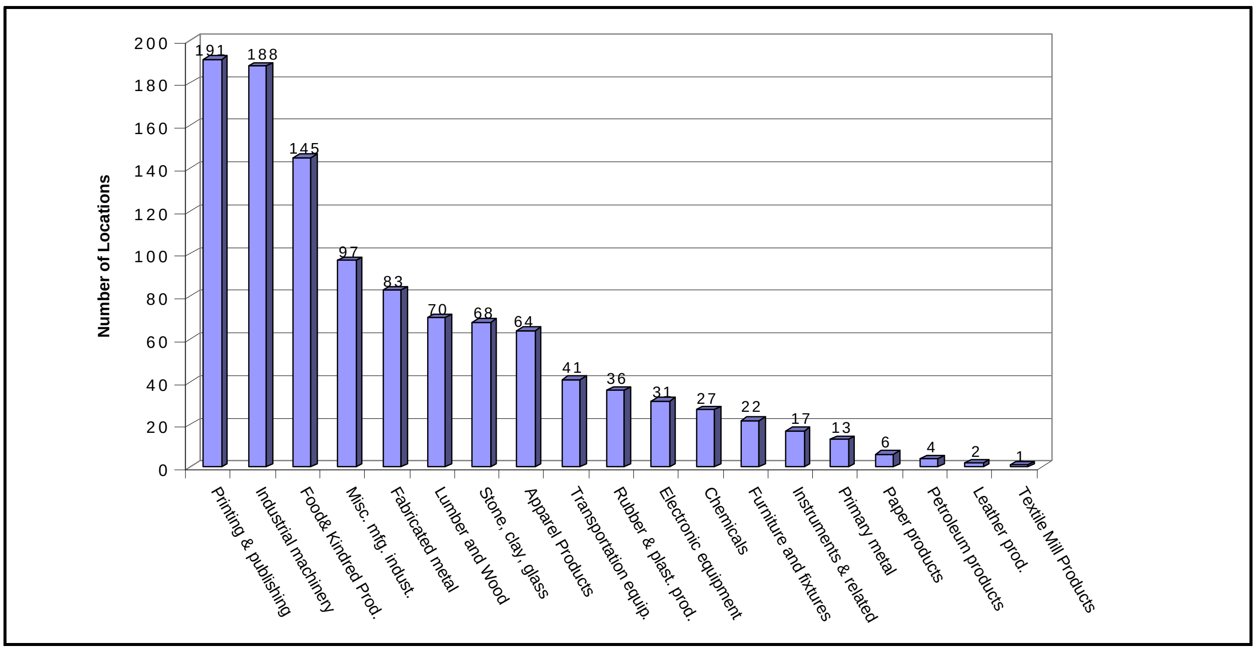


Figure 34: Number of Manufacturing Locations in North Dakota, By Industry - 2001 (Source: Manufacturer's News, Inc.)

[11]The number of locations is somewhat higher than the number of firms since the same firm may have more than one plant.

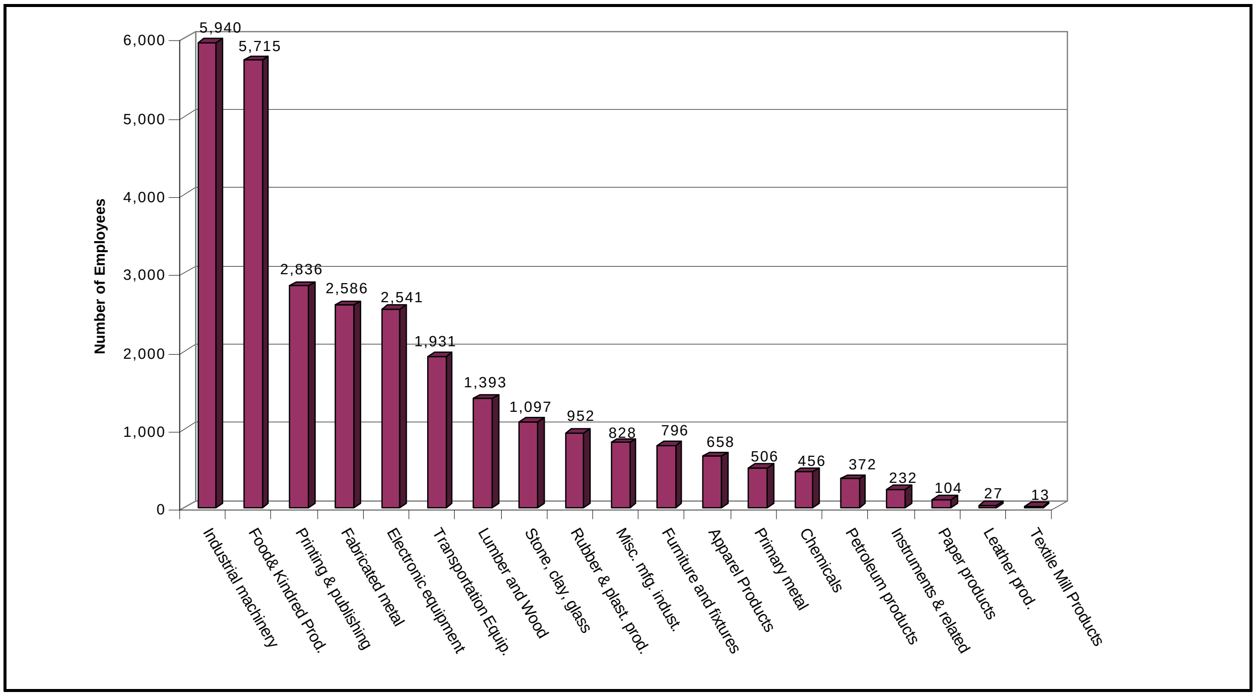


Figure 35: North Dakota Manufacturing Employment - 2001 (Source: Manufacturer's News, Inc.

Because sales data are not available by firm, it is difficult to get a measure of the size of manufacturing firms in North Dakota. However, the number of employees per firm can serve as a proxy for firm size.[12] Figure 36 shows that the average firm size in North Dakota has ranged between 23 and 30 employees per firm during the 1980 to 1999 period.

[12]Since the amount of productive output per employee is different in different industries, employees per firm are not a perfect measure of firm size. Output per firm would be the preferred measure.

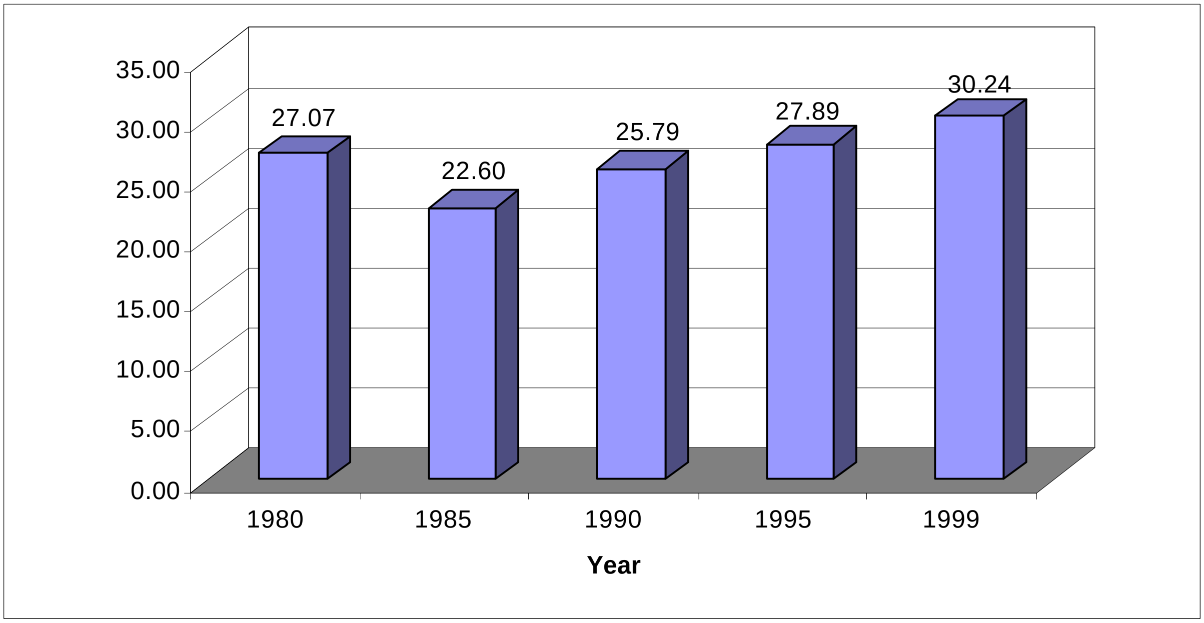


Figure 36: Average Number of Employees per Firm for North Dakota Manufacturing - 1980-1999 (Source: U.S. Bureau of Labor Statistics)

While the average number of employees per North Dakota manufacturing firm is about 30, there is a great deal of variation in the size of firms. Figure 37 shows that the largest 10 manufacturing locations accounted for more than 21 percent of the state's manufacturing employment. Similarly, the largest 25, 50, 100, and 200 manufacturing locations employed 35, 47, 62, and 78 percent of the state's manufacturing workers, respectively. Since there are more than 1,100 manufacturing locations in the state, these numbers suggest that there are some large manufacturing locations in the state, and a lot of small manufacturing firms in the state.[13] The figure highlights this by showing the average number of employees per firm for the largest firms. The largest 10, 25, 50, 100, and 200 manufacturing locations have average employment of 619, 401, 274, 181, and 112, respectively.

[13]There are more manufacturing locations than firms in the state, because some manufacturing firms have multiple facilities.

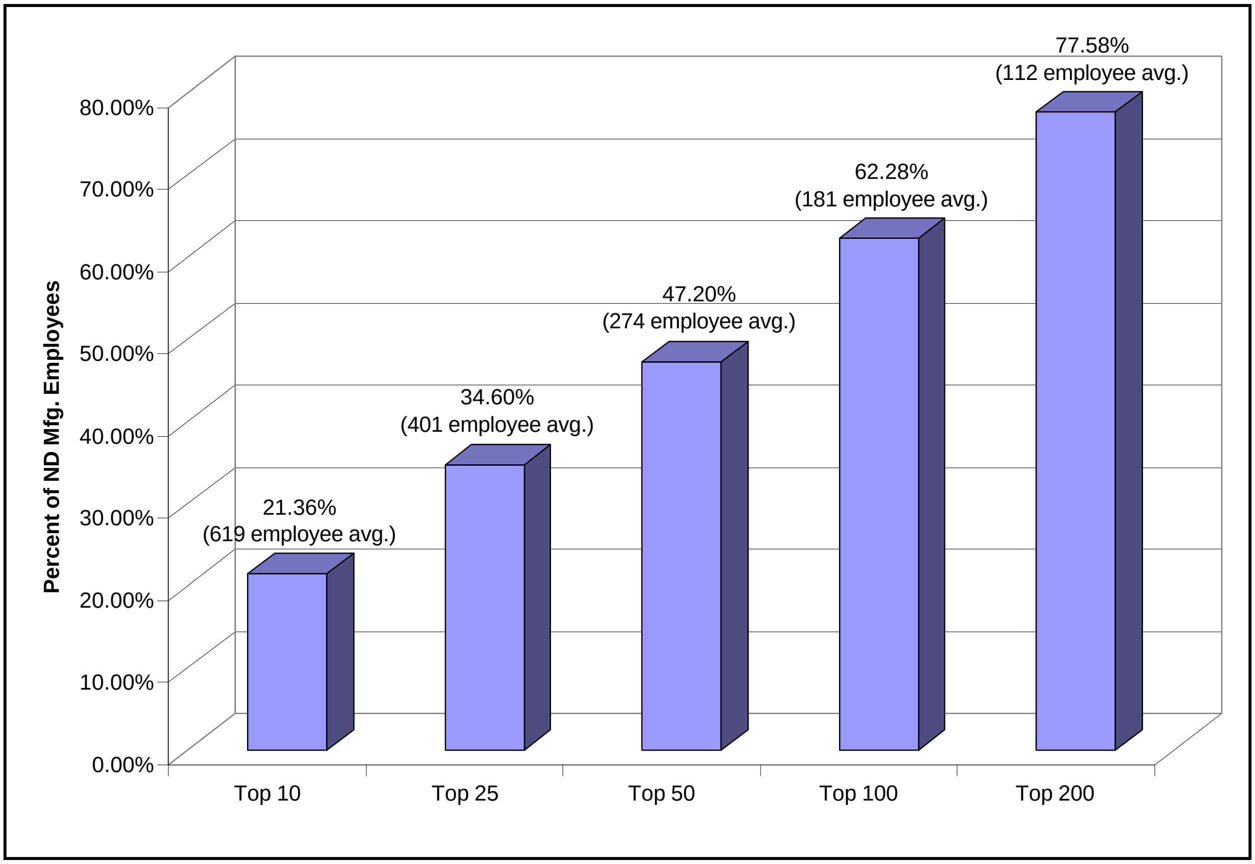


Figure 37: Percent of Manufacturing Employees Accounted for by the Largest Locations - 1999 (Source: Manufacturer's News, Inc.)

The large amount of manufacturing activity dominated by the largest firms also is shown by Figure 38, which shows the estimated proportion of manufacturing gross state product accounted for by the largest firms in the state.[14] Figure 38 shows that 29 percent of manufacturing GSP in North Dakota is estimated to occur in the largest 10 firms. Other estimates show 43 percent, 55 percent, 69 percent and 82 percent of the state's manufacturing GSP occurring in the largest 25, 50, 100, and 200 manufacturing firms, respectively.

Average location size also varies quite a lot among North Dakota manufacturing industries, as shown by Figure 39. Figure 39 shows the average number of employees per

[14]Gross state product per firm is estimated using a two-step process. First, average GSP per employee is calculated by dividing GSP in an industry by the number of employees in that industry. Next, the average GSP per employee for the firm's primary industry is multiplied by the firm's employees for an estimate of GSP for the firm.

manufacturing location, by industry in 2001. As the figure shows, some industries, such as petroleum and electronic equipment, have large average numbers of employees per firm, while others, such as apparel, printing, and instruments, have few.

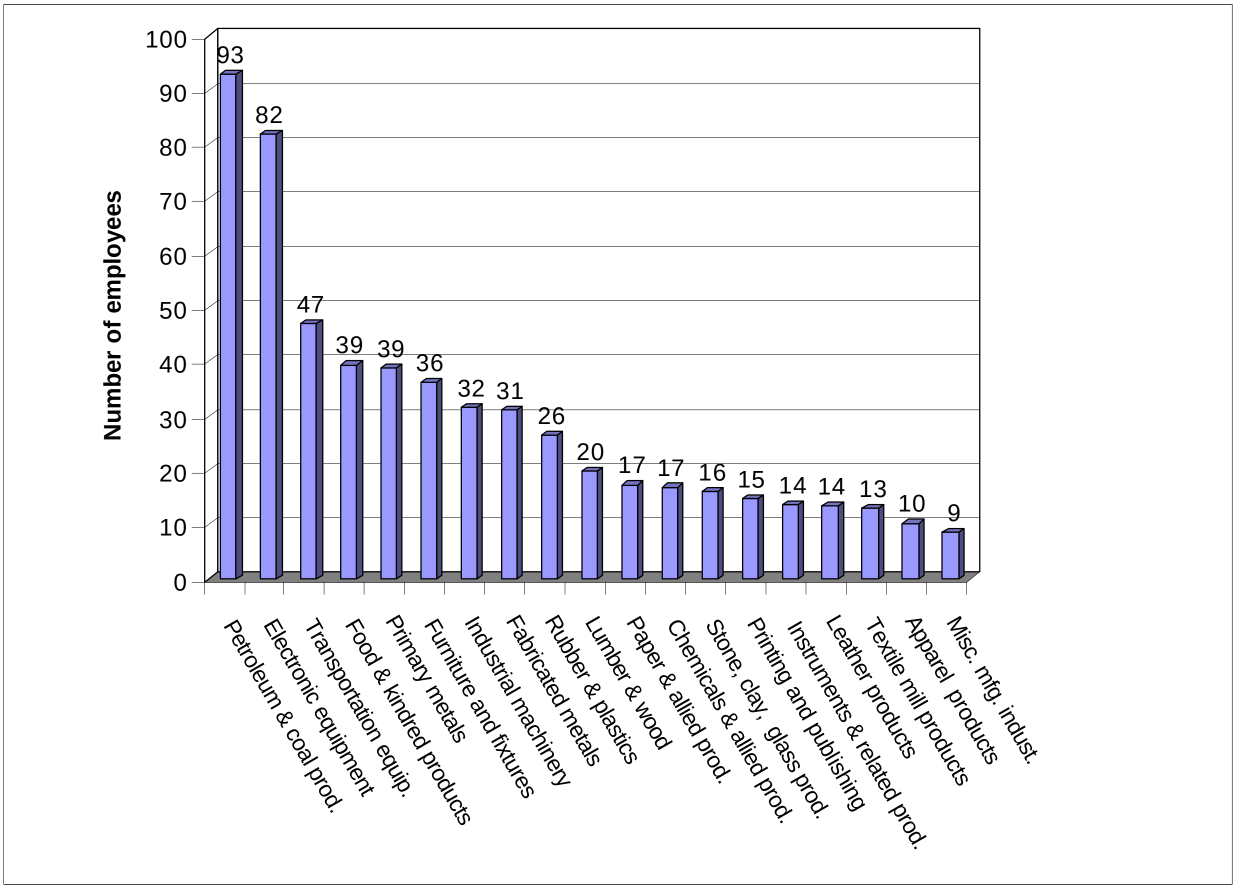


Figure 38.Average Number of Employees per Manufacturing Location - 2001 (Source: Manufacturer's News, Inc.)

The following section of this report examines the number of firms, employees, and average firm sizes by regions in North Dakota. This will provide insight into the extent of manufacturing activities in different parts of the state.

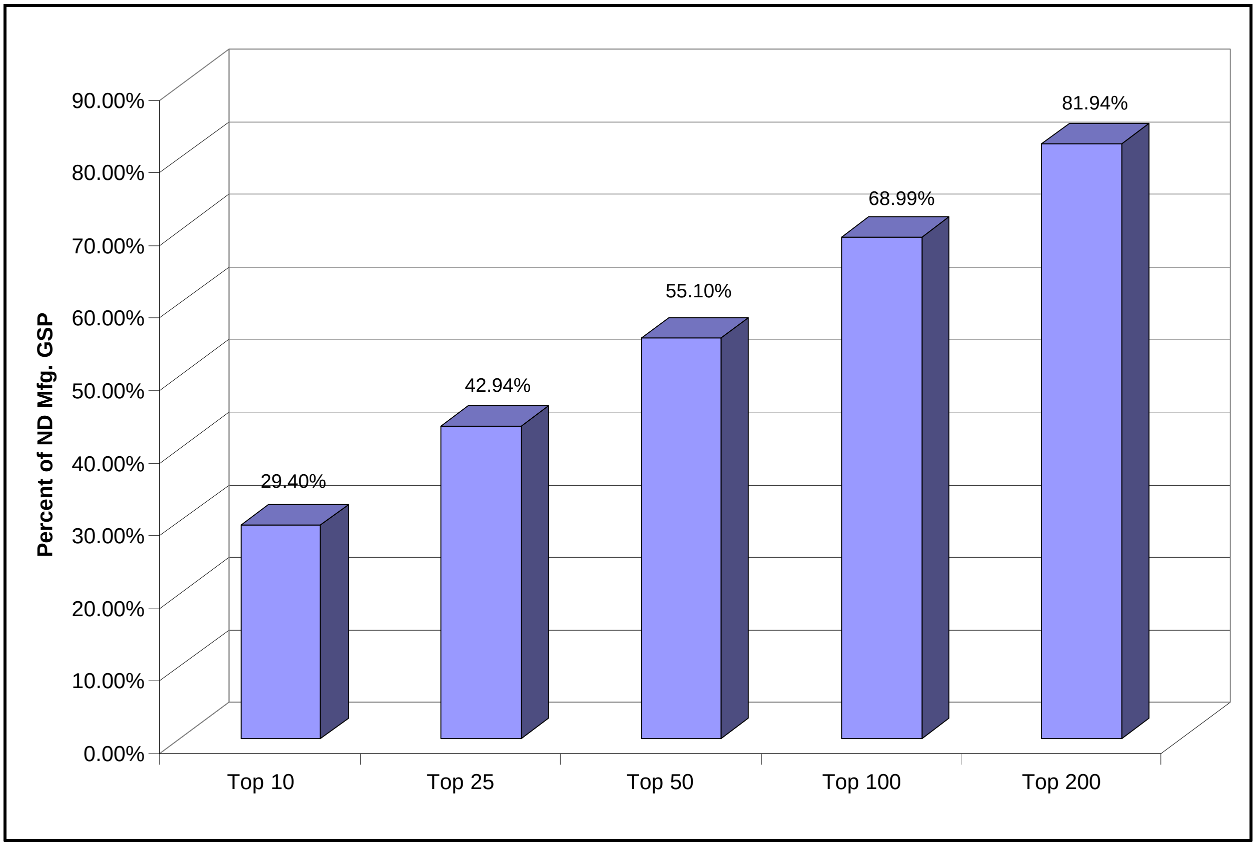


Figure 39: **Percent of Estimated Manufacturing GSP Accounted for by the Largest Locations - 2001 (Source: Authors' Calculations - Data from Manufacturer's News, Inc. and the U.S. Bureau of Economic Analysis)**

Regional Distribution of Manufacturing

Insight into distribution of manufacturing activity can be obtained by examining the number of firms, the number of manufacturing employees, and firm characteristics by region. Figure 40 shows eight regions used to examine manufacturing activity in North Dakota.

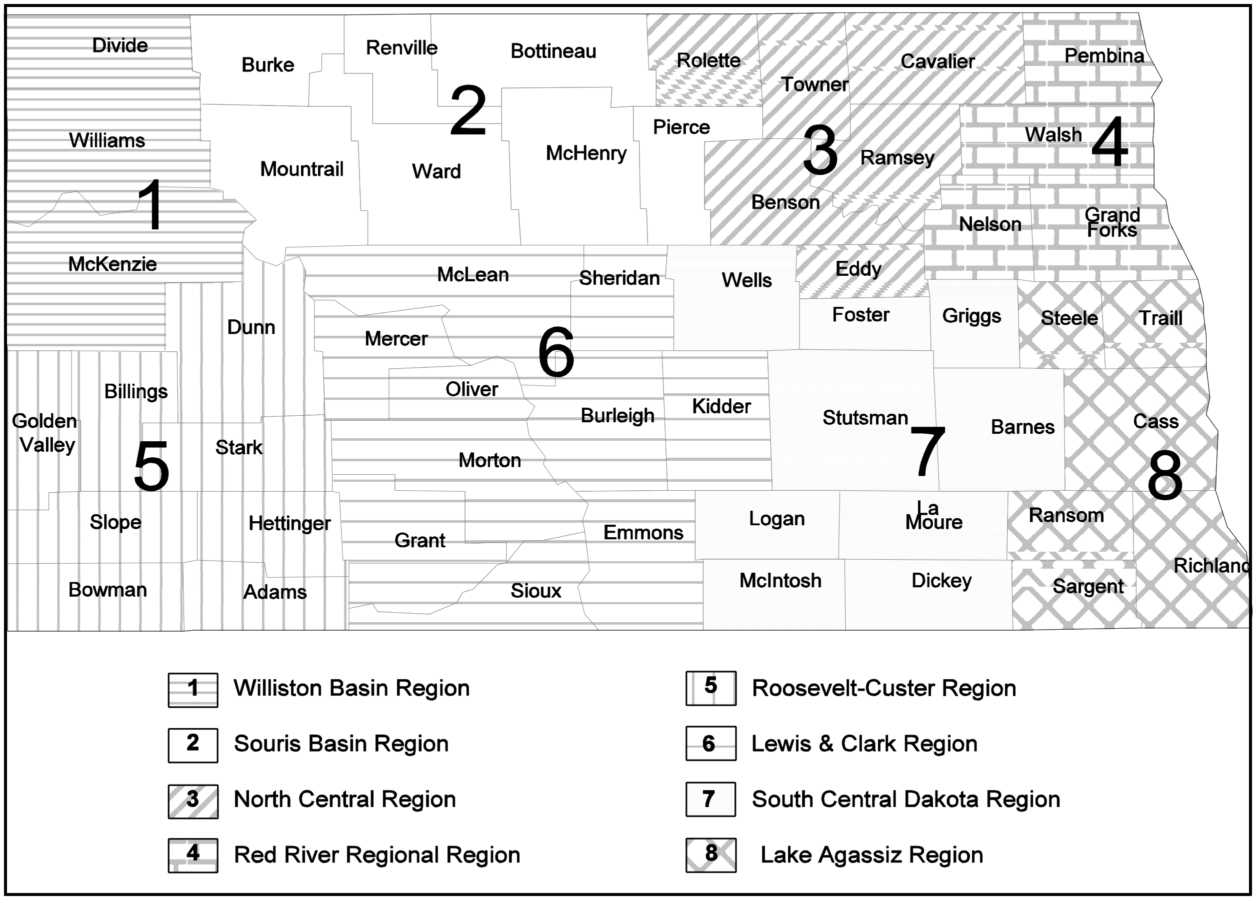


Figure 40: North Dakota Regional Definitions (Source: National Association of Regional Councils

Figure 41 shows the number of manufacturing locations by region. As the figure shows, there are many locations in the Red River Region and in the middle portion of the state. Many of these are in the major cities of Fargo, Grand Forks, Bismarck, and Minot.

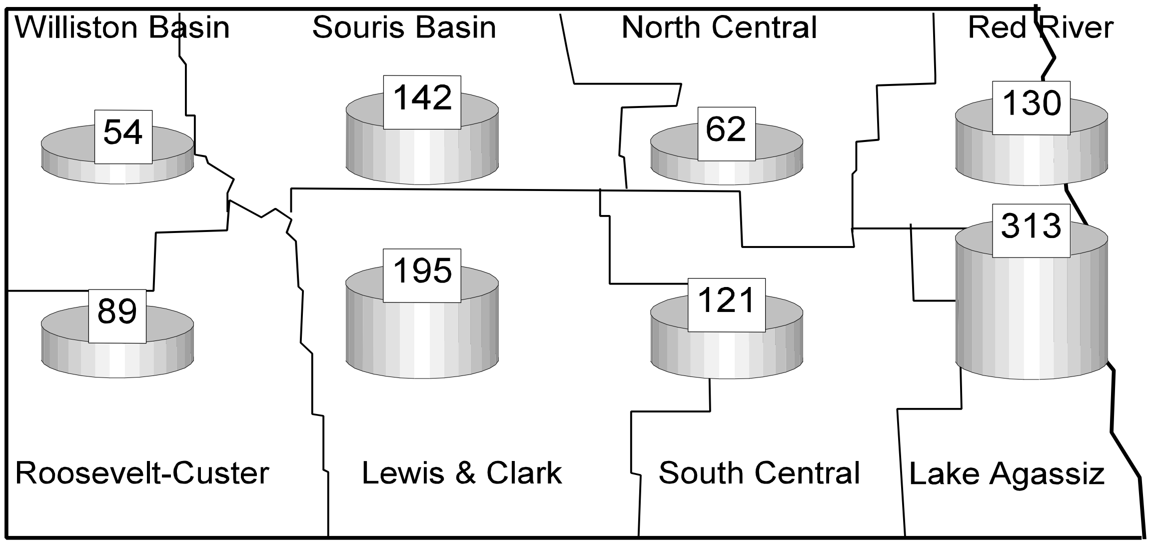


Figure 41: Number of Manufacturing Locations by Region - 2001 (Source: Manufacturer's News, Inc.)

However, a somewhat different picture is shown by the number of manufacturing employees by region. Figure 42 shows that nearly 60 percent of the manufacturing employees in the state are in the Red River Region, and more than 40 percent of the state's manufacturing employees are in Lake Agassiz Region.

Similarly, much of the state's GSP in manufacturing is in the Red River Region. Figure 43 shows that 58 percent of the state's manufacturing GSP is in the Red River Region, and 43 percent is in the Lake Agassiz Region alone.

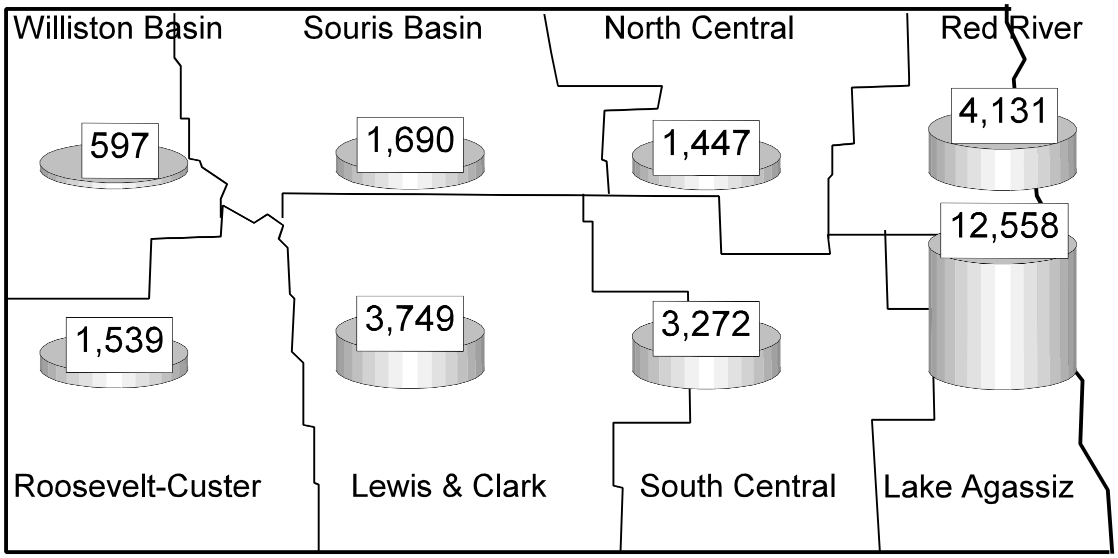


Figure 42: Number of Manufacturing Employees by Region - 2001 (Source: Manufacturer's News, Inc.)

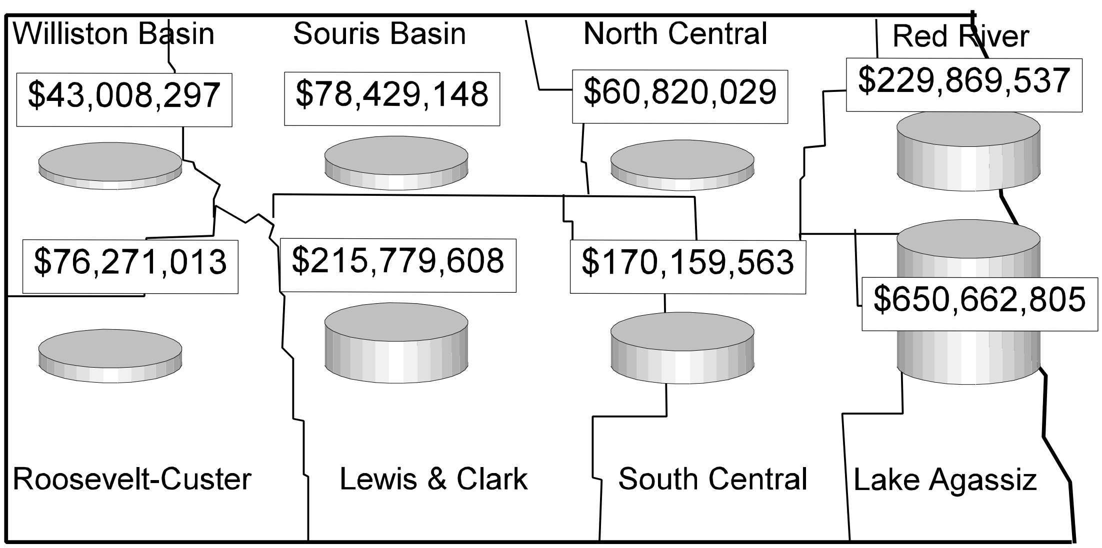


Figure 43: Estimated Manufacturing GSP by Region - 2001 (Source: Authors' Calculations - Data from Manufacturer's News, Inc. and U.S. Bureau of Economic Analysis)

The average size of manufacturing firms, as measured by the number of employees per firm, is shown by region in Figure 44. As the figure shows, the largest firms are in the Lake Agassiz Region, with an average number of employees per firm of 40. The figure also shows that average firm size decreases in moving from eastern regions to western regions.

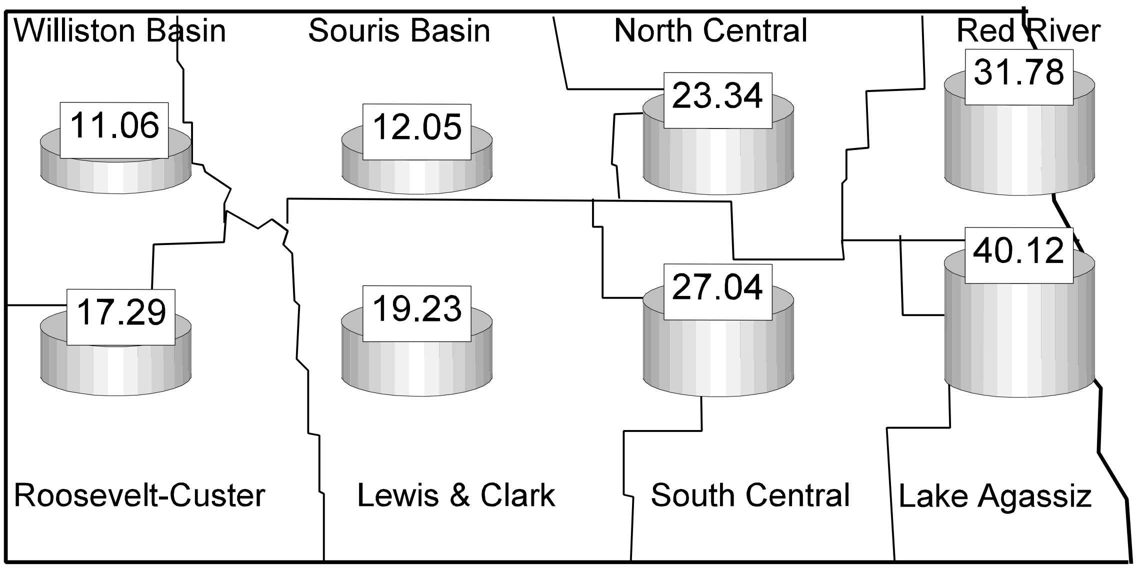


Figure 44: Average Employees per Manufacturing Location by Region - 2001 (Source: Manufacturer's News, Inc.)

Another way to measure firm size is by the value-added per firm. Gross state product, which is measured in the same way as value added, is estimated for all North Dakota firms, and summarized by region. Figure 45 shows the estimated average gross state product per firm by region. As the figure shows, the largest firms, measured in this way, are in the Red River Region. Other areas with large firms include the South Central Region and the Lewis & Clark Region.

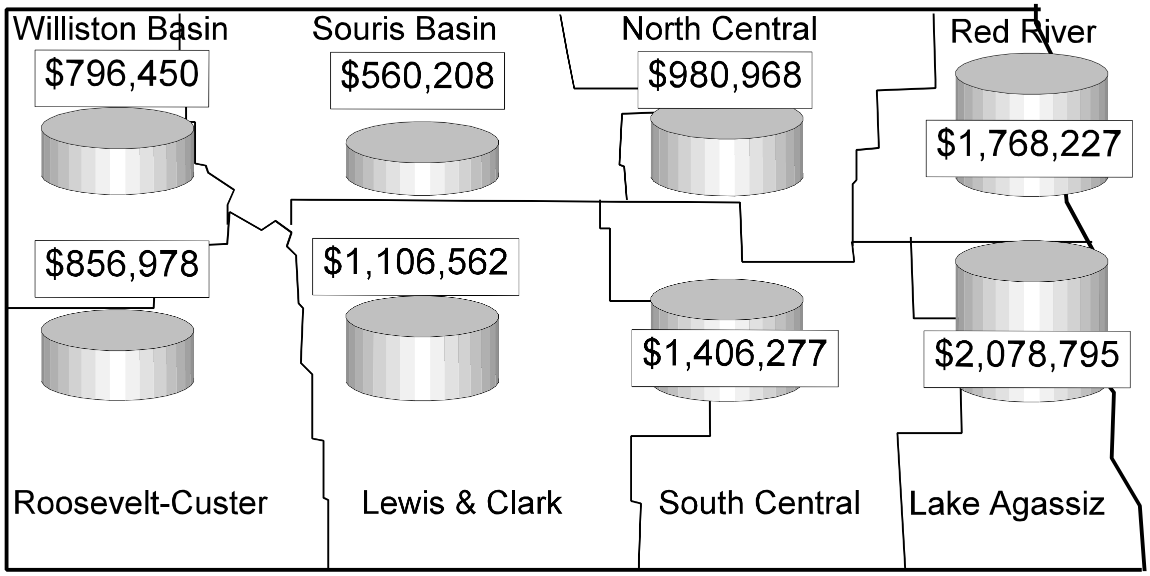


Figure 45: Estimated Gross State Product per Manufacturing Location by Region - 2001 (Source: Authors' Calculation - Data from Manufacturer's News, Inc. and U.S. Bureau of Economic Analysis)

Figures 46 through 60 show the number of locations, the estimated gross state product, and the average size of firms by region for specific manufacturing industries. The manufacturing industries highlighted are the top five North Dakota industries in terms of location quotients.[15] These are industrial machinery and equipment, food and kindred products, petroleum and coal products, lumber and wood products, and furniture and fixtures.

Figures 46 and 47 show that much of the industrial machinery and equipment manufacturing in the state is concentrated in the Lake Agassiz Region. Figure 47 shows that approximately 53 percent of the state's GSP in industrial machinery and equipment is estimated to occur in the Lake Agassiz region. The next largest region in this industry is the Lewis & Clark Region, where approximately 16 percent of the state's GSP in industrial machinery and equipment is estimated to occur.

[15]Recall that the location quotient shows the dependence of the North Dakota economy on a particular industry in comparison to the nation's dependence on that same industry. Industries with higher location quotients are more likely to export their products out of the state than other industries.

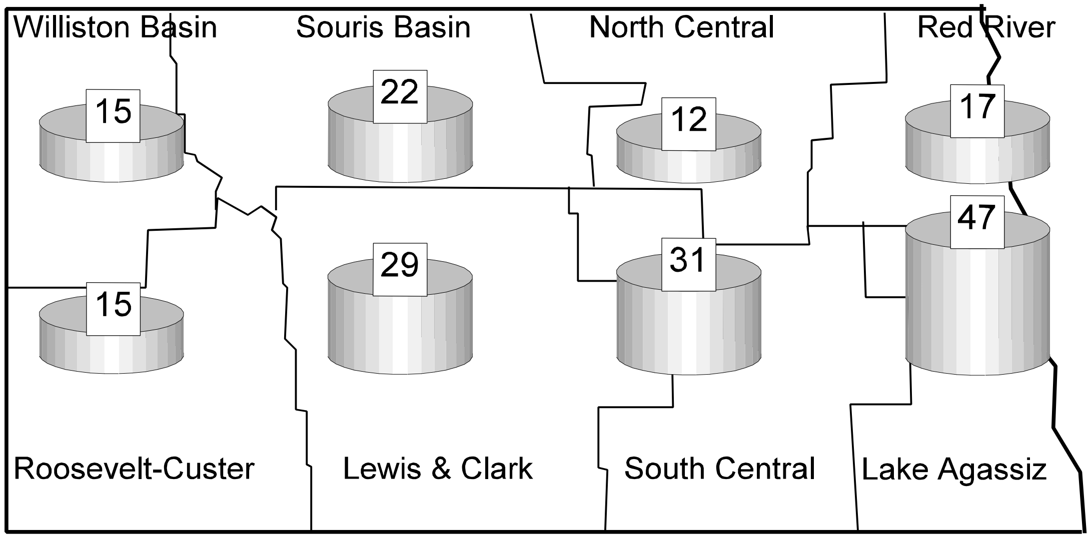


Figure 46: Number of Industrial Machinery and Equipment Manufacturing Locations by Region - 2001 (Source: Manufacturer's News, Inc.)

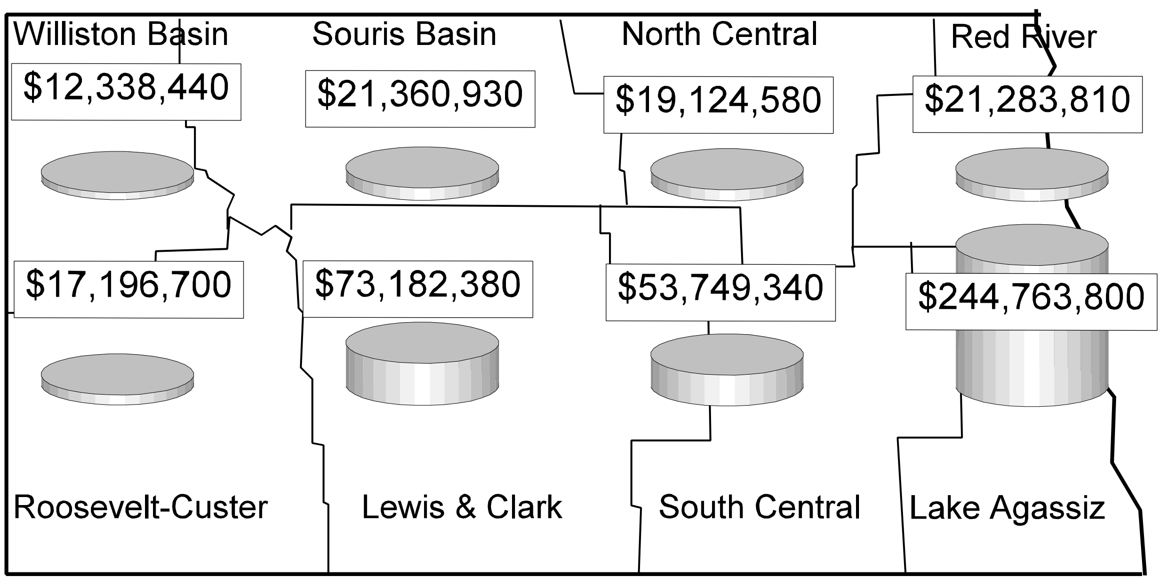


Figure 47: Estimated Gross State Product in Industrial Machinery and Equipment Manufacturing by Region - 2001 (Source: Manufacturer's News, Inc.)

Figure 48 shows that the largest locations in industrial machinery and equipment also are in the Lake Agassiz Region. The average location size in this region is at least twice the average for any other region.

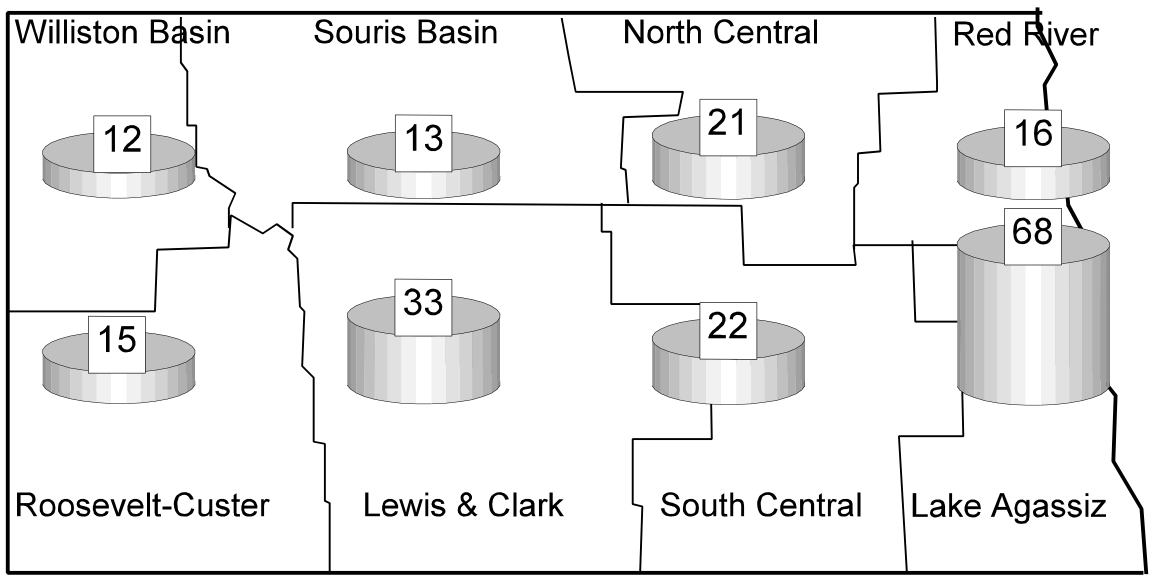


Figure 48: Average Number of Employees per Industrial Machinery and Equipment Location by Region - 2001 (Source: Manufacturer's News, Inc.)

Figures 49 and 50 show the number of locations and the estimated GSP in the food and kindred products industry by region. As Figure 49 shows, the regions with the largest numbers of locations in this industry are the Lake Agassiz Region and the Lewis & Clark Region. In terms of the estimated GSP, the Lake Agassiz Region and the Red River Region are the largest. It is estimated that approximately 58 percent of the state's 2001 GSP in this industry was in these two regions, as shown in Figure 50. This difference is explained by a larger location size in the Red River Region than in the Lake Agassiz Region.

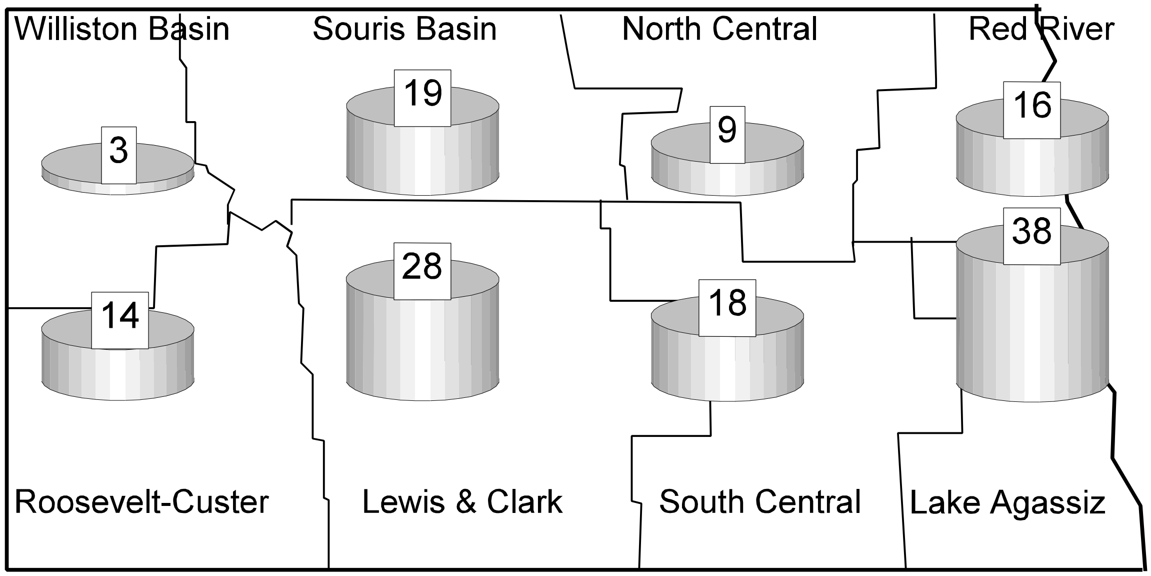


Figure 49: Number of Food and Kindred Products Manufacturing Locations by Region - 2001 (Source: Manufacturer's News, Inc.)

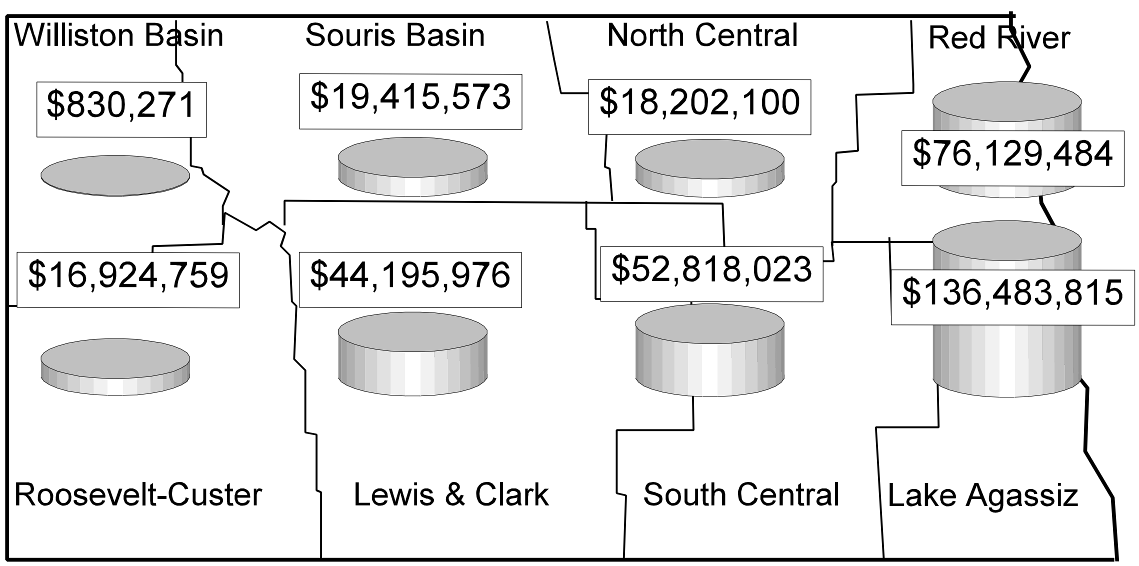


Figure 50: Estimated Gross State Product in Food and Kindred Products Manufacturing by Region - 2001 (Source: Manufacturer's News, Inc.)

Figure 51 shows the average location size of food and kindred products manufacturers in the state, as defined by employees per location. As the figure shows, the Red River Region has the largest average location size, followed by the Lake Agassiz Region. The Red River Region's average location size is boosted by large employers such as JR Simplot, American Crystal Sugar, RDO Foods, and the North Dakota Mill. There also are large average location sizes in the central regions.

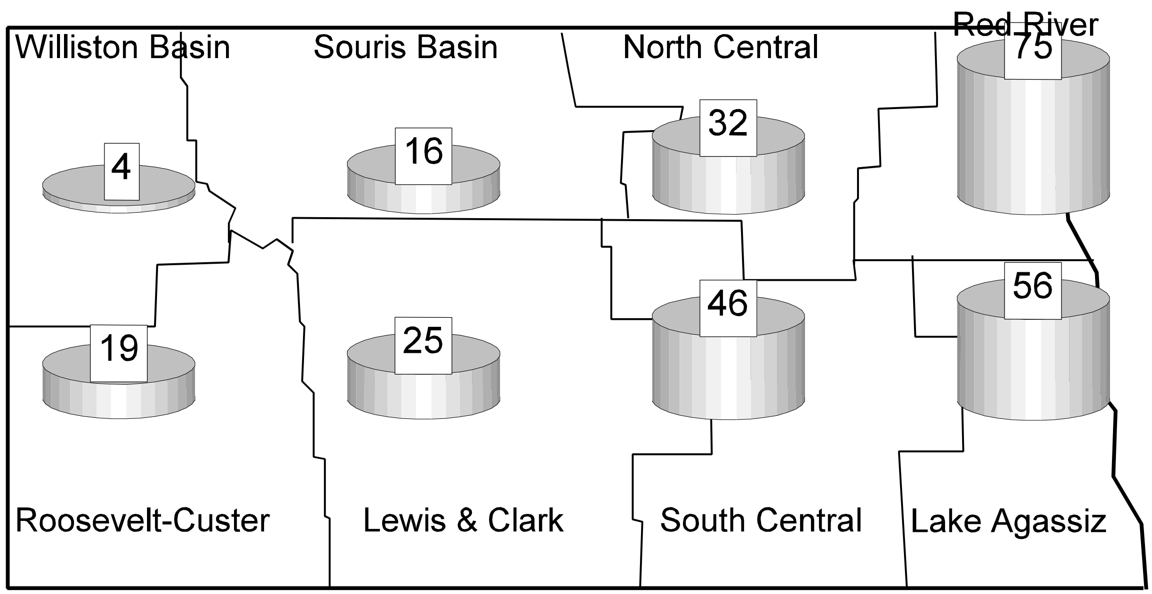


Figure 51: Average Number of Employees per Food and Kindred Products Manufacturing Location by Region - 2001 (Source: Manufacturer's News, Inc.)

Figures 52 and 53 show the number of petroleum and coal products manufacturing locations and the estimated GSP in petroleum and coal products manufacturing by region. As the figures show, all manufacturing in this industry is located in three regions in the western part of the state - Williston Basin Region, Roosevelt-Custer Region, and Lewis & Clark Region. The largest amount of activity in this industry, as defined by estimated GSP, is in the Lewis & Clark Region.

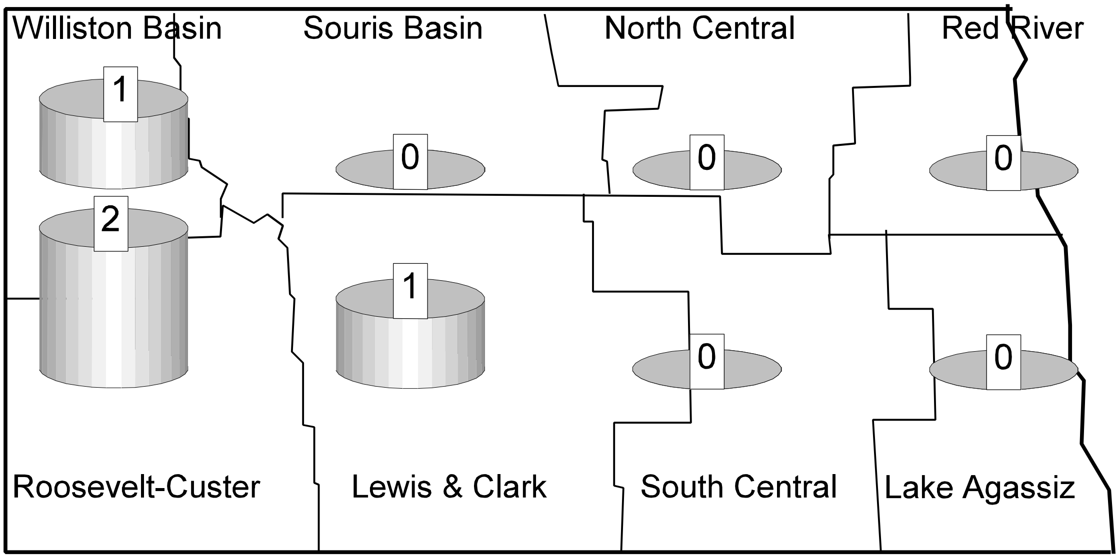


Figure 52: Number of Petroleum and Coal Products Manufacturing Locations by Region - 2001 (Source: Manufacturer's News, Inc.)

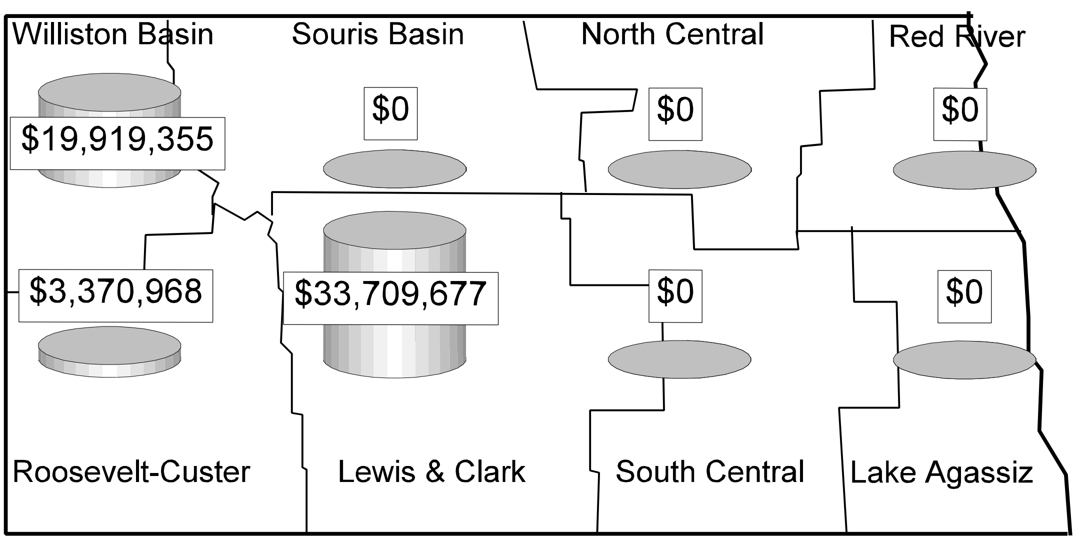


Figure 53: Estimated Gross State Product in Petroleum and Coal Products Manufacturing by Region - 2001 (Source: Manufacturer's News, Inc.)

Figure 54 shows the average size of petroleum and coal product manufacturing locations. As the figure shows, these locations have many employees, with a firm size in the Lewis & Clark region of 220 employees.

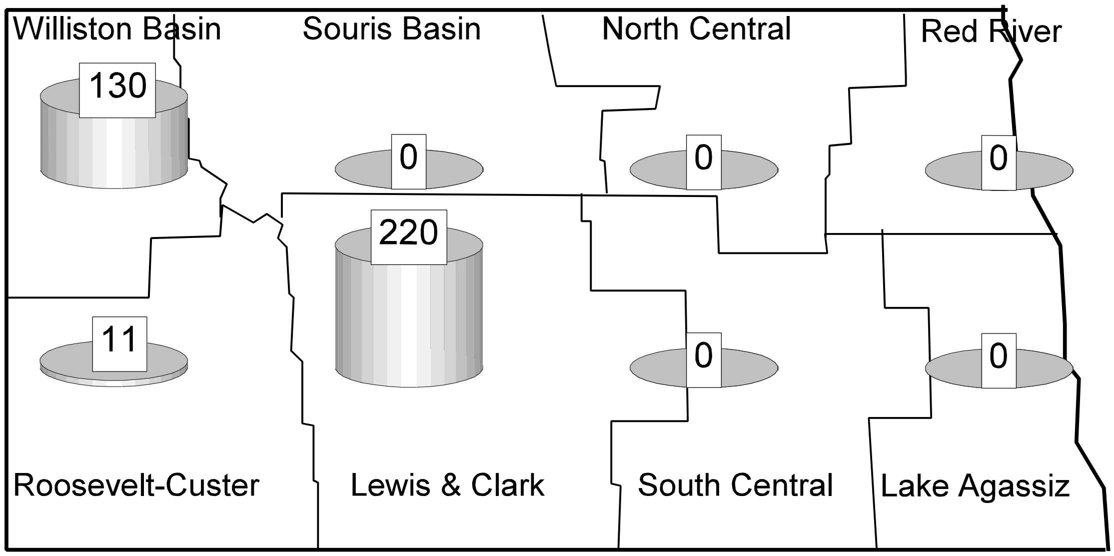


Figure 54: Average Number of Employees per Petroleum and Coal Products Manufacturing Location - 2001 (Source: Manufacturer's News, Inc.)

Figures 55 and 56 show the number of manufacturing locations and the estimated GSP by region in the lumber and wood products industry. As the figures show, most manufacturing activity in this industry is concentrated in the Lake Agassiz Region. Figure 56 shows that 70 percent of the estimated GSP in this industry is attributable to the Lake Agassiz Region.

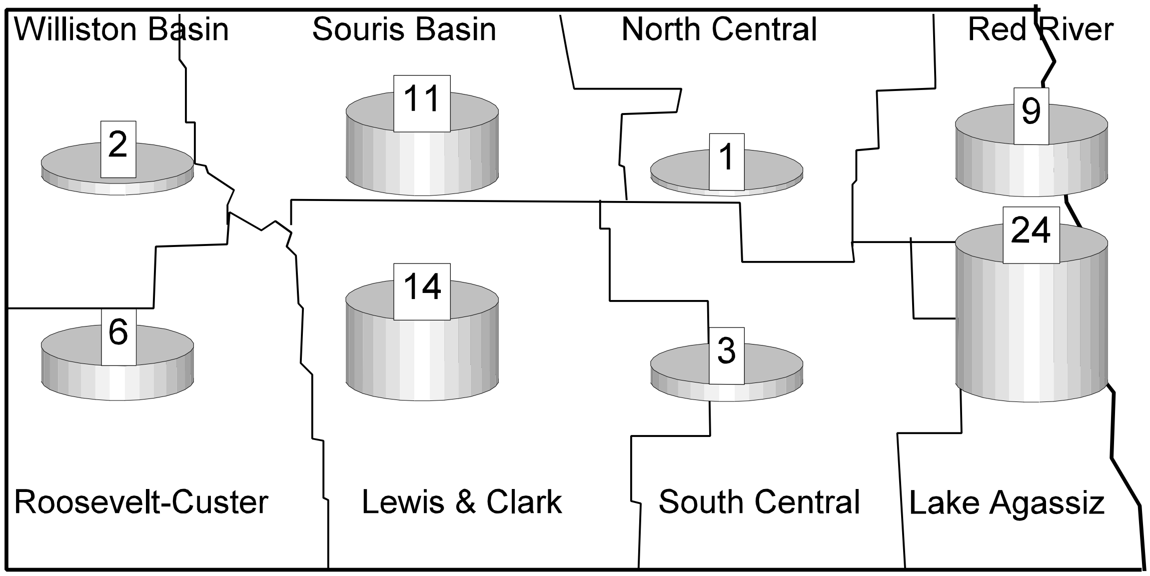


Figure 55: Number of Lumber and Wood Products Manufacturing Locations by Region - 2001 (Source: Manufacturer's News, Inc.)

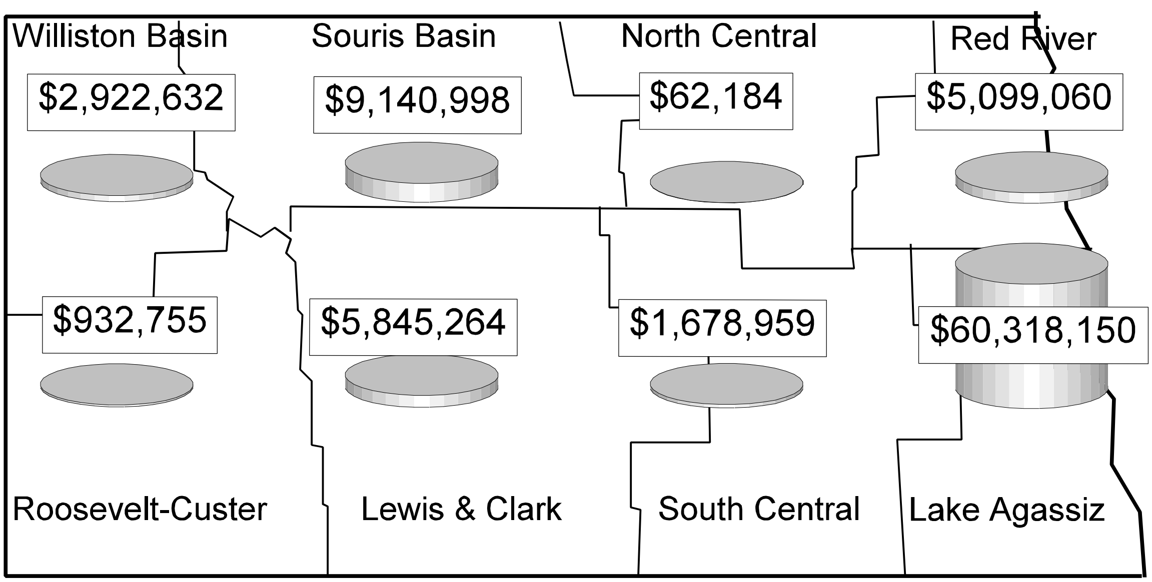


Figure 56: Estimated Gross State Product in Lumber and Wood Products Manufacturing by Region - 2001 (Source: Manufacturer's News, Inc.)

Figure 57 shows that the average firm size in the lumber and wood products industry is much larger in the Lake Agassiz Region than in others. The Williston Basin Region also has a large average firm size.

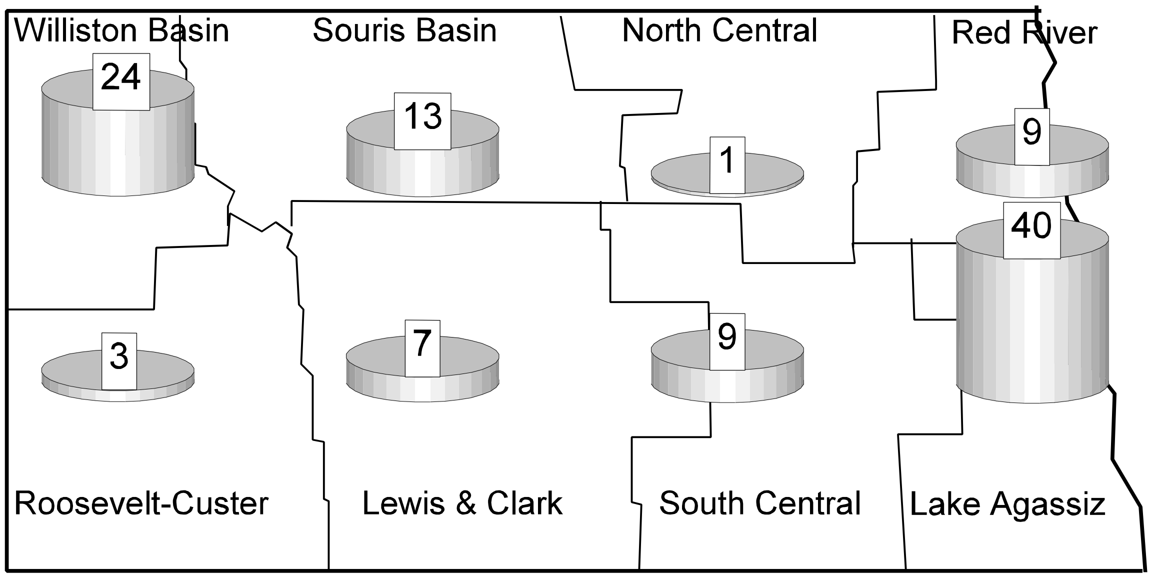


Figure 57: Average Number of Employees per Lumber and Wood Products Manufacturing Location - 2001 (Source: Manufacturer's News, Inc.)

Figures 58 and 59 show the manufacturing activity in the furniture and fixtures industry as measured by the number of locations and estimated GSP. Figure 58 shows that the Lake Agassiz Region has the largest number of locations in this industry. However, the largest estimated GSP in this industry is in the Roosevelt-Custer Region. The reason for this is that the state's largest manufacturer in this industry, TMI, is located in Dickinson.

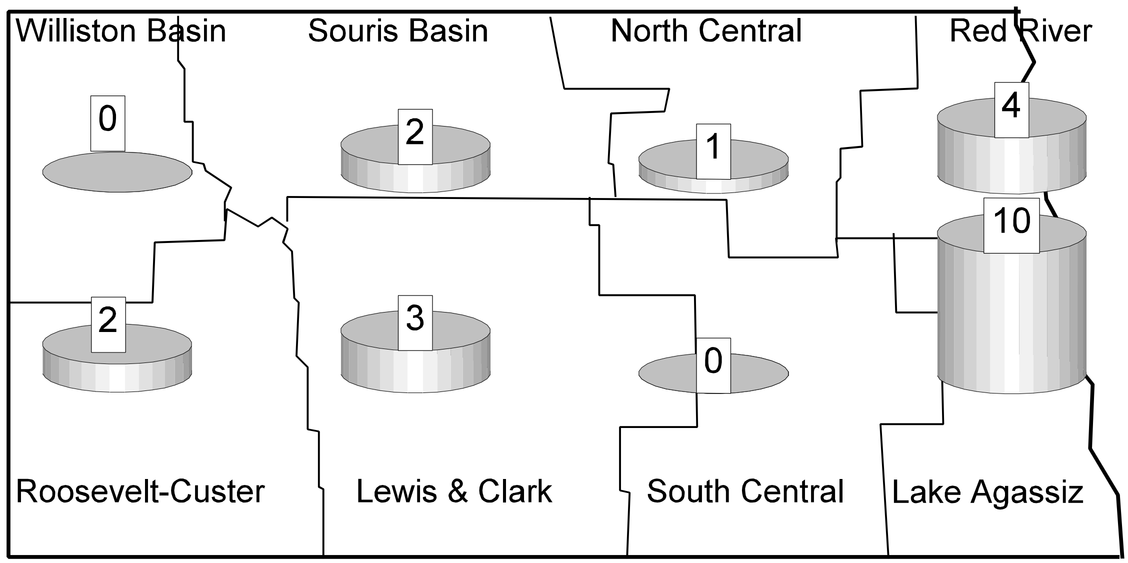


Figure 58: Number of Furniture and Fixtures Manufacturing Locations by Region - 2001 (Source: Manufacturer's News, Inc.)

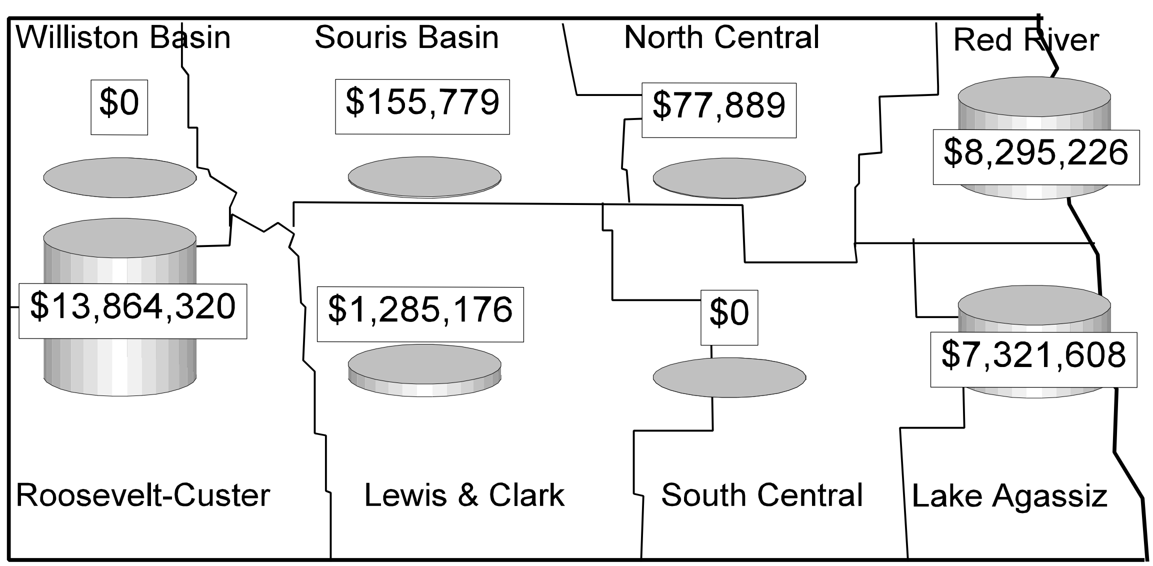


Figure 59: Estimated Gross State Product in Furniture and Fixtures Manufacturing by Region - 2001 (Source: Manufacturer's News, Inc.)

Figure 60 shows the average number of employees per location in the furniture and fixtures industry. As the figure shows, the largest average furniture and fixtures manufacturing locations are in the Roosevelt-Custer Region and the Red River Region.

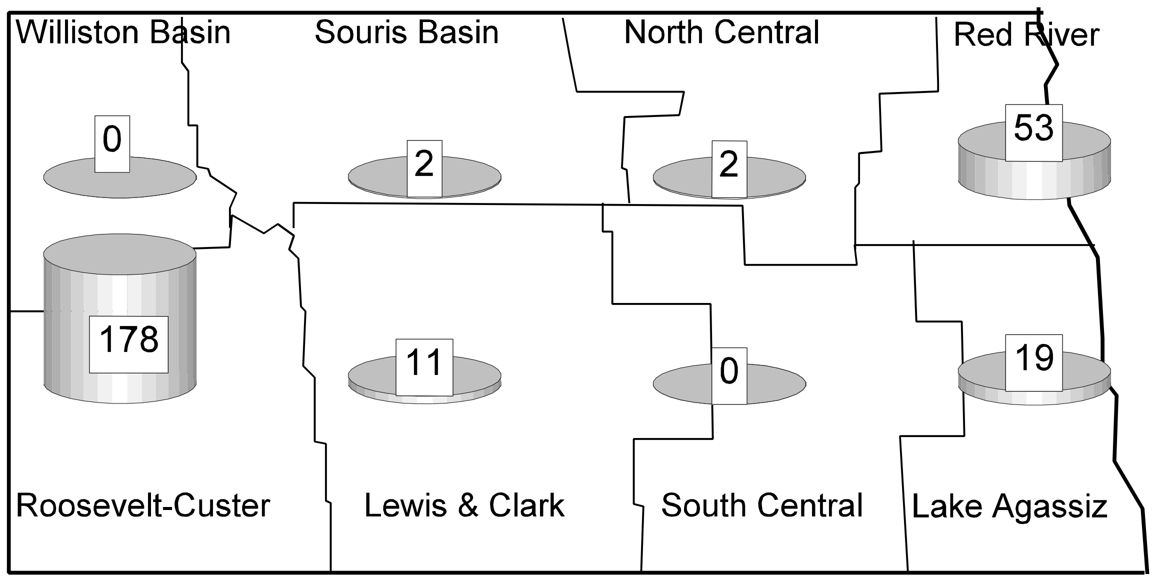


Figure 60: Average Number of Employees per Furniture and Fixtures Manufacturing Location by Region - 2001 (Source: Manufacturer's News, Inc.)

Previous sections of this report have shown the industrial composition of the North Dakota Economy, composition of the North Dakota manufacturing sector, types of products produced by North Dakota manufacturers, number and size of manufacturing firms in North Dakota, and specific regional locations of North Dakota Manufacturing. The following sections of this report examine the characteristics of products shipped by North Dakota manufacturers, major competitor locations for North Dakota manufactured products, destinations for North Dakota manufactured products, and modal shares of these products. In addition a case study highlighting transportation cost and transit time differences between an intermodal container shipment and truck shipment of specific commodities to foreign destinations will be included. This will provide insight into some of the potential benefits that an improved intermodal container shipping option may offer.

APPENDIX 2

Dilworth	4 Miles
Winnepeg	72 Miles
Regina	151 Miles
Mpls. / St. Paul	244 Miles
Billings	258 Miles
Saskatoon	312 Miles
Shelby	387 Miles
Butte	484 Miles

Figure 1. **Distances from North Dakota Border to Intermodal Facilities**

APPENDIX 3

Table 1. Number of Total Employees in Surveyed Areas by SIC-2 digit Code

2 digit - SIC code	Number of Total Employees (MNI)
20 - Food and kindred products	11,866
22 - Textile mill products	61
23 - Apparel and other textile products	1,287
24 - Lumber and wood products	5,971
25 - Furniture and fixtures	1,139
26 - Paper and allied products	387
27 - Printing and publishing	4,377
28 - Chemicals and allied products	985
29 - Petroleum and coal products	583
30 - Rubber and miscellaneous plastics products	2,073
31 - Leather and leather products	73
32 - Stone, clay, and glass products	1,885
33 - Primary metal industries	1,168
34 - Fabricated metal products	4,857
35 - Industrial machinery and equipment	9,292
36 - Electronic and other electric equipment	4,279
37 - Transportation and equipment	7,446
38 - Instruments and related products	1,185
39 - Miscellaneous manufacturing industries	1,686
99 - Nonclassifiable Establishments	419

Table 2. Outbound Tons per Employee produced in Surveyed Areas by SIC-2digit Code

2 digit- SIC code	Truck Tons per Employee	Rail Car Tons per Employee	20' Container Tons per employee	40' Container Tons per employee
20	341.39	512.87	2.61	5.52
22	.	.	.	.
23	1.30	0	0	0
24	27.21	0	3.83	0
25	9.51	0	0	0
26	138.00	0	0	0
27	24.98	0	0	0
28	2,308.91	0	0	0
29	.	.	.	.
30	140.60	0	0.01	0
31	.	.	.	.
32	548.22	302.44	0	0
33	61.66	0	0	0
34	48.79	0	0.53	0
35	74.34	8.18	4.81	11.17
36	162.22	0	0	1.58
37	41.22	0	0	0.03
38	0.07	0	0	0
39	32.53	0	0	0
99	438.66	82.60	107.92	0.35

. represents missing data from non-responses.

APPENDIX 4

Figure 1. Surveyed Regions in North Dakota, South Dakota, Montana (MT), and Minnesota (MN)

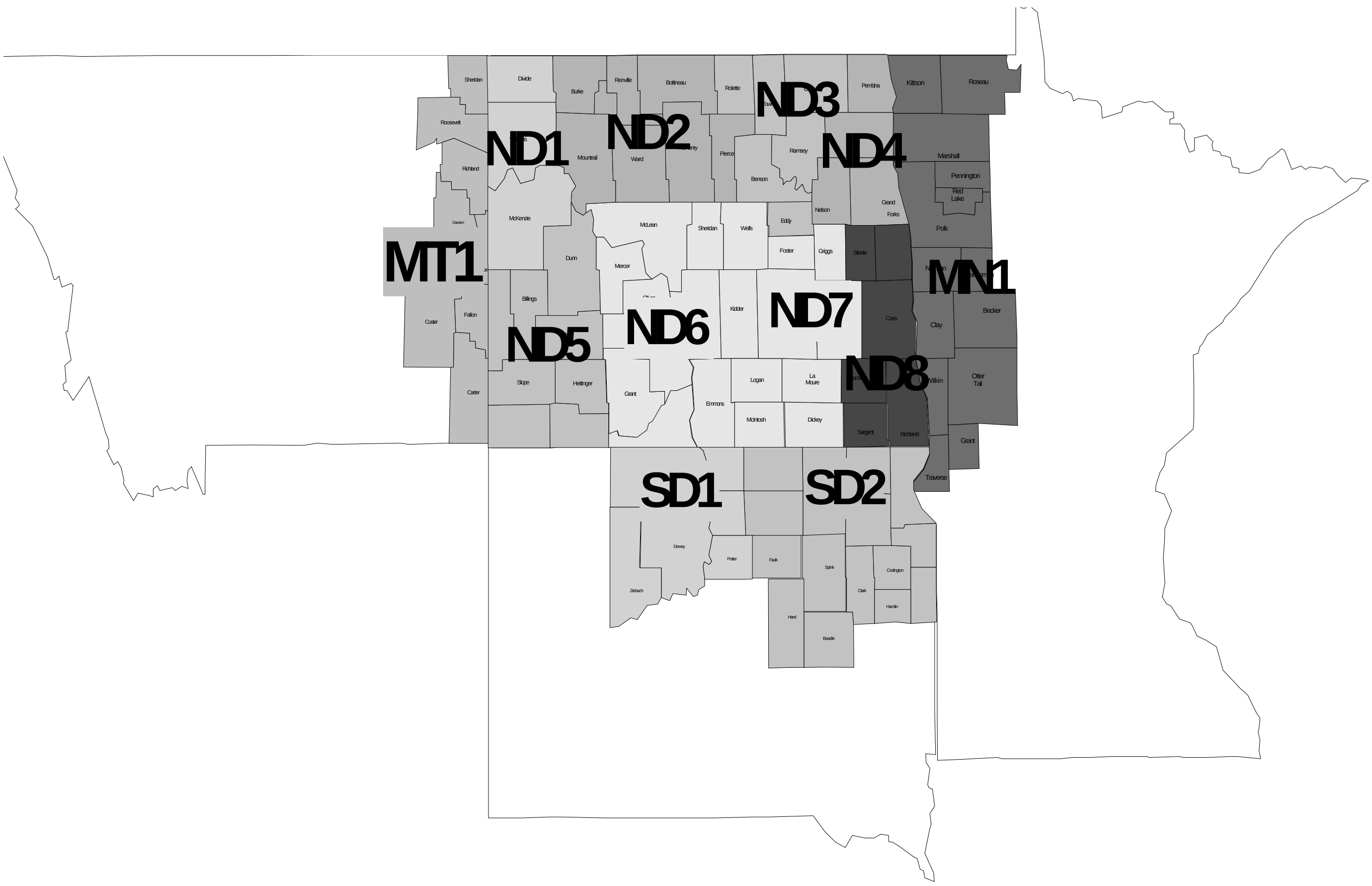


Table 1. List of Counties for Survey

Minnesota	Montana	South Dakota
Kittson	Sheridan	Marshall
Pennington	Roosevelt	McPherson
Norman	Richland	Campbell
Clay	Dawson	Corson
Wilken	Wibaux	Perkins
Traverse	Fallon	Harding
Grant	Fallon	Butte
Ottertail	Carter	Meade
Becker	Custer	Zieback
Mahnomen		Dewey
Red Lake		Walworth
Marshall		Potter
Roseau		Edmunds
Polk		Faulk
		Day
		Spink
		Roberts
		Grant
		Brown
		Codington
		Deuel
		Hamlin
		Clark
		Beadle
		Hand
		Hughes

APPENDIX 5
Maps with Regional Data

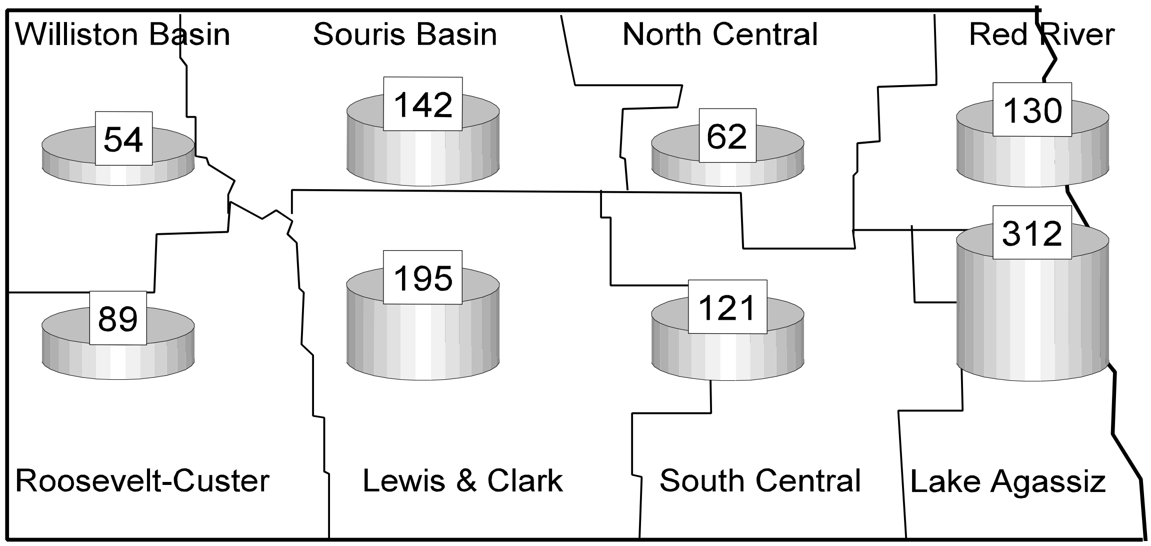


Figure 1: Number of Surveyed Firms (Locations) by Region - 2001 (Source: Manufacturer's News, Inc.)

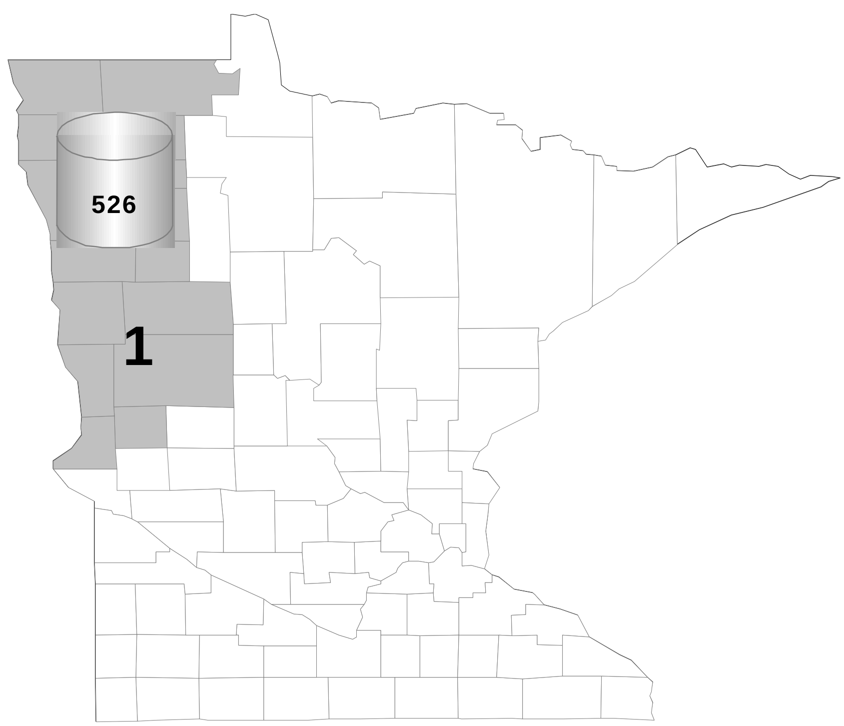


Figure 2. **Number of Manufacturing Firms (Locations) by Region (Source: Manufacturer's News, Inc.)**

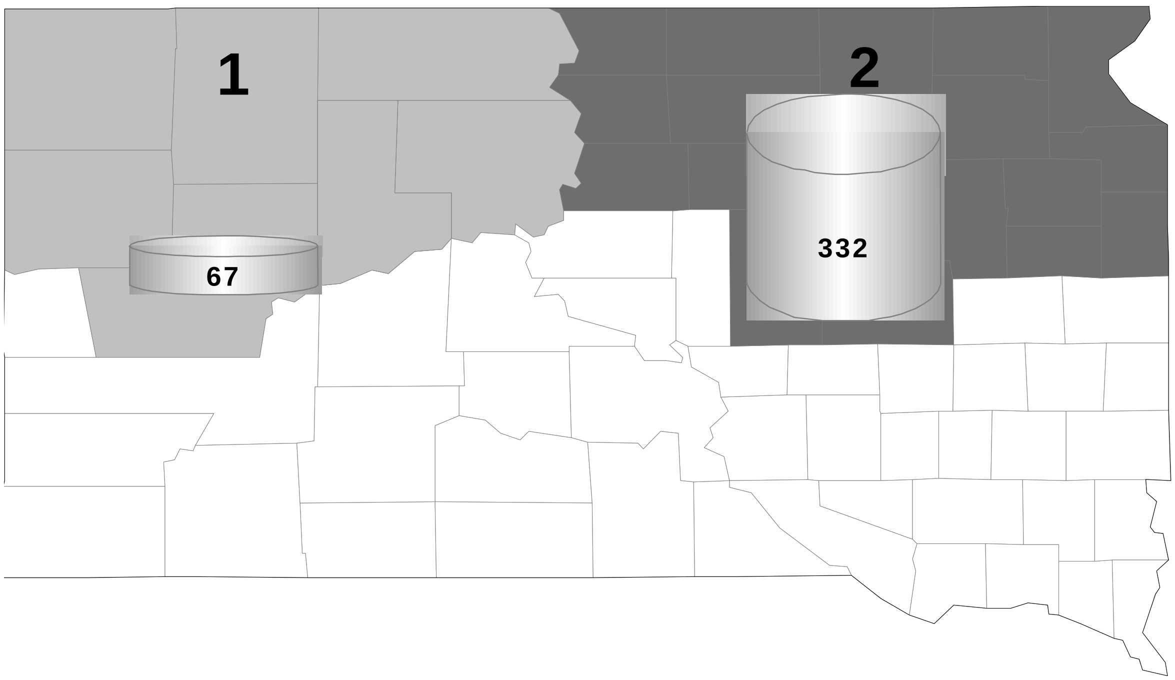


Figure 3. **Number of Manufacturing Firms (Locations) by Region (Source: Manufacturer's News, Inc.)**

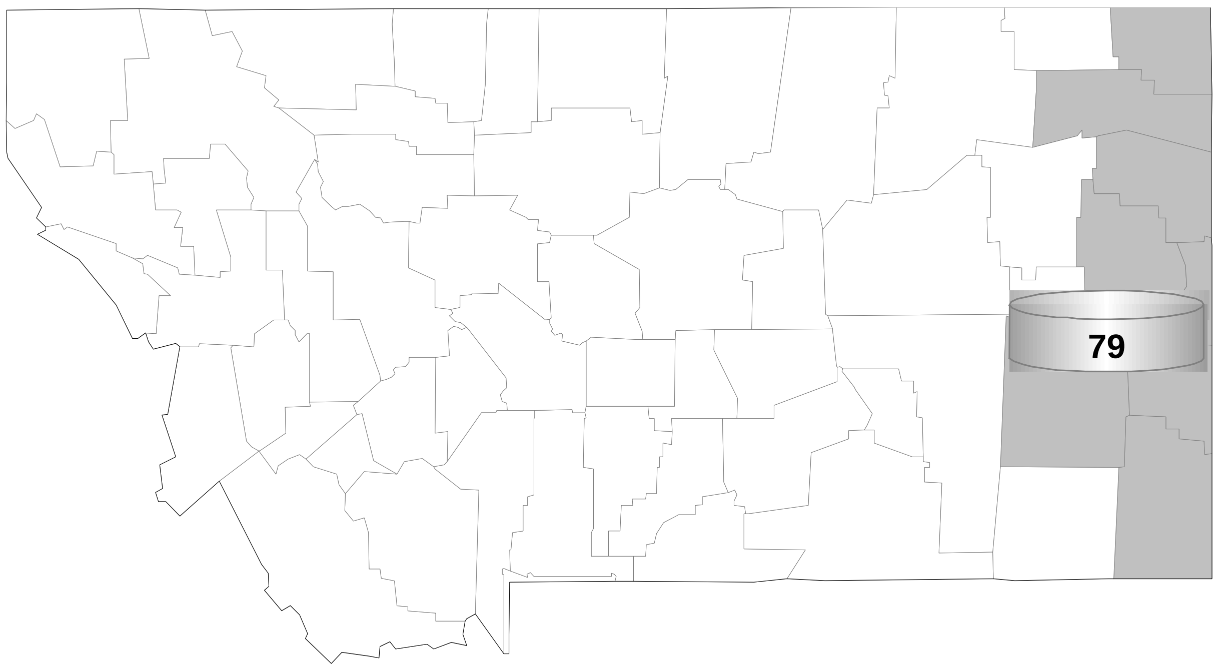


Figure 4. **Number of Manufacturing Firms (Locations) by Region (Source: Manufacturer's News, Inc.)**

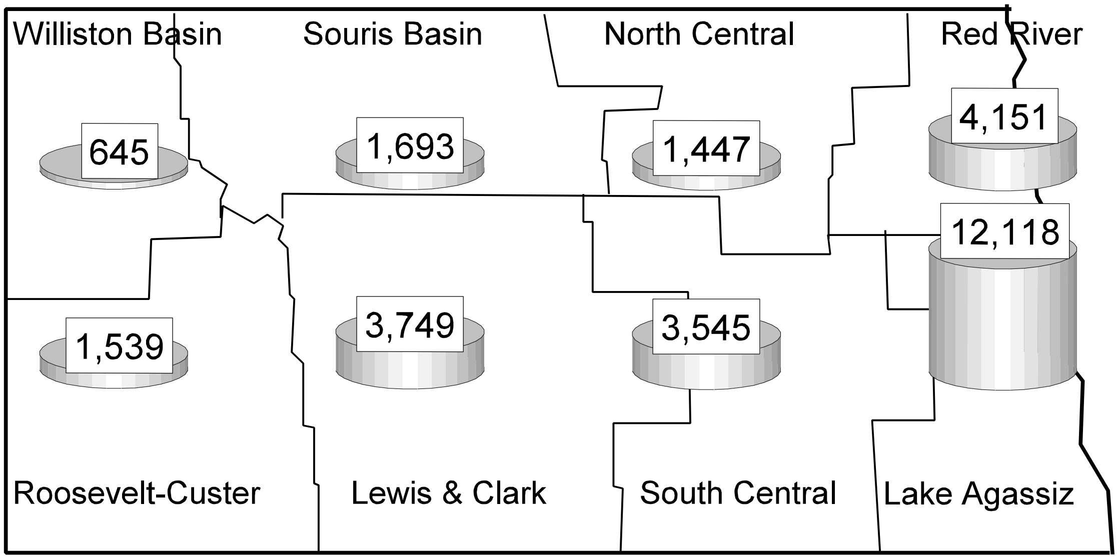


Figure 6: Number of Employees in Surveyed Firms by Region - 2001 (Source: Manufacturer's News, Inc.)

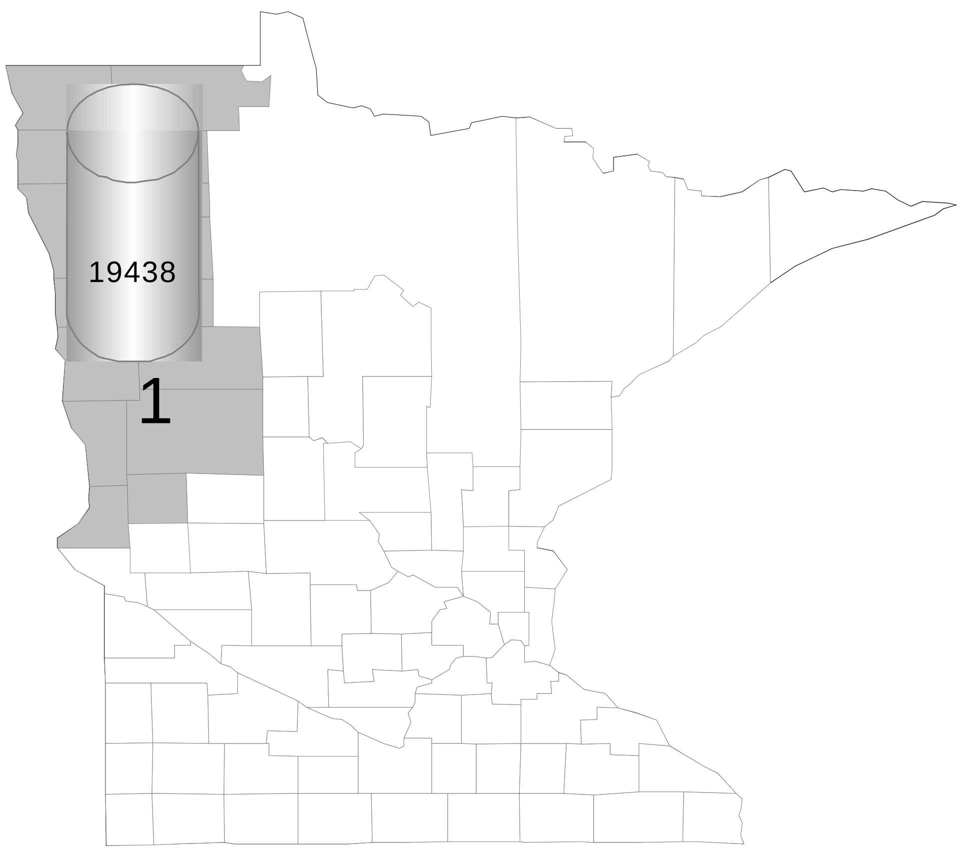


Figure 5. Number of Employees in Manufacturing Firms by Region (Source: Manufacturer's News, Inc.)

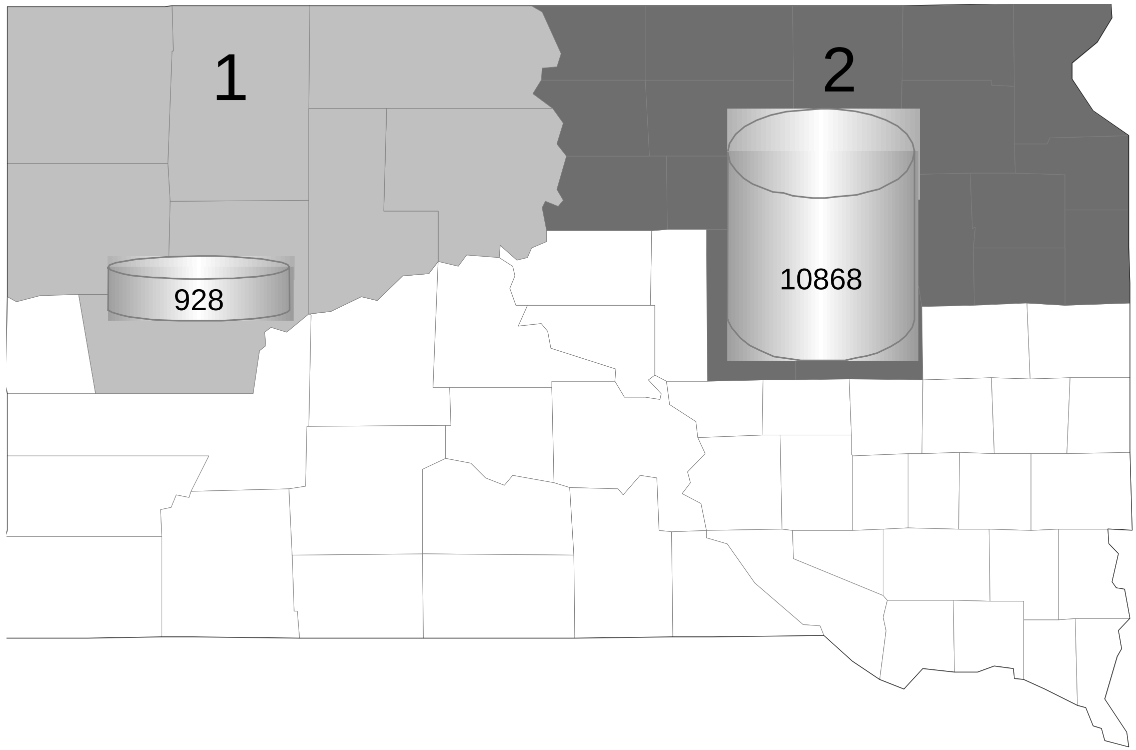


Figure 7. **Number of Employees in Manufacturing Firms by Region (Source: Manufacturer's News, Inc.)**

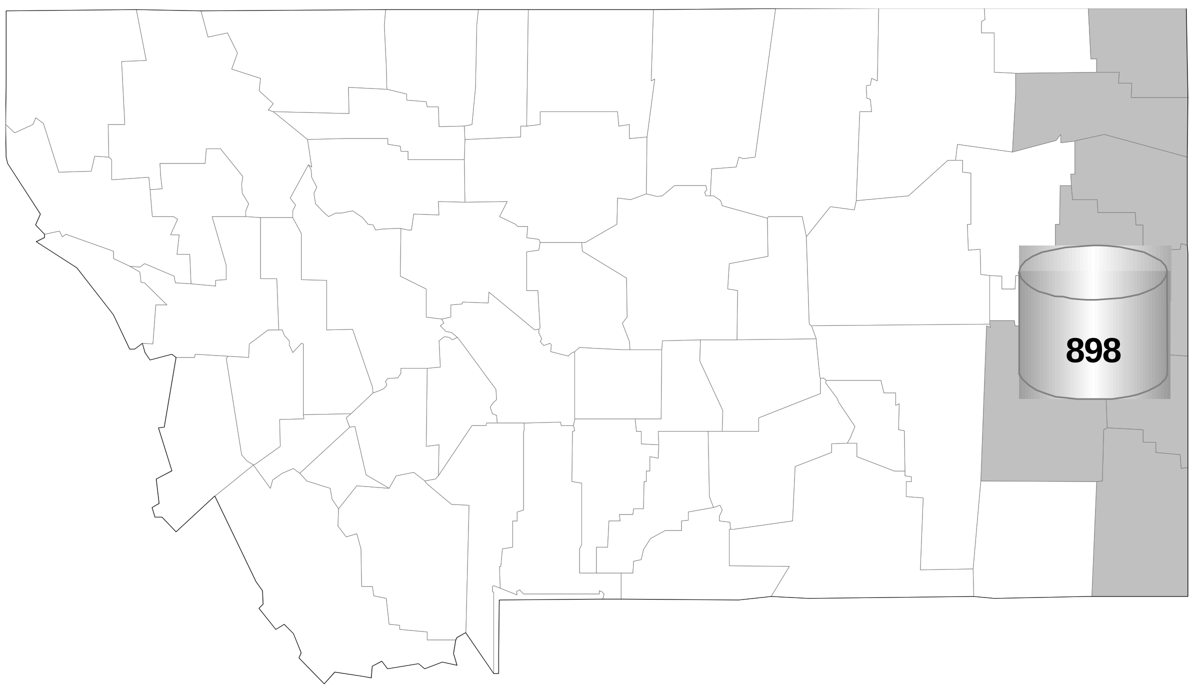


Figure 8. **Number of Employees in Manufacturing Firms by Region (Source: Manufacturer's News, Inc.)**

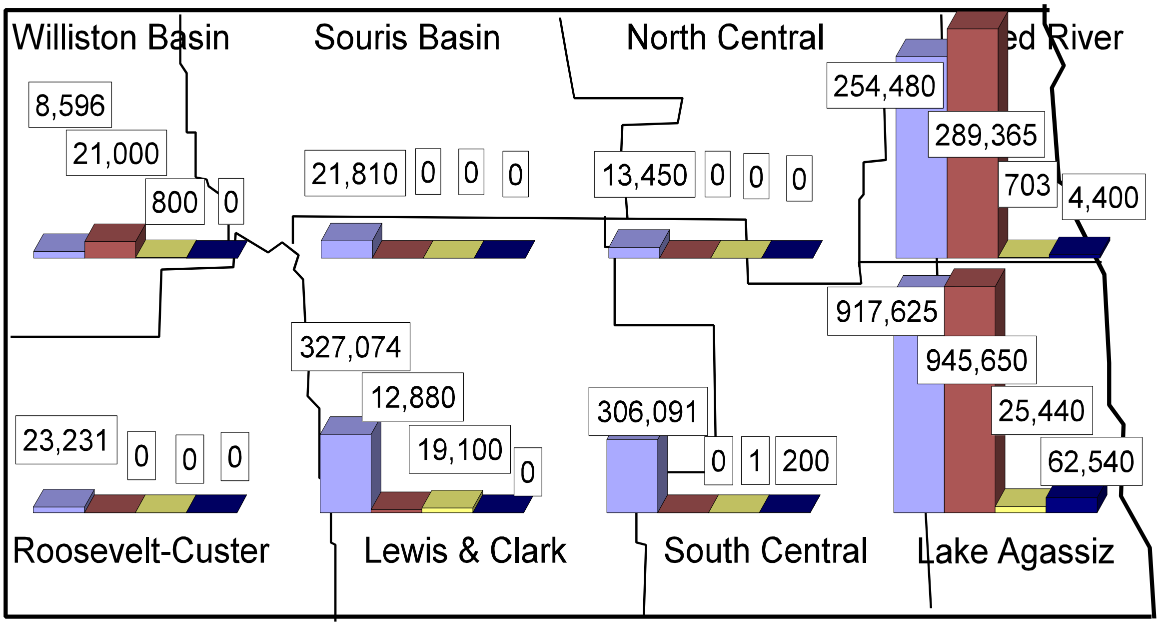
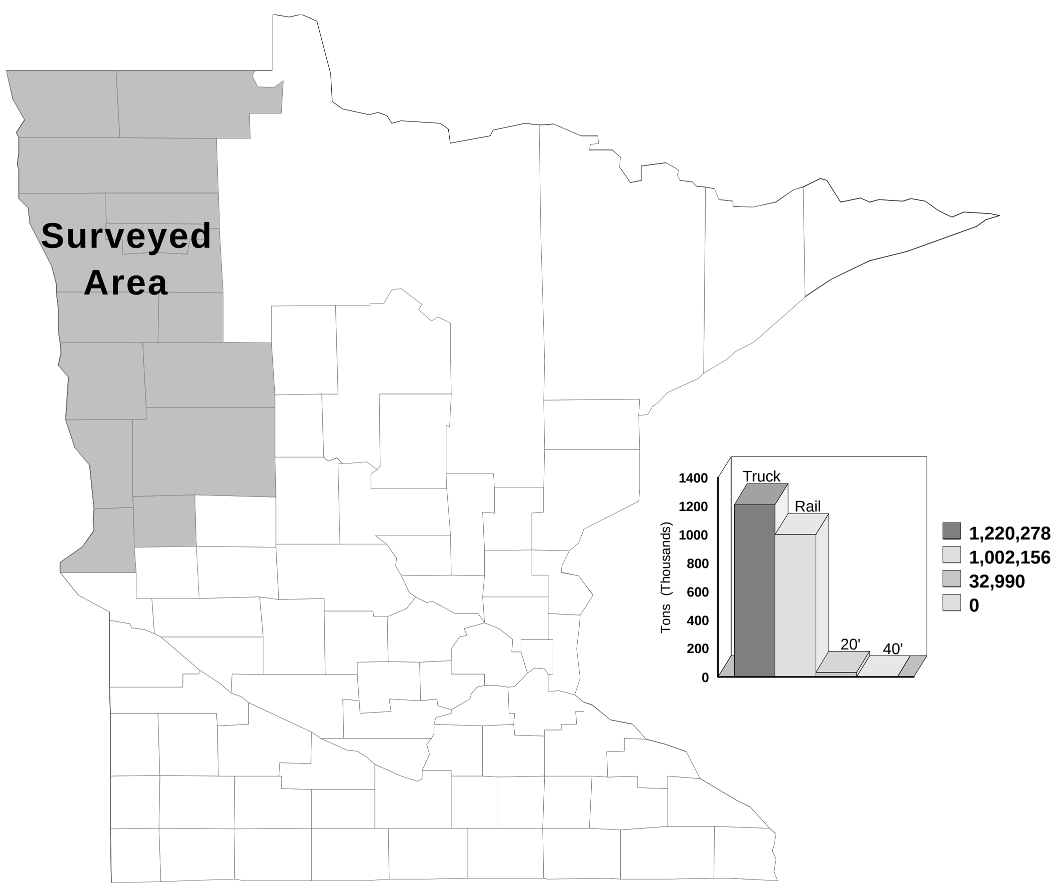


Figure 9. Outbound Truck, Rail, 20' and 40' Container Tons from the Intermodal Survey (2001)



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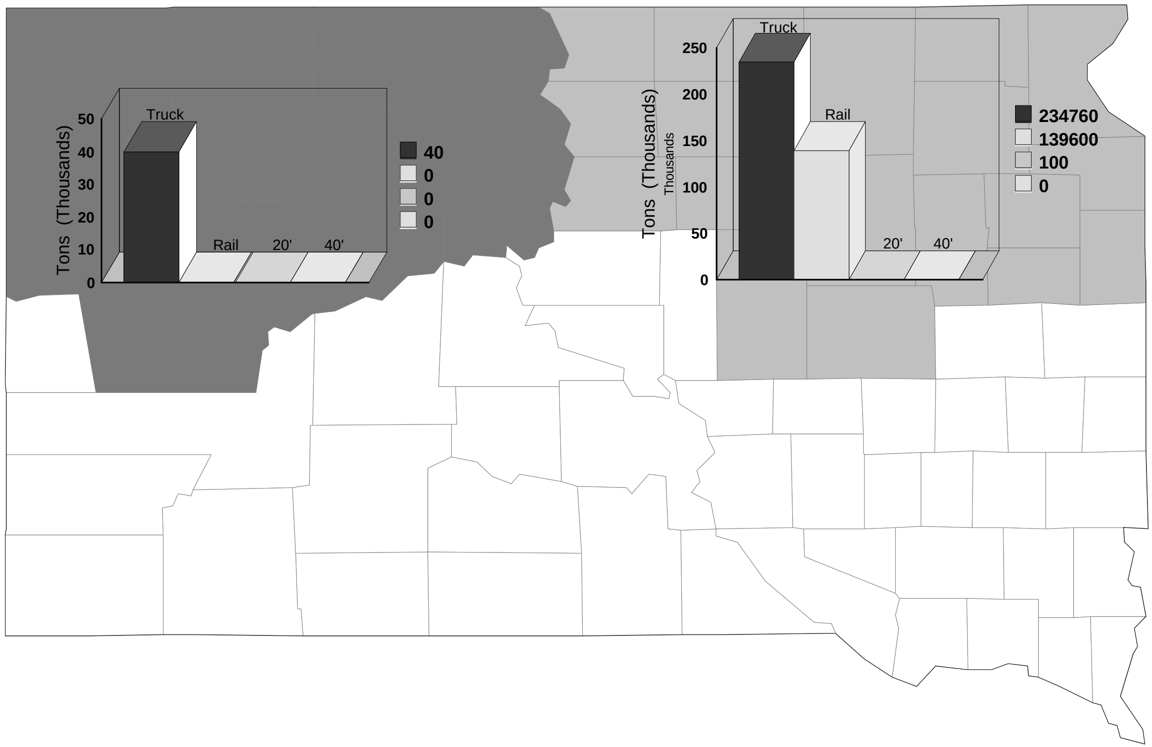


Figure 11. Outbound Truck, Rail, 20' and 40' Container Tons from Intermodal Survey (2001)

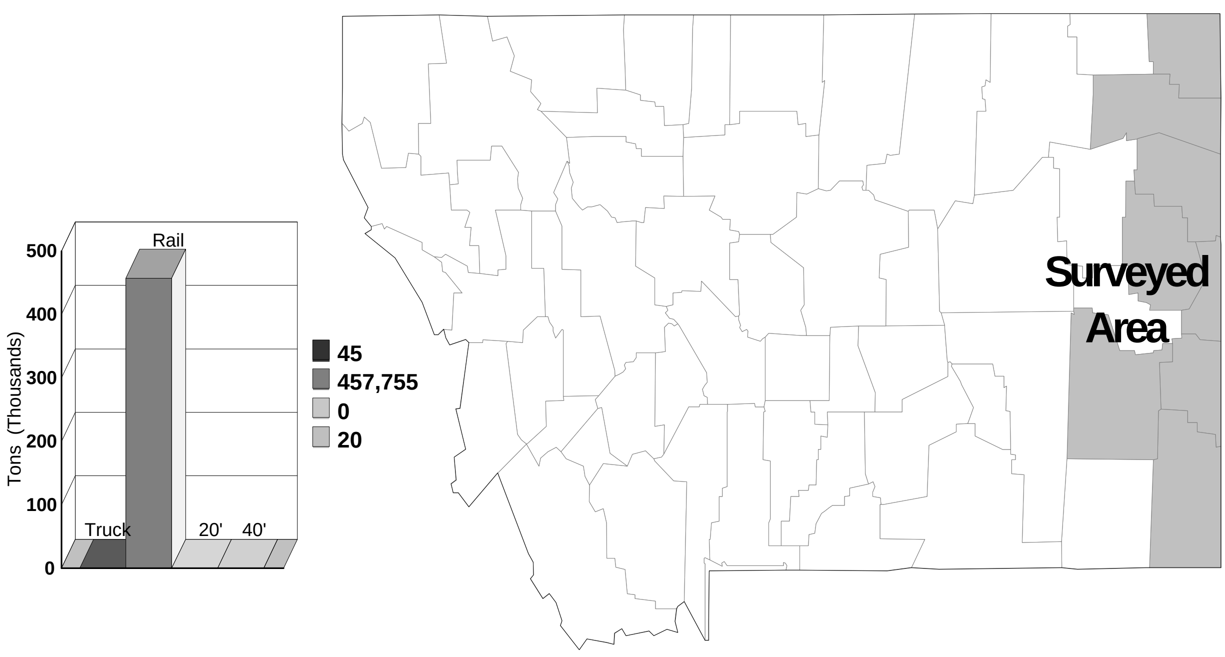


Figure 12. Outbound Truck, Rail, 20' and 40' Container Tons from the Intermodal Survey (2001)

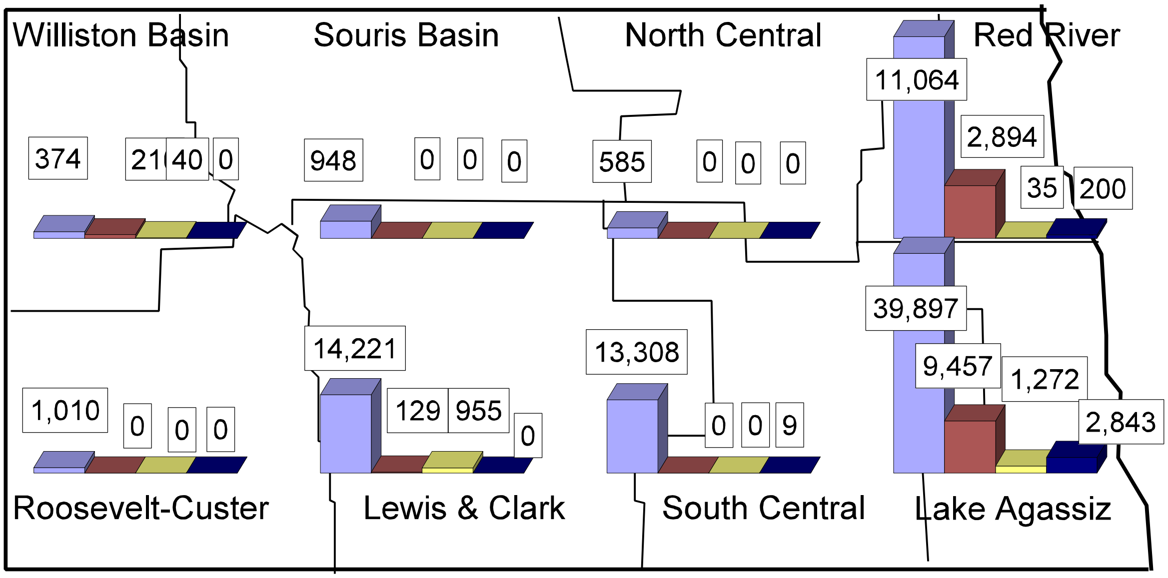


Figure 13. Outbound Truck, Rail, 20' and 40' Container Freight from the Intermodal Survey (2001)

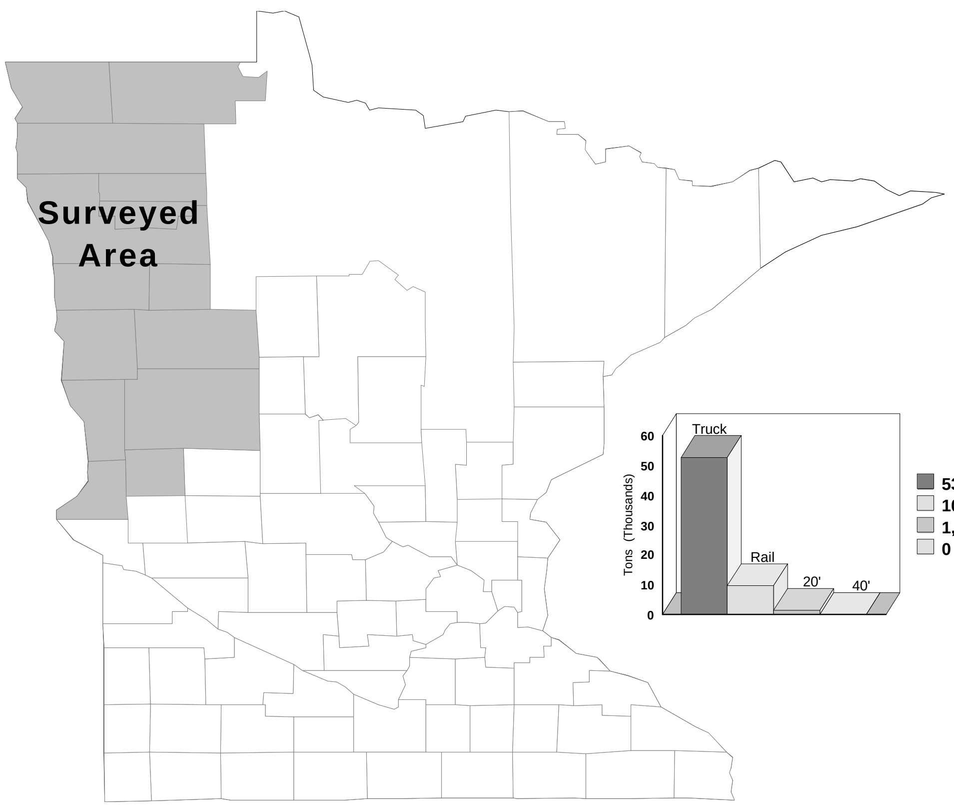


Figure 14. Outbound Truck, Rail, 20' and 40' Container Freight from the Intermodal Survey (2001)

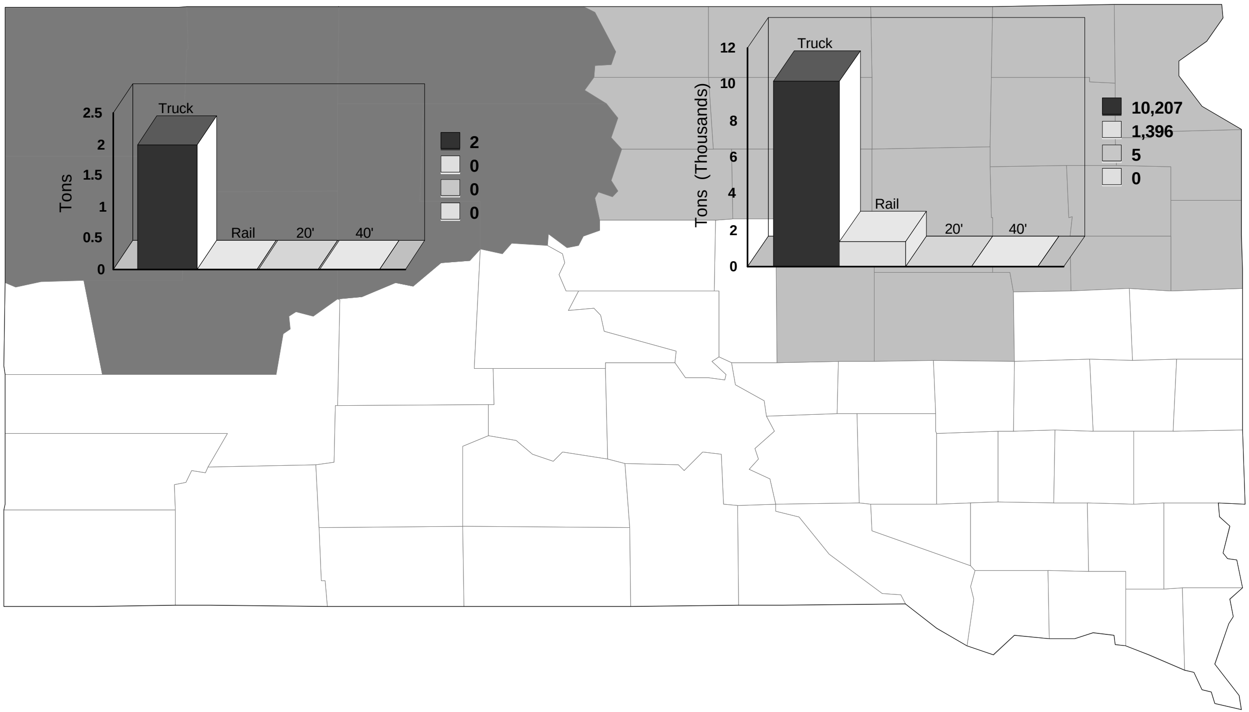


Figure 15. Outbound Truck, Rail, 20' and 40' Container Freight from the Intermodal Survey (2001)

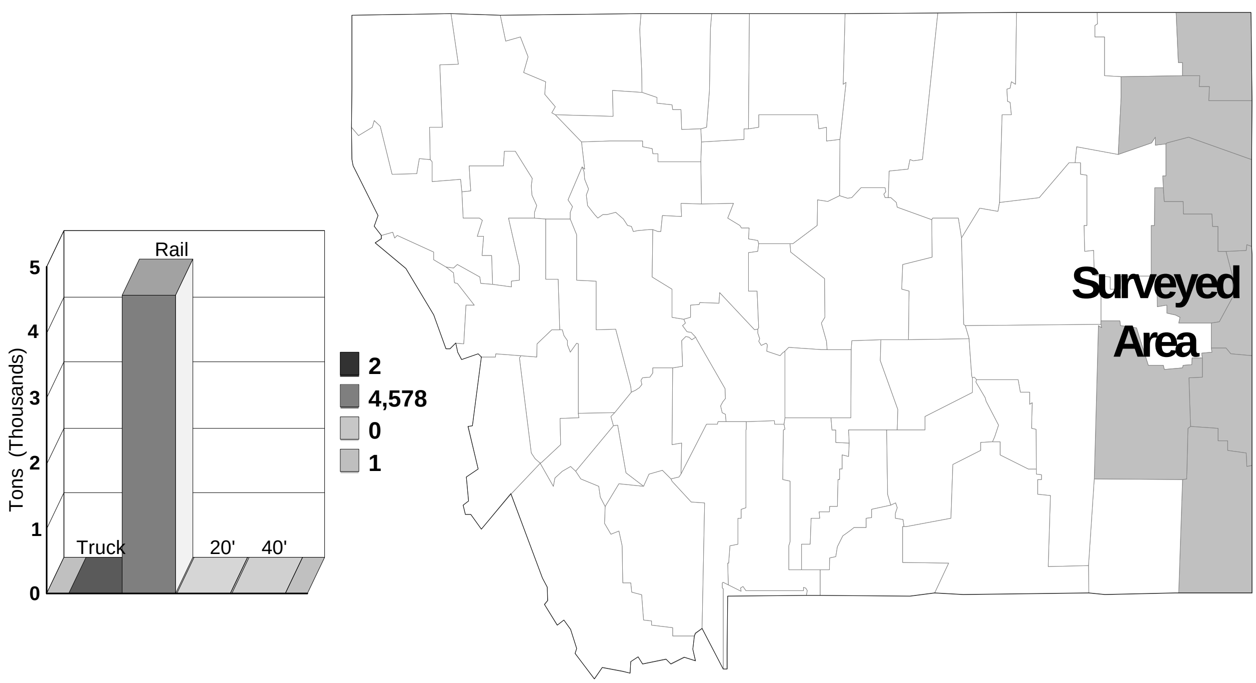


Figure 16. Outbound Truck, Rail, 20' and 40' Container Freight from the Intermodal Survey (2001)

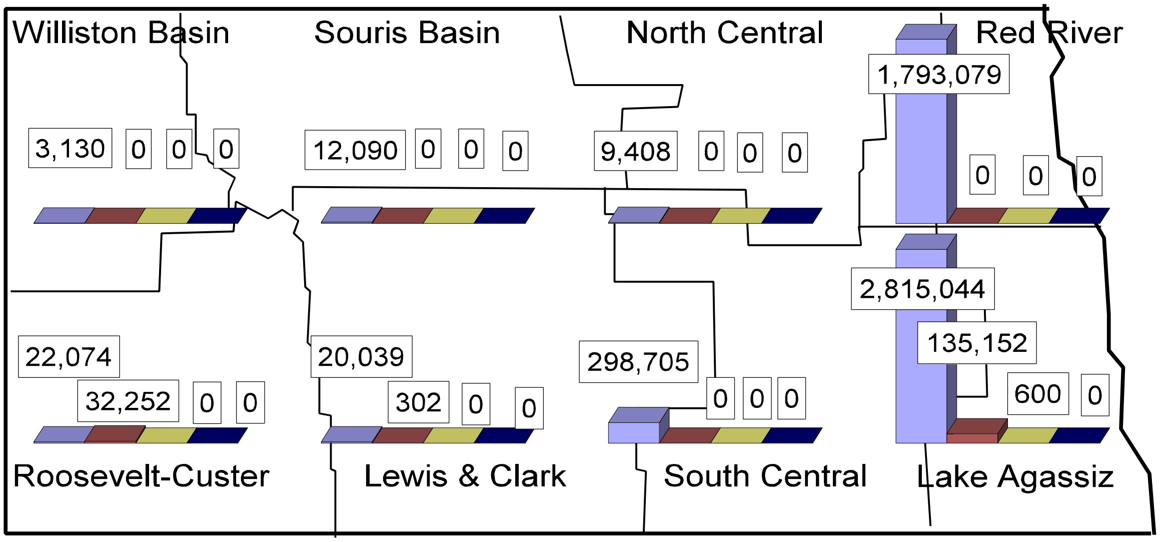
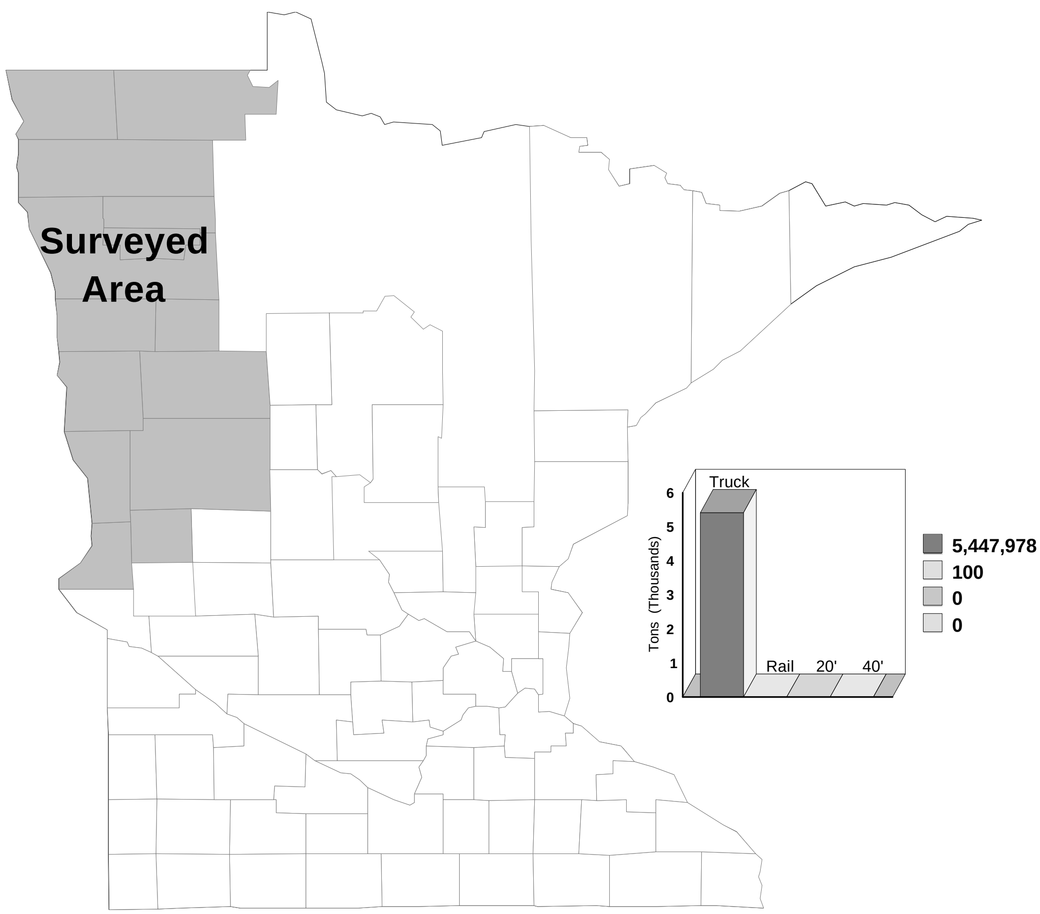


Figure 17. Inbound Truck, Rail, 20' and 40' Container Tons from the Intermodal Survey (2001)



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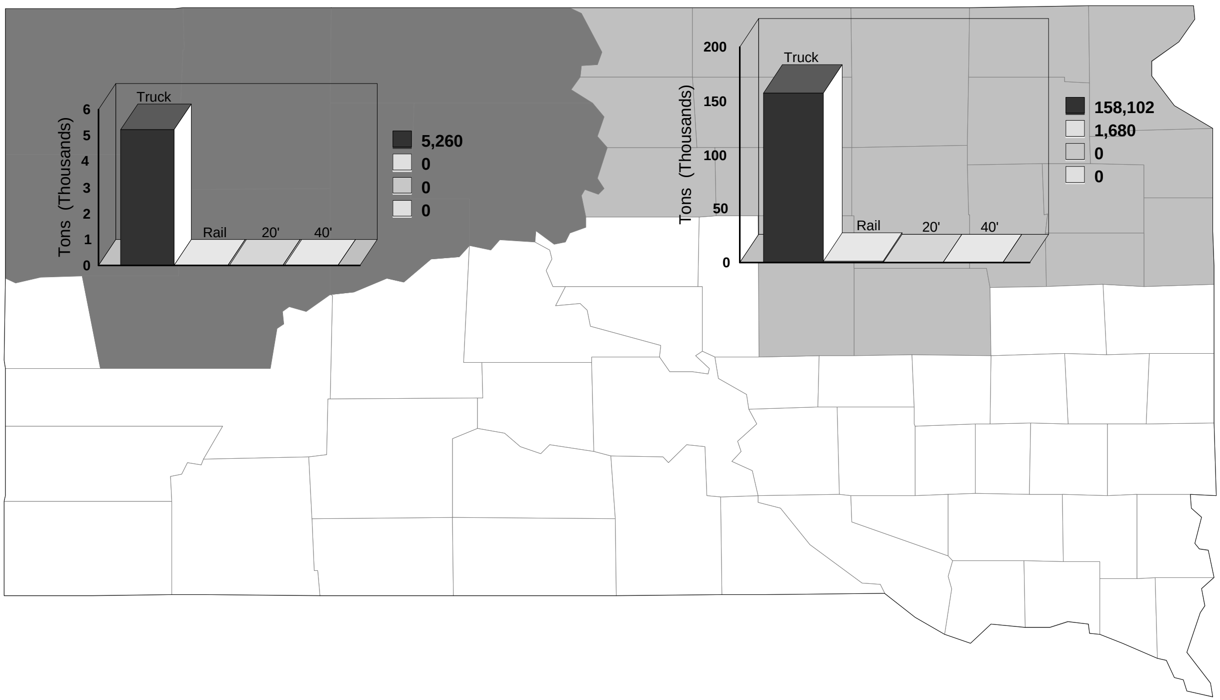
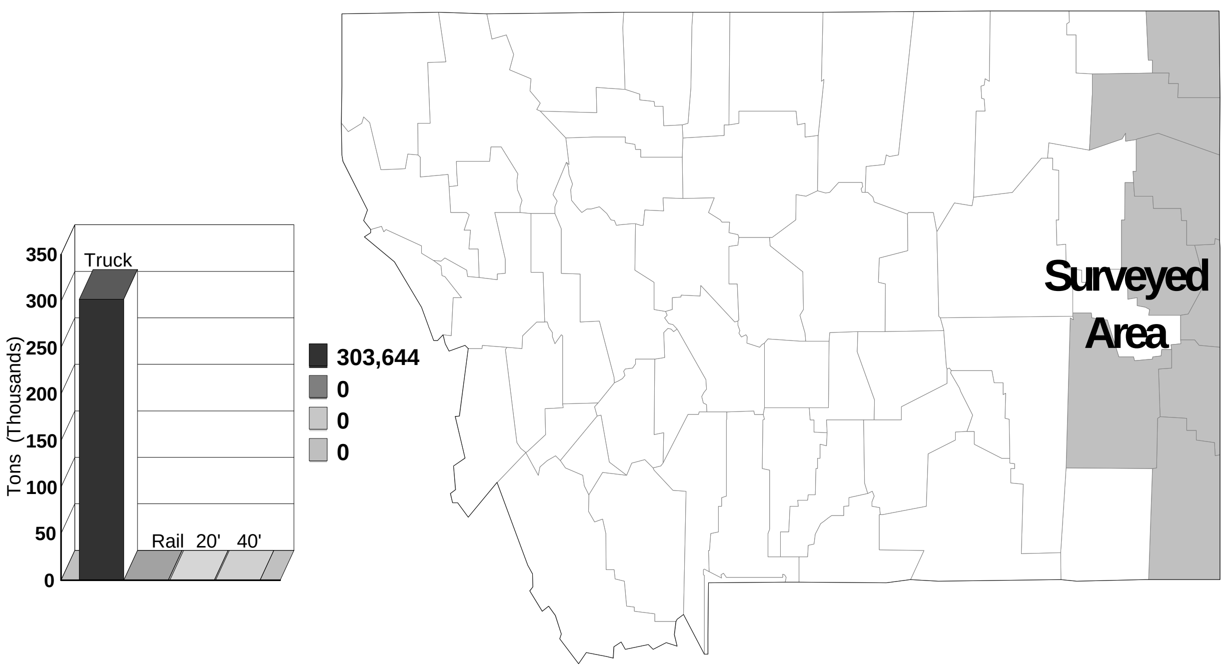


Figure 19. Inbound Truck, Rail, 20' and 40' Container Tons from the Intermodal Survey (2001)



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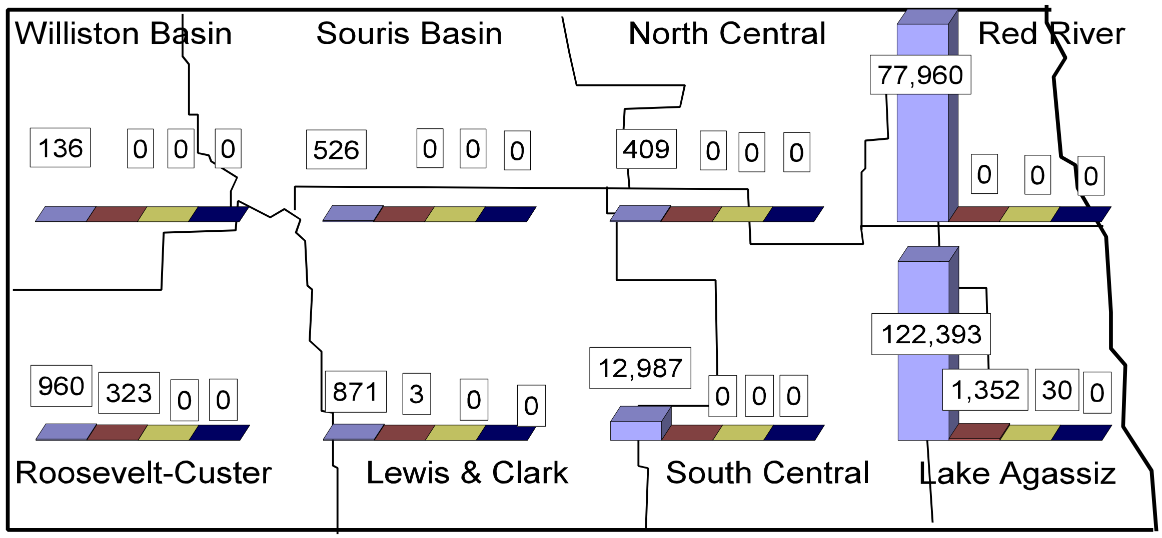

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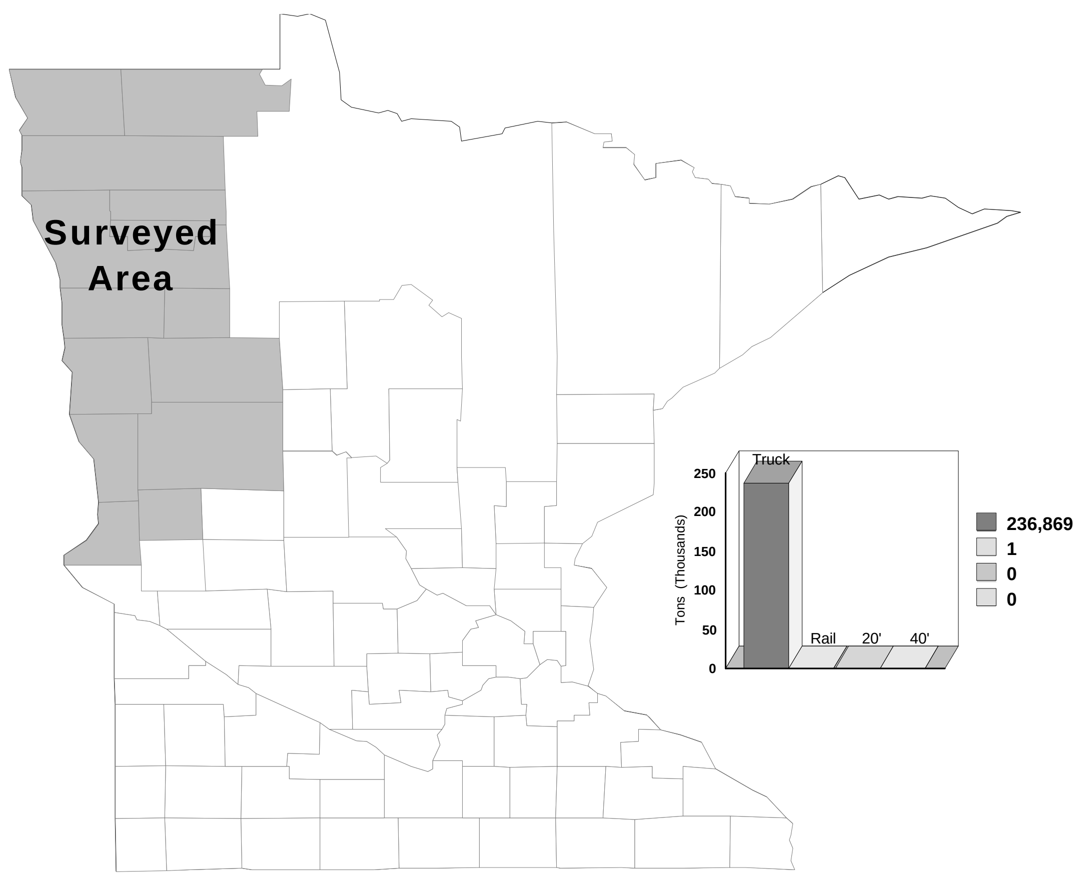

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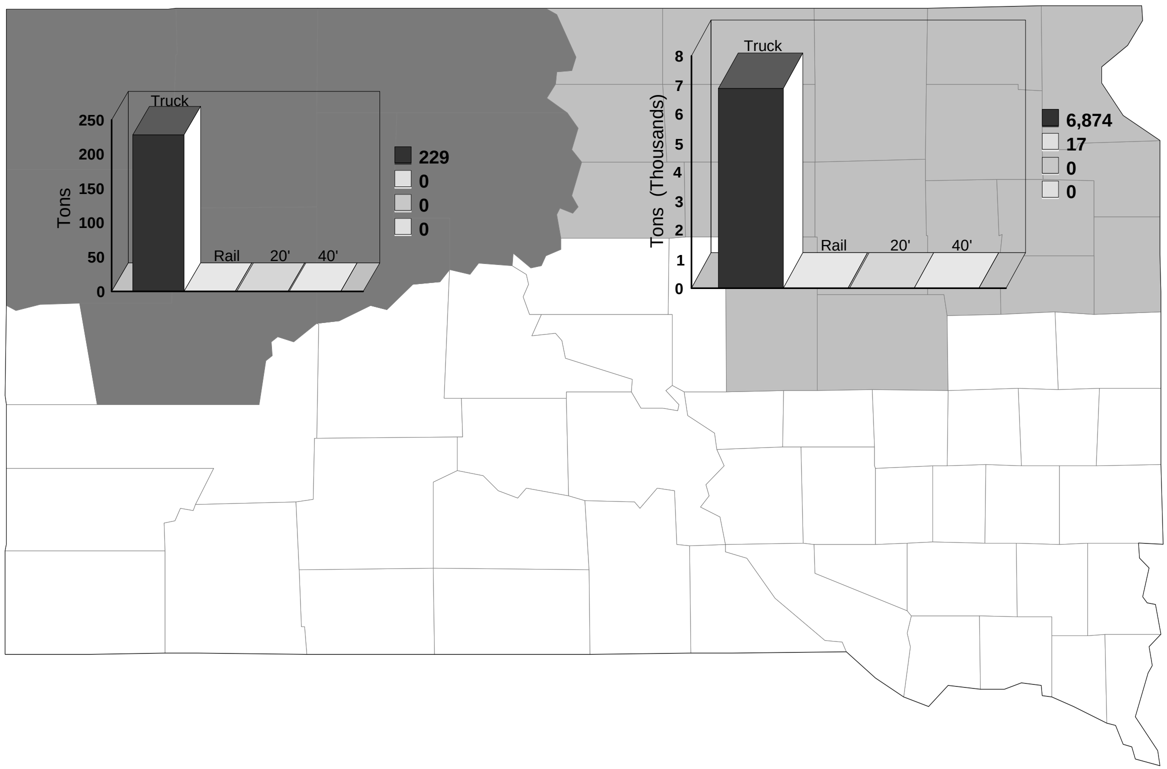


Figure 23. Inbound Truck, Rail, 20' and 40' Container Freight from the Intermodal Survey (2001)

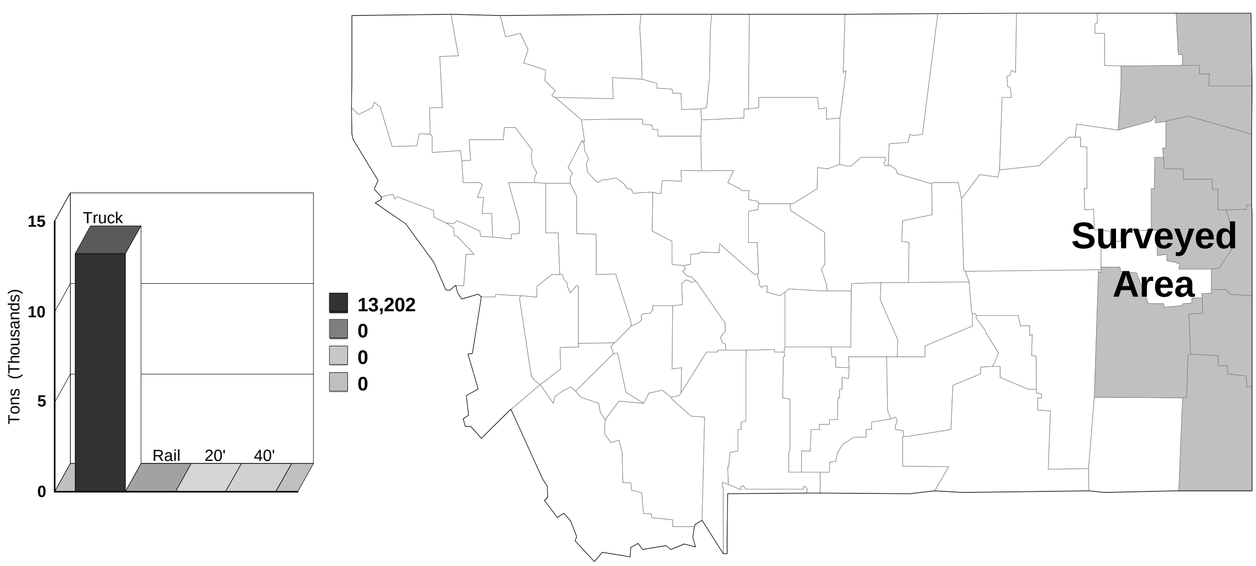


Figure 24. Inbound Truck, Rail, 20' and 40' Container Freight from the Intermodal Survey (2001)

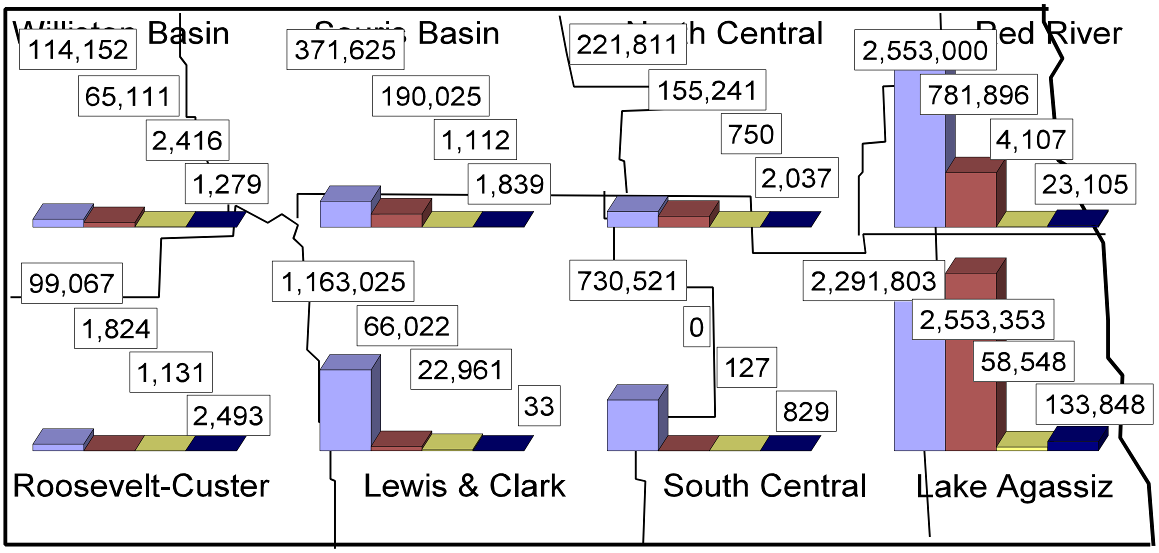
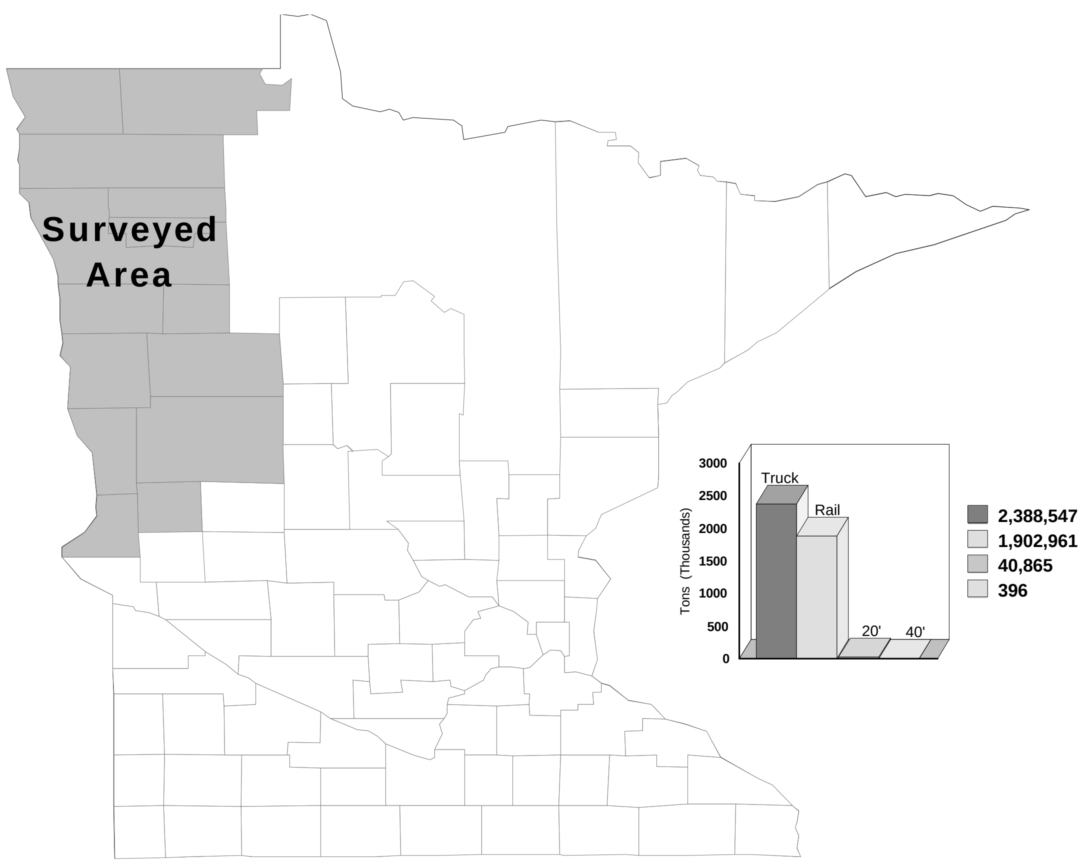


Figure 25. Estimated Outbound Truck, Rail, 20' and 40' Container Tons from the Intermodal Survey (2001) - Authors' Calculation using the Survey and MNI



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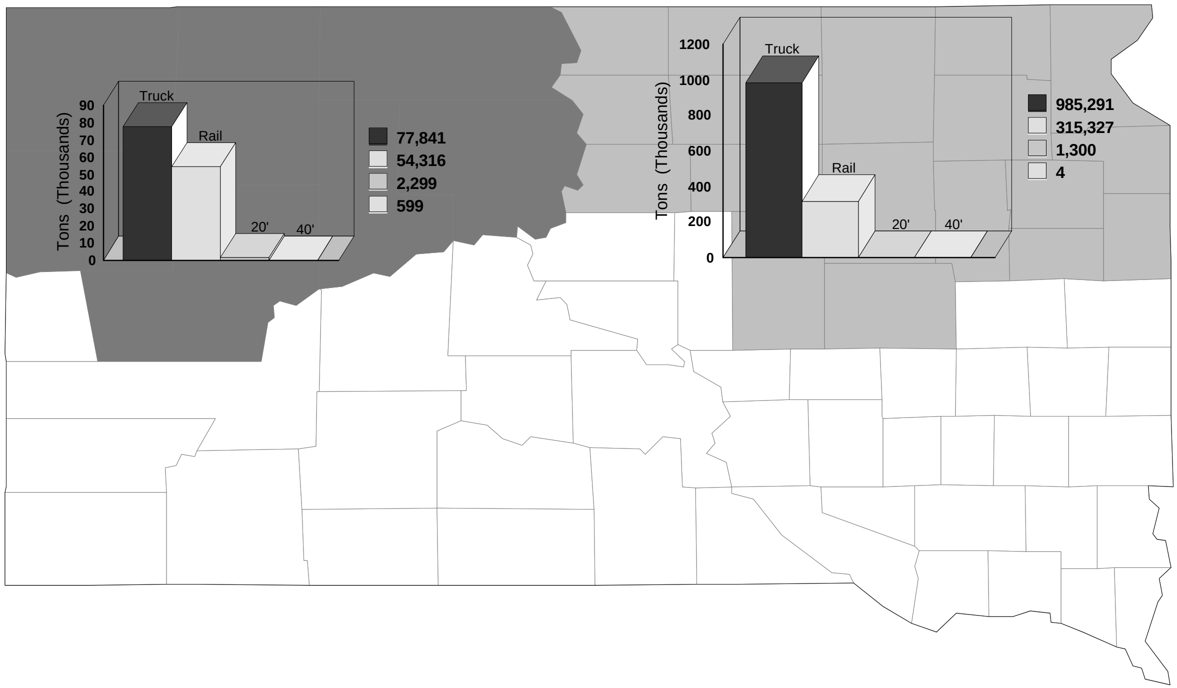

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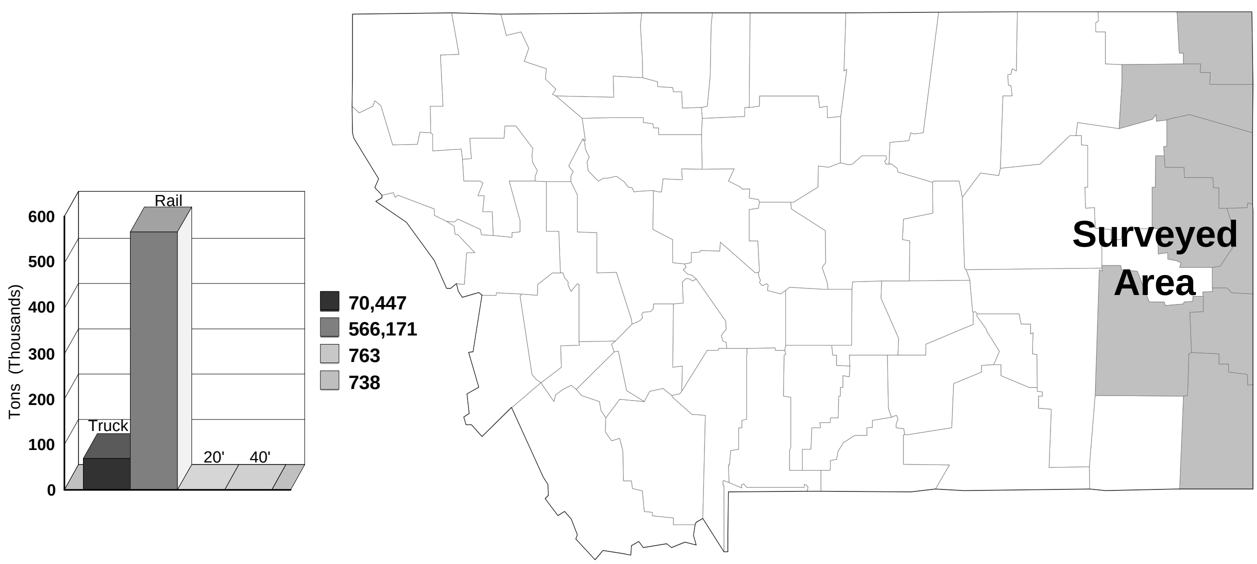

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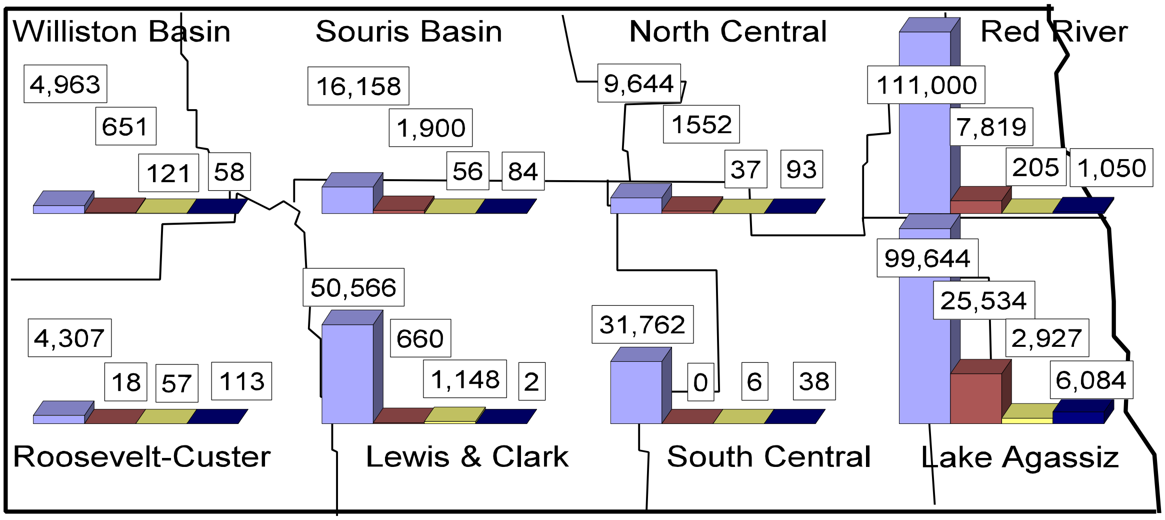

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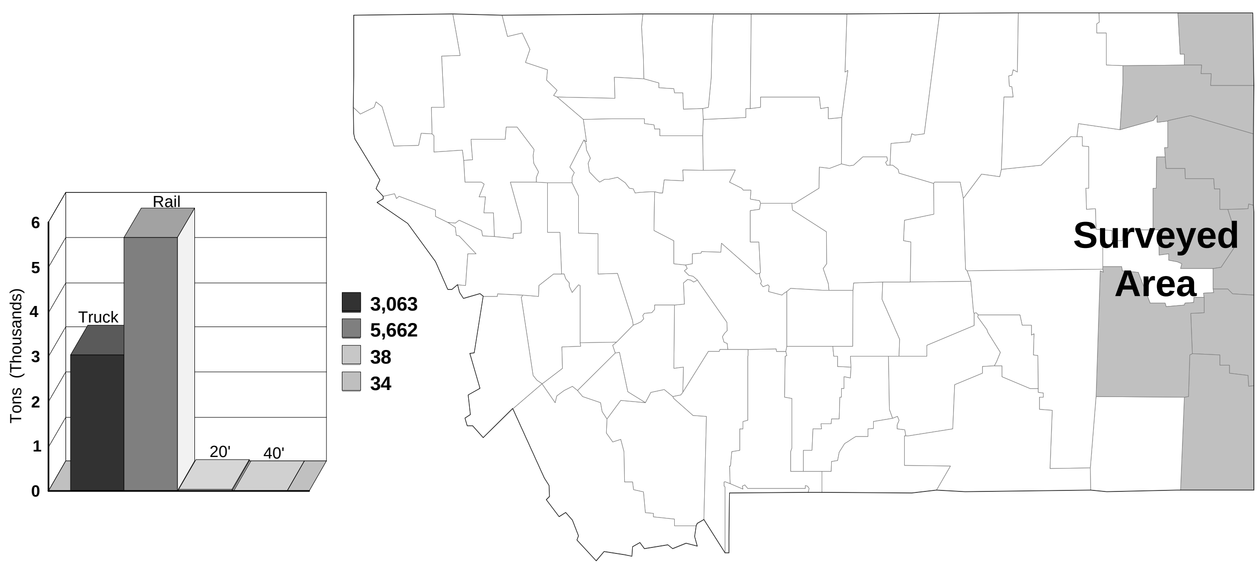

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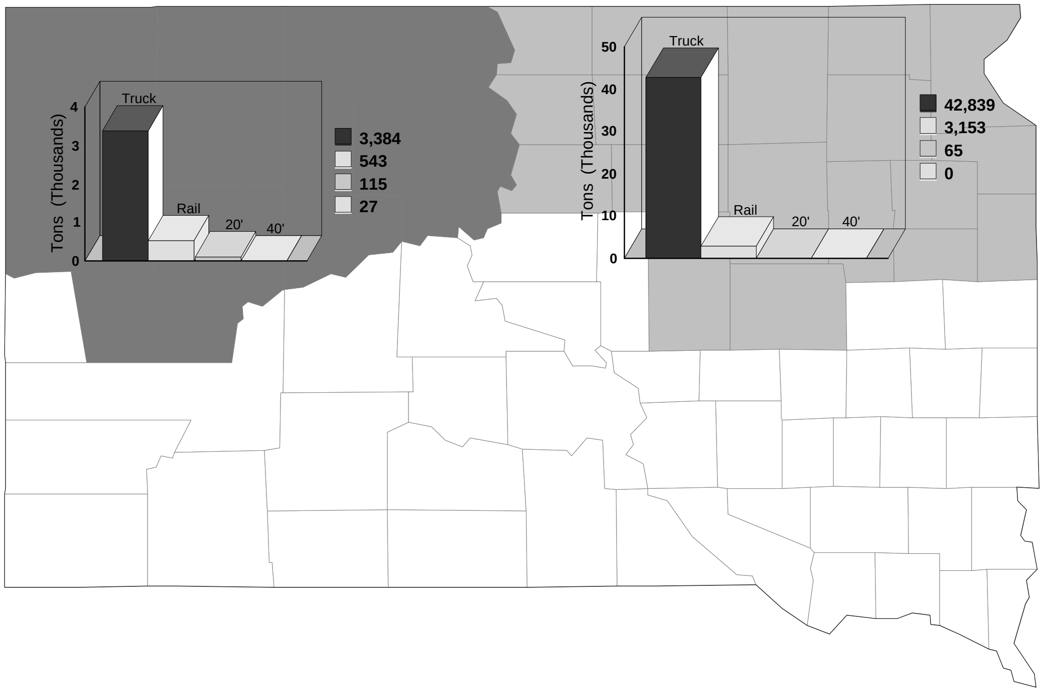

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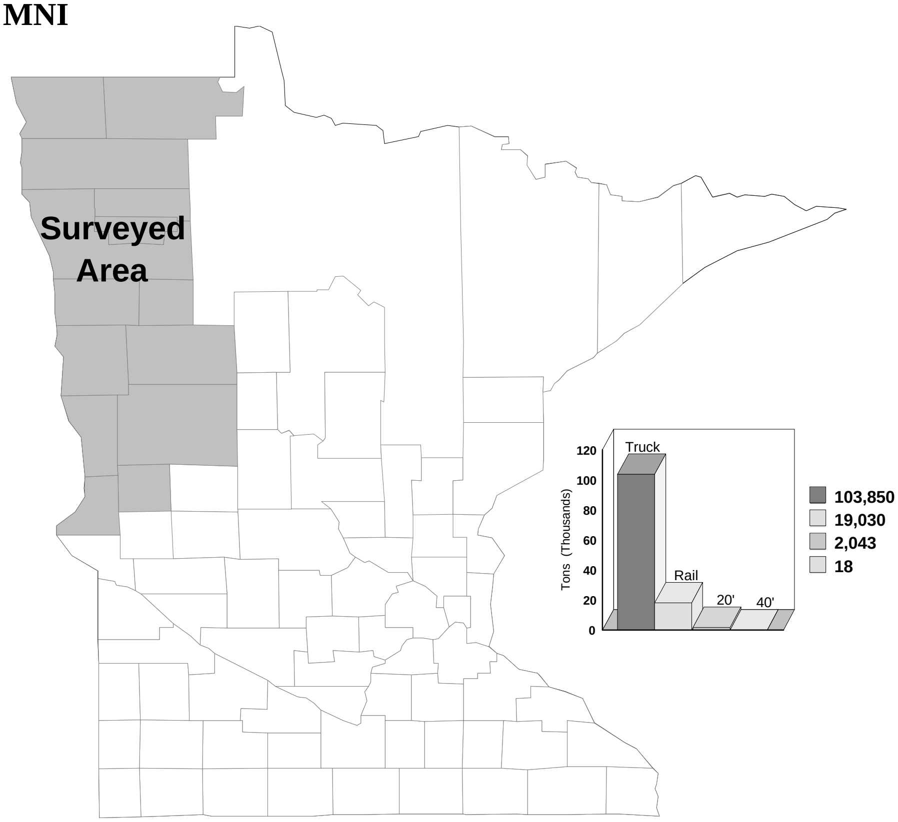

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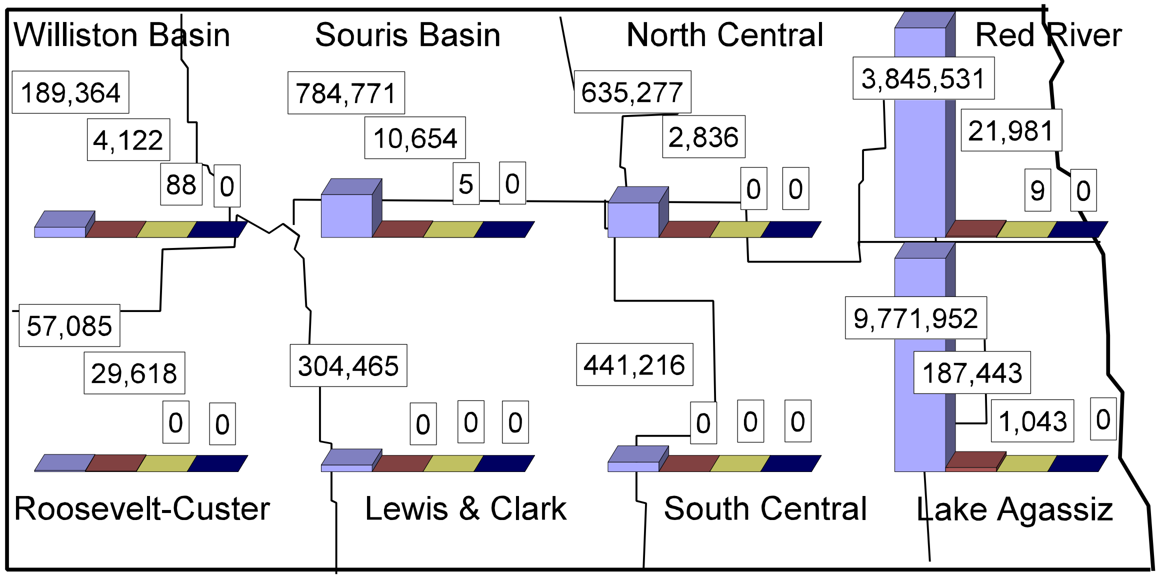

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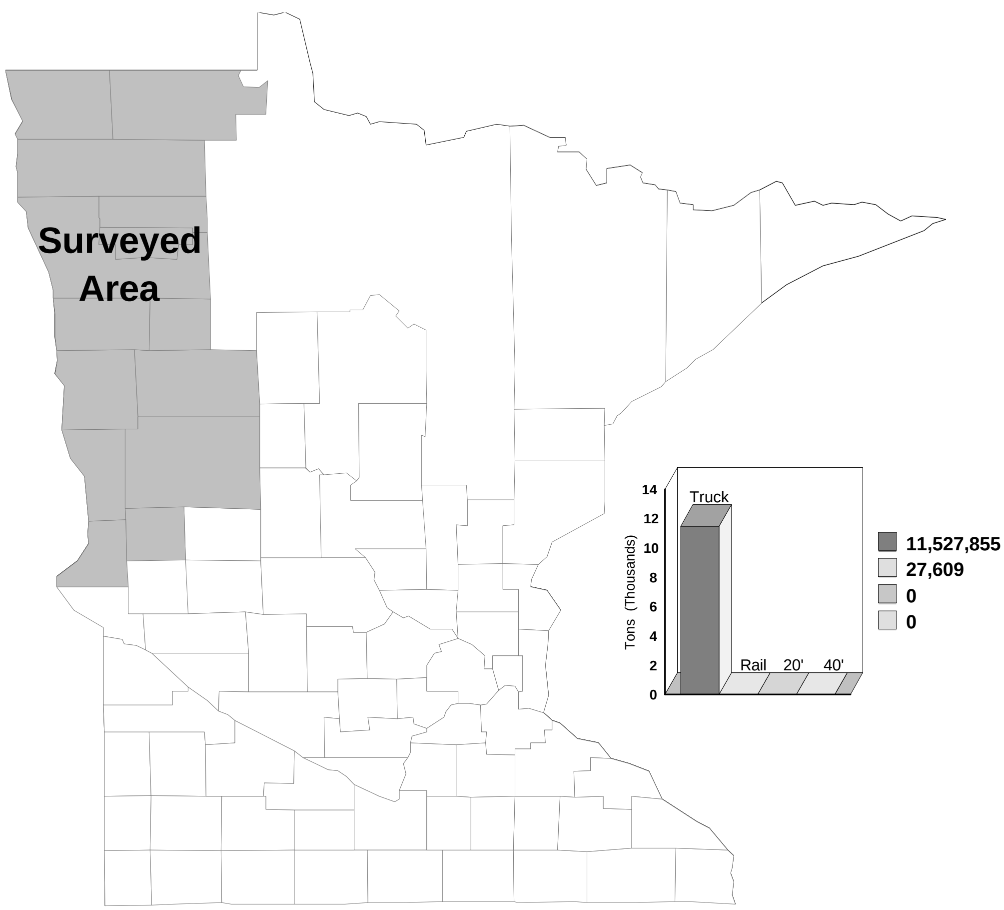

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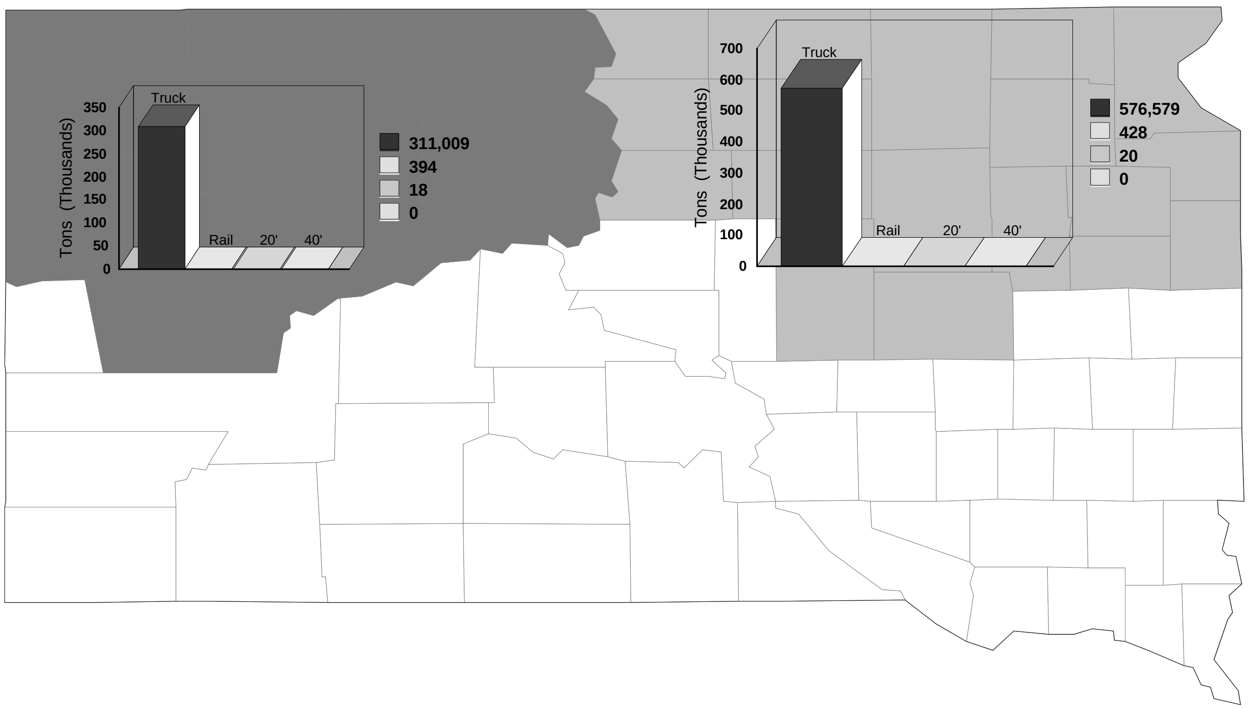

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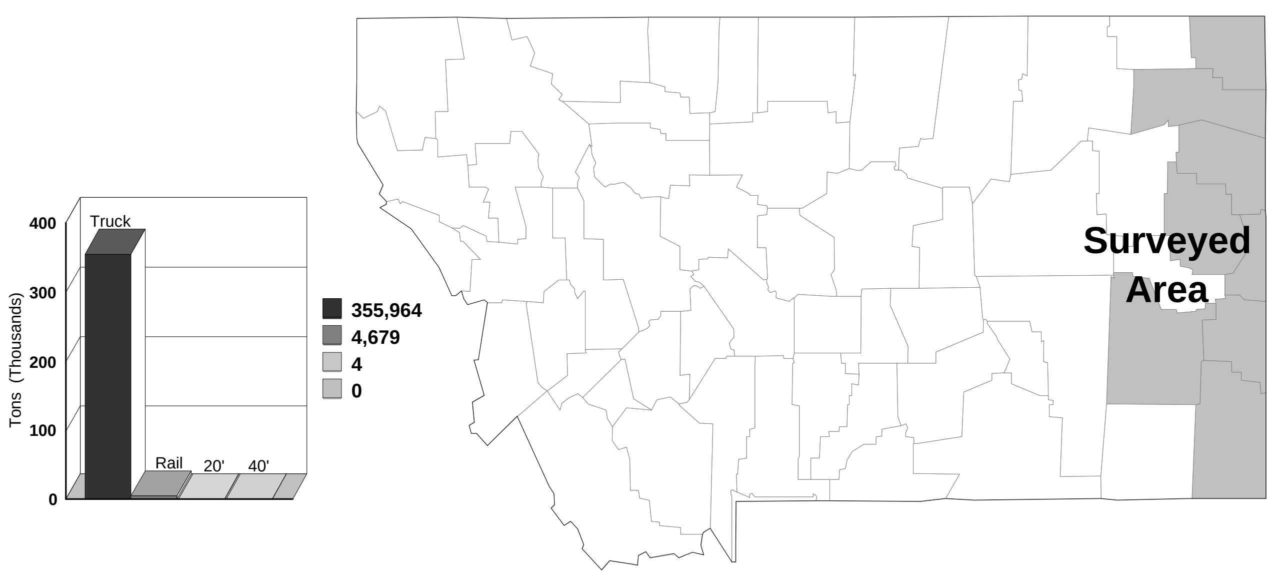

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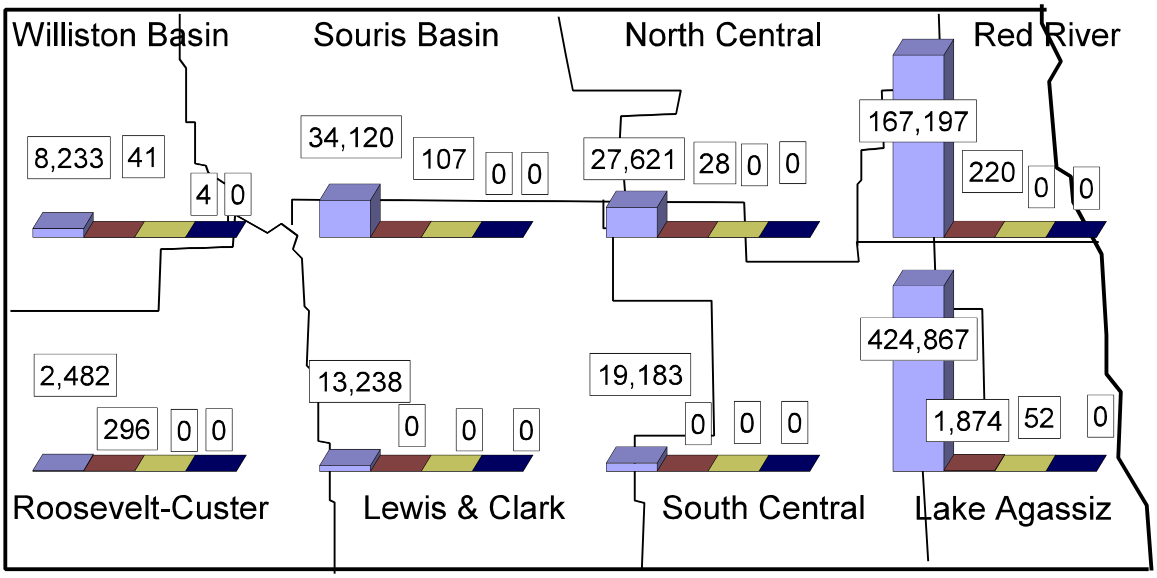
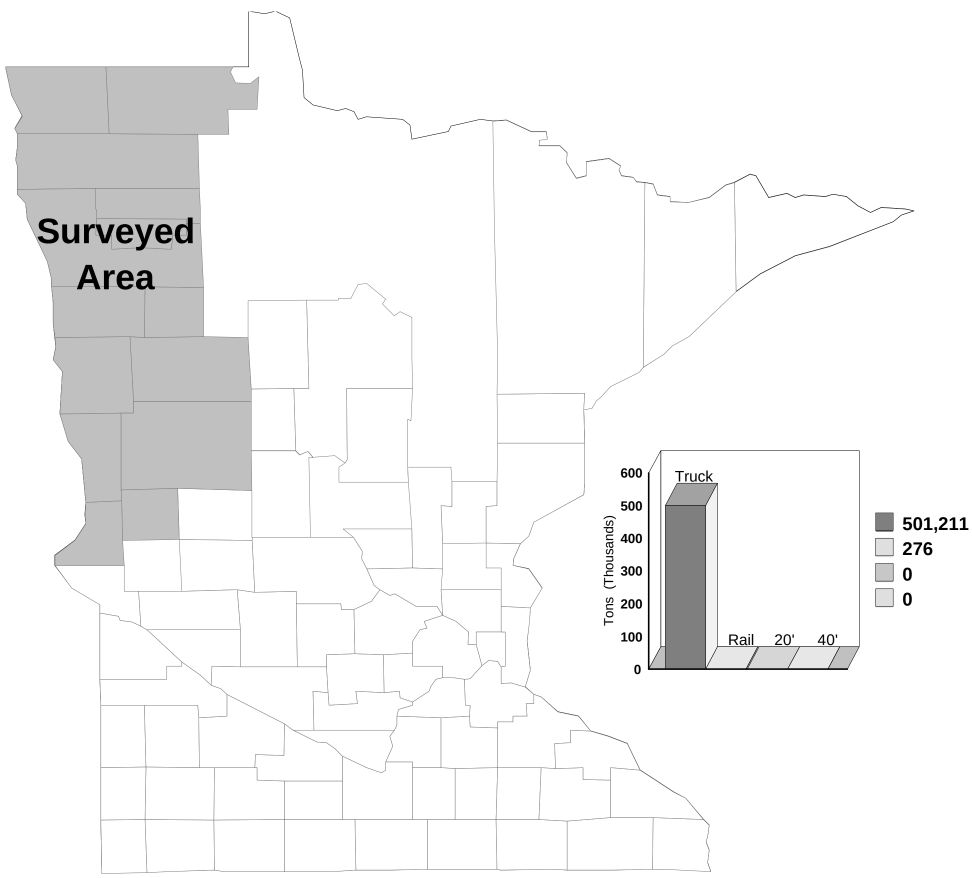


Figure 37. **Estimated Inbound Truck, Rail, 20' and 40' Container Freight from the Intermodal Survey (2001) - Authors' Calculation using the Survey and MNI**



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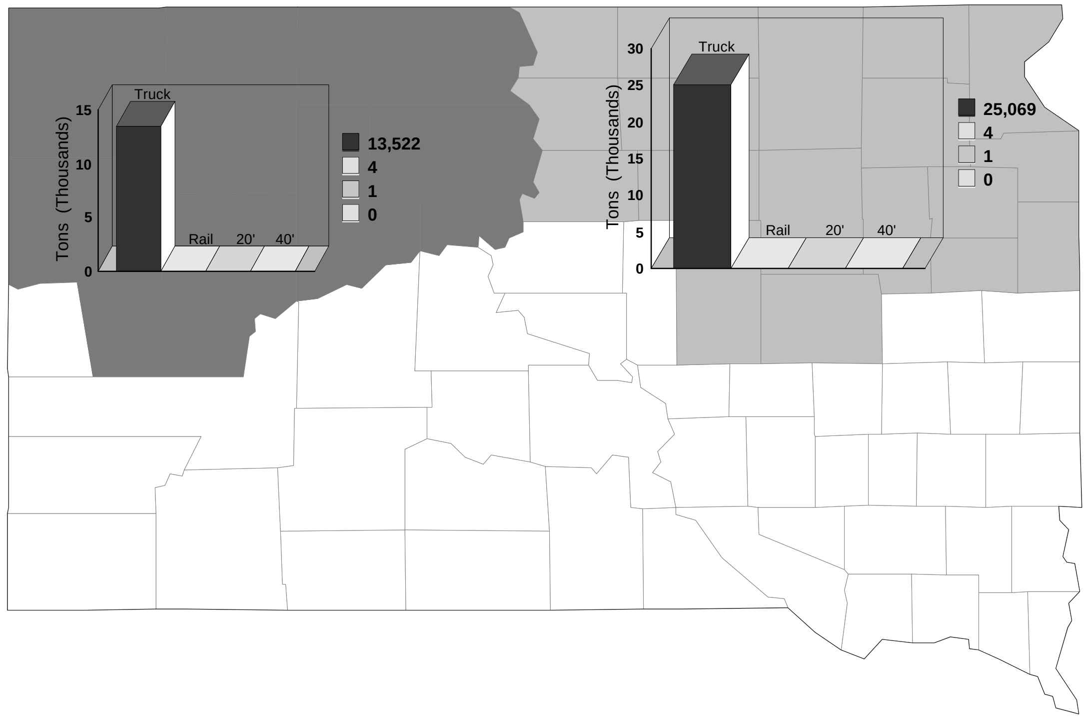

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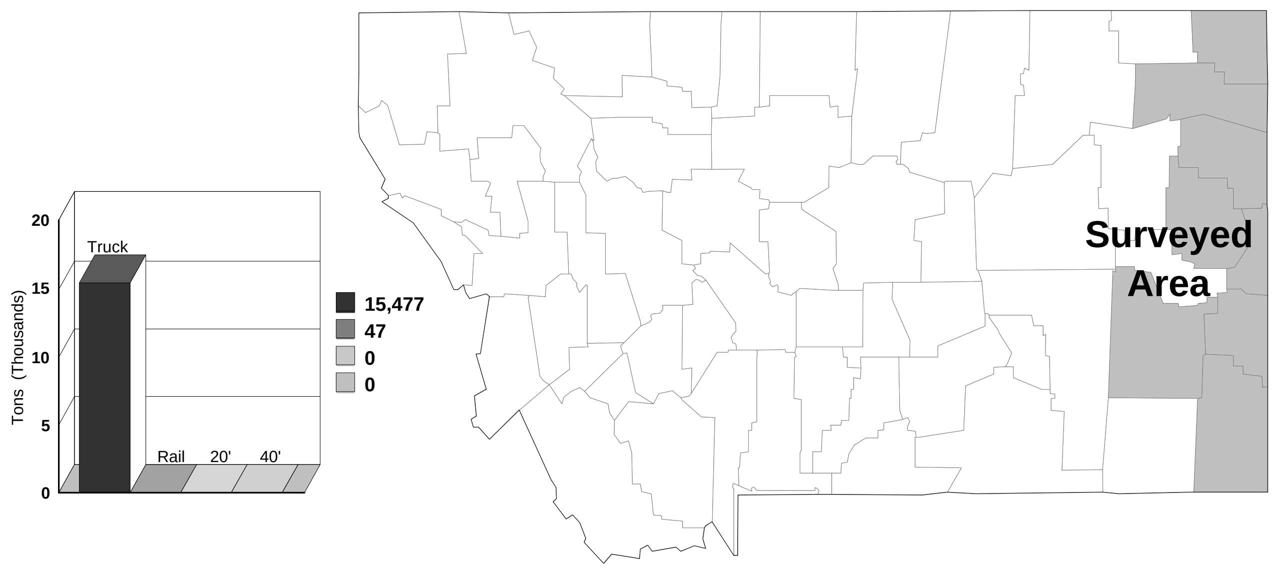

Figure 40. Estimated Inbound Truck, Rail, 20' and 40' Container Freight from the Intermodal Survey (2001) - Authors' Calculation using the Survey and MNI

APPENDIX 6

PROGRAM PURPOSE: Public Law 480 (P.L. 480) also known as the Food for Peace Program.

The P.L. 480 food aid program is comprised of three titles. Each title has different objectives and provides agricultural assistance to countries at different levels of economic development. Title I of the P.L. 480 program is administered by USDA, and Titles II and III are administered by the Agency for International Development (AID). P.L. 480 programs are entered to combat hunger and malnutrition; promote broad-based equitable and sustainable development, including agricultural development; expand international trade; develop and expand export markets for United States agricultural commodities; and to foster and encourage development of private enterprise and democratic participation in developing countries.

Source: http://www.fas.usda.gov/excredits/pl480/pl480ofst.html

Steamship companies are required to arrange for a Vessel Loading Observation (VLO) certificate for commodities which are shipped under the PL480 Title II and Title III, Food for Progress, and Section 416b programs.

The VLO certificate includes requirements and procedures for inspection, shipment, and safe handling of all PL480 Title II and Title III, Food for Progress, and Section 416b commodities to eliminate the loading of damaged packages that could potentially create unsanitary transfer of goods. Pre-packaged commodities arriving at the supplier's (steamship company) plant receive an initial inspection for damage. Depending on the extent of damage, packages may be repaired. Paper bags with multi-wall construction can be repaired only if all layers are not punctured and the contents are not leaking. The outer walls can be repaired using specified (brown) tape, as long as the inner walls of the bag are intact. Textile bags with significant punctures which leak contents can be repaired by sewing, stitching, or slipping a sound and clean textile bag over the top of the punctured bag. Packages damaged beyond repair will not be loaded by the supplier plant. The procedure requirements, however, do not apply to shipments in which commodities are to be delivered free on board at the commodity supplier's plant. Basically, there are no stringent requirements for commodity suppliers as to which mode of transport their products endure whether shipping by truck, railcar, 20= container, or 40= container. The only requirement is that the commodity meets AU.S. Standards for Whole Dry Peas, Split Peas, and Lentils@ upon arrival and departure from the supplier's facility. In accordance with applicable laws, steamship companies are responsible for the sanitary loading of commodities once the commodities are delivered to their loading facility.

Sources: http://www.fsa.usda.gov/daco/eod_notices/eod68.pdf
http://www.fas.usda.gov/excredits/pl480/commodities/peabeans.htm

Customs mean many things to many people. To the international traveler, Customs is the men and women in blue at the border station, airport, or seaport who examine personal baggage upon return to the States. To the importer, Customs provides advice, protection, and control of merchandise shipped into the country. To the smuggler, Customs is the planes, vessels, vehicles, and dedicated people constantly monitoring the nation's perimeter to thwart smuggling and attempts at illicit entry of merchandise.

The United States Customs Service is the primary enforcement agency protecting the Nation's borders. It is the only border agency with an extensive air, land, and marine interdiction force and with an investigative component supported by its own intelligence branch.

Determining Admissibility/Customs Examination of Goods

In simple cases involving small shipments or certain classes of goods, such as bulk shipments, examination may be made on the docks, at container stations, cargo terminals, or the importer's premises. The goods are then released to the importer. In other shipments, sample packages of the merchandise may be retained by Customs for appraisal or classification purposes and the remainder of the shipment released. These sample packages also will be released to the importer after examination.

Examination of goods is necessary to determine:

- The value of the goods for Customs purposes and their dutiable status.
- Whether the goods are properly marked with the country of their origin. Special marking or labeling may apply. Generally, imported merchandise must be legibly marked in a conspicuous place and with the English name of the country of origin. Certain specific articles are exempt from this requirement. (For further information see Customs Publication No. 539 Marking of Country of Origin on U.S. Imports.)
- Whether the goods have been correctly invoiced.
- Whether the shipment contains prohibited articles.
- Whether the requirements of other federal agencies have been met.
- Whether the amount of goods listed on the invoice is correct, and no shortage or overage exists.

If necessary, goods may be analyzed by a Customs laboratory to determine proper classification and appraisal, to determine that the goods meet safety requirements, or to ensure that they are not counterfeit or otherwise in violation of U.S. laws.

If Customs determines that the goods are different from the entered descriptions in quantity or value, that the classification of the goods is incorrect, or that a different rate of duty than the one indicated by the importer applies, an increase in duties may be assessed. If Customs determines that the importer has deliberately failed to properly classify and value his goods, he may be liable for a fine, or other penalty.

When all information has been acquired, including the report of the Customs import specialist as to customs value of the goods, and the laboratory report, if required, a final determination of duty is made and the entry is liquidated. At this time, any overpayment of duty is returned or under-payments billed.

Source: http://www.customs.gov/impoexpo/import.htm

Imports

Imports are continually checked to ensure that they comply with the myriad of laws involving public health, safety, and protection of intellectual property rights. To speed customs clearance, the import community and the Customs Service have created the Customs Automated Commercial System (ACS), which electronically receives and processes entry documentation and provides cargo disposition information. Cargo carriers, customs brokers, and importers may use the system, which reduces clearance time from days to hours or even minutes. Persons entering into the importing trade who intend to file their own entry documentation with Customs are encouraged to explore this method of transacting business. Also, those importing merchandise either for their own use or for commercial transactions may use a customs broker who transacts customs business using the Automated Broker Interface (ABI) in combination with ACS.

Exports

The Automated Export System (AES) is a joint venture between the U.S. Customs Service, the Foreign Trade Division of the Bureau of the Census (Commerce), the Bureau of Industry and Security (Commerce), the Office of Defense Trade Controls (State), other Federal agencies, and the export trade community. It is the central point through which export shipment data required by multiple agencies is filed electronically to Customs, using the efficiencies of Electronic Data Interchange (EDI). AES provides an alternative to filing paper Shipper's Export Declarations (SEDs). Export information is collected electronically and edited immediately, and errors are detected and corrected at the time of filing. AES is a nationwide system operational at all ports and for all methods of transportation. It was designed to assure compliance with and enforcement of laws relating to exporting, improve trade statistics, reduce duplicate reporting to multiple agencies, and improve customer service. AES has the goal of paperless reporting of export information by the year 2002.

The export process begins when the exporter decides to export merchandise. The exporter or his authorized forwarding agent makes shipping arrangements with the carrier. The exporter or his authorized forwarding agent transmits the shipper’s export information using AES. This information can come directly from the exporter or his authorized agent or through a service center or port authority. The AES validates data against editing tables and U.S. Government agency requirement files and generates a confirmation message or error messages back to the filer. The carrier or an authorized forwarding agent transmits the export manifest data using AES. The AES validates the transportation data then generates either a confirmation message or an error message. Any errors messages generated by AES must be corrected and the corrections transmitted to AES.

APPENDIX 7

TRANSACTION, TEA21, STATUTE

TransAction: North Dakota's Statewide Strategic Transportation Plan

At the time this paper was written, North Dakota's Statewide Strategic Transportation Plan was in a draft form. It is necessary to review the plan for this study because of the implications of the vision, mission and goals of the planners in promoting intermodal in North Dakota. The promotion of an intermodal freight facility(s) in North Dakota may fit within the plan's many mentions of public private partnerships to promote economic development across the state.

There are many references to intermodal in the plan. Implications of the need for intermodal are stated in the vision, mission, and goals. The first reference to the need of an intermodal facility is in the emerging trends section identifying specialized agriculture. Also identifying the increasing world demand for value added agricultural products or finished food products. Also there is mention of a growing manufacturing sector that would promote the existence of an intermodal loading facility.

Table 1. Mission, Vision and Goals of North Dakota's Strategic Transportation Plan.

Mission: "North Dakota will provide a transportation system that offers personal choices, enhances business opportunities, and promotes the wise use of all resources."
Vision: "North Dakota's transportation system is an important part of regional, national, and global systems, developed strategically to help grow and diversify the economy and enhance our quality of life."
Goals: "Create safe and secure transportation for residents, vistors and freight. Create a transportation system that- allows optimum personal mobility. allows the efficient and effective movement of freight enhances economic diversity, growth and competitiveness. Create funding sufficient to protect North Dakota's transportation investment and address future transportation needs.

(North Dakota's Statewide Strategic Transportation Plan, 2002)

Within the plan, 16 initiatives were identified. Strategies were attached to the initiatives that provide solutions or guidance to act on the initiative. Of the 16 initiatives, 15 could apply to container highway/rail intermodal service within the state. These initiatives are:

1. North Dakota will strategically prioritize its use of tranportation resources.
2. North Dakota will define the levels of transportation service it will strive to provide and maintain.
3. North Dakota will enhance communication and facilitate cooperation and collaboration between and within governmental units, tribal authortities, modes of transportation, and the public and private sectors.
4. North Dakota will improve the performance of priority transportation corridors and facilities.
5. North Dakota will incorporate economic competitiveness as an integral component of transportation investment.
6. North Dakota will analyze the economic impacts of load limits and the benefits of establishing a statewide program to coordinate the administration of load limits.
7. ***North Dakota will determine the feasibility of, and identify the conditions necessary for, developing an intermodal freight facility or facilities.***
8. North Dakota will determine the opportunities for, and economic and safety impacts of, a regional uniform truck size, weight, and permitting system.
9. North Dakota will appropriately use Intelligent Transportation System (ITS) technologies.
10. North Dakota will conduct a statewide freight origin and destination study and identify priority transportation corridors and facilities.
11. North Dakota will create a special transportation program (infrastructure funding and technical assistance) to facilitate economic development and competitiveness.
12. North Dakota will take a lead role in promoting public private partnerships to bring about selected transportation initiatives.
13. North Dakota will actively participate in regional and national initiatives, programs, studies, and projects.
14. North Dakota will increase its emphasis on safety and security as integral components in planning, developing, and maintaining the transportation system.
15. North Dakota will develop a statewide passenger service and transit plan.
16. North Dakota will monitor trends in agriculture, manufacturing, tourism, and energy production to identify potential transportation impacts and opportunities.

The Transportation Equity Act for the 21st Century (TEA-21)

The Transportation Equity Act for the 21st Century (TEA-21) was first enacted on June 9, 1998, and the TEA-21 Restoration Act was enacted on July 22, 1998. The Transportation Equity Act for the 21st Century authorized highway, highway safety, transit and other surface transportation programs for the next six years. Goals of the TEA-21 are to improve public safety, protect environment, and expand job opportunity, and rebuild transportation infrastructure. This will promote economic growth and trade, increase competitiveness of companies, and enhance rail or intermodal service to small communities or rural areas.

Specific features of TEA-21 are:

1. Assurance of a guaranteed level of federal funds for surface transportation through FY 2003. Transit funding is guaranteed at a selected fixed amount.

2. Extension of the disadvantaged business enterprises (DBE) program, providing a flexible national 10 percent goal for the participation of disadvantaged business enterprises

3. Strengthening of safety programs across the department of transportation (DOT). New incentive programs are aimed at increasing the use of safety belts and promoting the enactment and enforcement for drunk driving.

4. Continuation of the proven and effective program structure established for highways and transit under the landmark ISTEA legislation. New programs, such as border infrastructure, transportation infrastructure finance and innovation, and access to jobs target special areas of national interest and concern.

5. Conducting research and its application to maximize the performance of the transportation system.

The total TEA-21 fund for the six years (1998-2003) is $217,889 million and the average is $36,315 million. The fund provides loans and loan guarantees to state and local governments, government sponsored authorities, corporations, railroads, and joint ventures. Specifically, the TEA-21 fund consists in federal-aid highways (Title 1), highway safety (Title 2), federal transit administration programs (Title 3), motor carrier safety (Title 4), transportation research 9 (Title 5), and miscellaneous (Title 6). These funds are described in Table 2.

As shown in Tables 2, Federal-Aid highways including national highway, surface transportation, terminal and infrastructure programs, have a large portion of TEA-21 funds.

Furthermore, TEA-21 highlights intermodalism to promote balanced, integrated, and efficient transportation to improve economic competitiveness. This is associated with the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA).

Table 2. Total Transportation Equity Act for the 21st Century (TEA-21) Funds (Source: Authorization Table, TEA-21, United States Department of Transportation)

	1998	1999	2000	2001	2002	2003	Total	Average
Title 1 - Federal-aid highways	$23,816	$28,191	$28,910	$29,487	$30,065	$30,636	$171,108	$28,518
Title 2 - Highway safety	$258	$274	$288	$294	$297	$299	$1,711	$285
Title 3 - Federal transit administration	$4,643	$6,341	$6,810	$7,274	$7,737	$8,194	$40,999	$6,833
Title 4 - Motor carrier safety	$85	$100	$105	$112	$117	$125	$644	$107
Title 5 - Transportation research	$407	$463	$482	$497	$507	$522	$2,881	$480
Title 6 - Miscellaneous	$57	$145	$146	$150	$22	$22	$544	$90
Grand Total TEA-21	$29,268	$35,515	$36,742	$37,815	$38,747	$39,799	$217,889	$36,314

(Amounts in Millions of dollars)

As shown in Tables 2, Federal-Aid highways including national highway, surface transportation, terminal and infrastructure programs, have a large portion of TEA-21 funds. Furthermore, TEA-21 highlights intermodalism to promote balanced, integrated, and efficient transportation to improve economic competitiveness. This is associated with the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA).

ISTEA states that it encourages and promotes development of a national intermodal transportation system in the United States to move people and goods in an energy-efficient manner, provide the foundation for improved productivity growth, strengthen the Nation's ability to compete in the global economy, and obtain the optimum yield from the Nation's transportation resources. Its specific objectives are to promote economic prosperity, improve quality of life and safety, enhance the environment, and ensure national security.

To achieve these objectives, ISTEA constructed the following specific steps.

1. To promote intermodalism
2. To improve planning and public participation
3. To empower state and local officials
4. To strengthen partnerships
5. To encourage performance management
6. To promote innovative financing
7. To encourage new technologies
8. To encourage better infrastructure investment and management

Further, it increases economic growth and competitiveness through efficient and flexible transportation at regional, domestic, and international levels.

However, there are several obstacles for funding and carrying out the ISTEA steps in North Dakota. A crucial problem is derived from a gap between a need for intermodal transportation facility and the level of available funds. North Dakota is the 17^{th} largest state in the U.S. in land area, forth smallest in population, and forth least densely populated (Regional Transportation Online Center, National Association of Development Organizations). Approximately 97 percent of its roads are rural and major shipping products are low-valued agricultural products. Since economic returns of intermodal transportation investment is lower than metropolitan regions, funding for intermodal transportation investment is limited.

Port Authority

"The term port authority refers to a state or local government that owns, operates, or otherwise provides wharf, dock, and other terminal investments at ports" (Coyle et.al., 1994). Ports can be municipal airports or other public transportation systems moving people and goods.

Many cities, counties, regions, and or states have provided terminal facilities to promote transit and efficient freight transportation. In the case of freight, the port authority may operate portions or all of the facility or lease facilities to private firms.

A taxing authority may provide funding for constructing and operating a port facility. Many states, counties, and or municipalities have engaged using port authority as a tool for providing shipping options for existing and or new development. Legislation dealing with port authority is common.

In conducting a cursory review of statutes for Montana and Idaho it was found that Montana code provides for regional and local port authority. Regional would be any two or more local governments may by joint resolution create a public body to be known as a regional port authority. In addition any county or municipality may, by resolution, create a public body known as the local port authority. There are special election rules and commissioners are elected or appointed to oversee the facility (Montana Code Annotated 7-14-1102 thru 7-14-1137, 2001).

The authority once established would have the authority to tax under certain guidelines, issue bonds, and expand to other counties or municipalities. Montana also has a statute for railroad and intermodal transportation facility loans and grants. This authorization is for the continued operation of branch lines and construction and operation of intermodal facilities (Montana Code Annotated 60-11-120, 2001).

The Idaho statute, which is titled “Watercourses and Port Districts,” focuses on water ports. It also states that the port only may be established in counties bordering on any continuous waterway system and can contain no more than one county. The authority once established would have the authority to tax under certain guidelines and issue bonds (Idaho Statutes 70-1102 thru 70-1113 and 70-1501 thru 70-1512).

A Port Authority statute for North Dakota could provide a method for cities, counties and/or regions to access the tax base for funding for an intermodal facility. Port Authority status may only provide for maintenance of a facility and not enough capital for initial construction. It may take initial funding from the state's general fund or a low interest loan from the Bank of North Dakota. Bonding authority that may be set forth in the rules of port authority status and may help provide a capital base to construct a facility.

The North Dakota Statewide Strategic Transportation Plan aims to use state transportation funds in a way that promotes economic development throughout the state. The following section of the report reviews the plan, examining ways that funding an intermodal facility may be complementary to its goals.

North Dakota Statute 24-02-37.

State highway fund - Priorities for expenditure - Use of investment income. The state highway fund, created by law and not otherwise appropriated and allocated must be applied and used for the purposes named in this section, as follows:

1. Except for investment income as provided in subsection 3, the fund must be applied in the following order of priority.

    a. The cost of maintaining the state highway system.

    b. The cost of construction and reconstruction of highways in the amount necessary to match, in whatever proportion may be required, federal aid granted to this state by the United States government for road purposes in North Dakota.

    c. Any portion of the highway fund not allocated as provided in subdivisions a and b may be expended for the construction of state highways without federal aid or maintenance of such state highways.

2. All funds heretofore appropriated or hereafter appropriated or transferred to the department, whether earmarked or designated for special projects or special purposes or not, must be placed or transferred into a single state highway fund in the office of the state treasurer and any claims for money expended by the department upon warrants prepared and issued by the office of management and budget and signed by the state auditor under this title must be paid out of the state highway fund by the state treasurer; provided, however, that the commissioner shall keep and maintain complete and accurate records showing that all expenditures have been made in accordance with legislative appropriations and authorizations.

3. The state treasurer shall deposit the monies in the state highway fund in an interest-bearing account at the Bank of North Dakota. The state treasure shall deposit 40 percent of the income derived from the interest-bearing account in a special

interest-bearing account in the state treasury known as the special road fund. The special road fund may be used, within the limits of legislative appropriation, exclusively for the construction and maintenance of access roads to and roads within recreational, tourist, and historical areas as designated by the special road committee. A political subdivision or state agency may request funds from the special road fund by applying to the committee on forms designated by the committee. The committee may require the political subdivision or state agency to contribute to the cost of the project as a condition of any expenditure authorized from the special road fund. Any monies in the fund not obligated by the special road committee on June 30th of each odd-numbered year must revert to the state highway fund.

APPENDIX 8

PRIOR STUDY

North Dakota's Outbound/Inbound Intermodal Survey

In 2000 a study was conducted by UGPTI to estimate intermodal volume. The survey was of North Dakota businesses. The businesses were chosen from a combination of the Department of Economic Development and Finance list of manufacturers in Bismarck and the Manufacturers Register of the State of North Dakota. A total of 457 businesses were surveyed, with 195 responding.

The survey identified 8,999 containers now being shipped by truck/rail intermodal from North Dakota (Table 1). This survey did not include elevators or individual farmers or groups of farmers now shipping identity-preserved grain. Respondents identified that the majority of shipments were from the Southeast portion of the state. The Southeast portion of the state

Table 1. Intermodal Survey: State Totals

Outbound Business	Number	Eastbound	Westbound
Export			
Rail Car	100	0%	100%
Trucks	2954	61%	39%
Containers	8011	65%	35%
Domestic			
Rail Car	1416	55%	45%
Trucks	32162	57%	43%
Containers	988	50%	50%
Inbound Business	Number	Eastbound	Westbound
Import			
Rail Car	104	50%	50%
Trucks	2064	61%	39%
Containers	813	50%	50%
Domestic			
Rail Car	1034	50%	50%
Trucks	19162	64%	36%
Containers	0	0%	0%

represented some 63 percent of all traffic. The Southcentral area of the state identified the next most traffic. There were many more respondents from Southeastern and Southcentral North Dakota than from the rest of the state. Of the 195 respondents, 85 were from Southeastern North Dakota and 28 were from Southcentral North Dakota.

The respondents in the Northwest region identified 17 containers — outbound and inbound. This may represent problems associated with the distance to an intermodal loading facility. The Northwest region represented a balance for inbound and outbound trucks and containers. The Northwest region of North Dakota includes the city of Minot. The number of businesses responding in Ward County was only 10, which does not provide an adequate representation of the Northwest region of North Dakota.

Table 2. Intermodal Survey: Northwest Region Totals

Outbound Business	Number	Eastbound	Westbound
Export			
Rail Car	4	0%	100%
Trucks	277	50%	50%
Containers	14	58%	42%
Domestic			
Rail Car	0	0%	0%
Trucks	838	59%	41%
Containers	0	0%	0%
Inbound Business	Number	Eastbound	Westbound
Import			
Rail Car	0	0%	0%
Trucks	293	69%	31%
Containers	3	50%	50%
Domestic			
Rail Car	0	0%	0%
Trucks	1150	64%	36%
Containers	0	0%	0%

The survey identified only truck traffic for the North-central region of North Dakota. Respondents identified no container traffic. The survey results are based on respondents and business density, therefore some areas of the state with low volume may not be a true representation of actual freight flows to and from an area.

Table 3. Intermodal Survey: North Central Region Totals

Outbound Business	Number	Eastbound	Westbound
Export			
Rail Car	0	0%	0%
Trucks	36	80%	20%
Containers	0	0%	0%
Domestic			
Rail Car	0	0%	0%
Trucks	1,154	53%	48%
Containers	0	0%	0%

Inbound Business	Number	Eastbound	Westbound
Import			
Rail Car	0	0%	0%
Trucks	212	75%	25%
Containers	0	0%	0%
Domestic			
Rail Car	0	0%	0%
Trucks	268	40%	60%
Containers	0	0%	0%

No containers were identified in the northeast region of North Dakota. There were only five respondents from Grand Forks County. A previous feasibility study for locating an intermodal facility at Grand Forks indicates a much larger freight flow from northeast North Dakota.

Table 4. Intermodal Survey: Northeast Region Totals

Outbound Business	Number	Eastbound	Westbound
Export			
Rail Car	0	0%	0%
Trucks	182	50%	50%
Containers	0	0%	0%
Domestic			
Rail Car	0	0%	0%
Trucks	249	63%	37%
Containers	0	0%	0%

Inbound Business	Number	Eastbound	Westbound
Import			
Rail Car	0	0%	0%
Trucks	53	50%	50%
Containers	0	0%	0%
Domestic			
Rail Car	0	0%	0%
Trucks	204	62%	38%
Containers	0	0%	0%

The southeast region of North Dakota represents the largest freight flow volumes from any area in the state. This is a combination of business density and willing respondents. The southeast region also is closest to an intermodal loading facility, which is located in Dilworth, Minn. The southeast region identified more than 8,000 outbound containers and more than 800 inbound containers. This represents a ratio of 10 to 1. For every 10 containers leaving the state, only one returns loaded. There is a cost associated with moving empty containers to shippers in the state. The southeast region also identified more than 20,000 trucks originating freight annually.

Table 5. Intermodal Survey: Southeast Region Totals

Outbound Business	Number	Eastbound	Westbound
Export			
Rail Car	100	0%	0%
Trucks	1,436	50%	50%
Containers	7,946	65%	35%
Domestic			
Rail Car	50	0%	0%
Trucks	19,164	60%	40%
Containers	780	50%	50%

Inbound Business	Number	Eastbound	Westbound
Import			
Rail Car	104	50%	50%
Trucks	1,426	75%	25%
Containers	810	87%	13%
Domestic			
Rail Car	30	100%	0%
Trucks	14,114	68%	32%
Containers	0	0%	0%

Table 6 shows that respondents reported 208 containers originating in south central North Dakota. The second highest response also was from the south central region of the state. This traffic represents a long drayage movements for empty and full containers to reach the intermodal facility.

Table 6. Intermodal Survey: South Central Region Totals

Outbound Business	Number	Eastbound	Westbound
Export			
Rail Car	0	0	0
Trucks	4	100%	0
Containers	0	0	0
Domestic			
Rail Car	1,260	60%	40%
Trucks	7,413	56%	44%
Containers	208	50%	50%

Inbound Business	Number	Eastbound	Westbound
Import			
Rail Car	0	0%	0%
Trucks	52	50%	50%
Containers	0	0	0
Domestic			
Rail Car	1,004	25%	75%
Trucks	2,558	59%	42%
Containers	0	0%	0%

Respondents from the southwest region of the state reported no container shipments. Outbound truck traffic was significant, but the long distance to an intermodal loading facility makes intermodal shipping impractical because of the high cost of drayage.

Table 7. Intermodal Survey: Southwest Region Total

OutboundBusines	Number	Eastbound	Westbound
Export			
Rail Car	0	0%	0%
Trucks	36	67%	33%
Containers	51	75%	25%
Domestic			
Rail Car	156	50%	50%
Trucks	3084	49%	51%
Containers	0	0%	0%
Inbound Business	Number	Eastbound	Westbound
Import			
Rail Car	0	0%	0%
Trucks	28	50%	50%
Containers	0	0%	0%
Domestic			
Rail Car	0	0%	0%
Trucks	868	78%	22%
Containers	0	0%	0%

The survey provides some insight into the shipping patterns for North Dakota. The low response rate in some areas of the state may not result in true representation of actual freight movements.

The survey revealed 8,999 outbound shipments by container. The factor most often identified by respondents in making shipping mode decisions was price or rate. The next factor respondents identified that determined transportation mode was availability. Third on the list was time or service.

APPENDIX 9

Explanation of Intermodal Equipment

This section gives brief descriptions of intermodal equipment. An intermodal facility could have all or part of the equipment listed below. There are many different intermodal options that could be used for a facility depending on volume, infrastructure needed, and product characteristics. The intermodal equipment listed below comes from Gerhardt Muller's *3rd Edition of Intermodal Freight Transportation.*

Cranes

Cranes of all types are used to move containers from ship-to-shore, or truck-to-train etc. The most widely used is the rail mounted gantry crane. It is built in the form of a bridge, supported by a trestle at each end. This is used mostly at ports to load and unload ships and has wheels so it can be moved from one pier to the other. A hinged boom crane is mounted so it can pivot at its base.

Straddle Carriers

Straddle carriers lift heavy loads to a minimum height for short-distance travel and are used to transfer containers to and from cranes. These straddle cranes also can be used to stack containers. Some straddle carriers are equipped with computer control systems used for direction and control of the straddle carrier and identification of containers.

Stacking Cranes

The rubber-tired gantry crane is a hybrid, falling between the gantry crane and straddle carrier. It is fashioned after the ship loading gantry without the boom and its purpose is to stack containers on the ground. It has the ability to stack containers higher and wider than the straddle carrier.

Forklift Trucks

Forklifts come in many sizes and varieties and these machines perform many tasks. These machines can move palletized freight or containers themselves, depending on their size. Forklifts have given way to roadstakers, which are similar to forklifts, but have the ability to reach over obstacles such as chassis, tracks, railcars, etc.

Container Handlers

Container handlers move, stack and load containers like forklift trucks, but use an overhead boom, rather than the underlift principle.

Yard Hostels

There is a variety of chassis-moving container handling equipment. This equipment is referred to by different names including: yard horses, hustlers, mules or terminal tractors. This equipment mainly is used at a terminal or port, but closely resembles an over the road tractor or truck.

Lifting Wheels

This device is attached to a hostel and allows for the operator to raise, lower, attach, and detach trailers without changing the trailers' dolly wheels. The lifting wheel gives the hostel a unique advantage over ordinary tractors and allows for quick attach and detaching expediting trailer movement.

Intermodal Transfer Point

Line-haul intermodal equipment container-handling equipment enters the intermodal terminal where containers are transferred between terminal equipment and line-haul equipment. This is the intermodal interchange.

Container Chassis

A chassis is rail, marine, and over-the-road equipment. This equipment is designed to handle containers and trailers. Chassis come in sizes compatible with containers, however there are adjustable chassis. These slide to accommodate the size container needing to be transported.

Chassis Flipper

Because of valuable space at terminals, chassis are stacked. The chassis flipper stands the chassis vertically. Chassis take up only 10 percent of the space stacked versus not stacked.

Containers

Containers are the vehicle of choice used to encase the product for an intermodal movement. The number of container boxes have been growing at an increasing rate. The number of containers grew from 8.2 million in 1994 to 10.8 million in 1997. Ocean carriers account for 52 percent of ownership, leasing companies some 47 percent, and the rest are split among private and container transport companies.

Containers come in many sizes and types. Dry freight containers are either 20 or 40 feet long. There is also a 40-foot high cube container, refrigerated containers. The estimated cost of a 20-foot dry freight container is between $2,000 and $3,000 and a 40-foot container is between $3,100 and $4,500.

For low volume users' leasing the container may be less costly than purchase. Muller reported that high costs are associated with empty container movements. This problem exists for some North Dakota shippers with less inbound freight than outbound and desiring to use the intermodal shipping option.

Model Explanation

Truck/Rail Container Intermodal Terminal Costs

Bierman, Bonini, and Hausman (1991) describe a model as a "simplified representation of an empirical situation." Variables are classified as decision variables, exogenous variables, intermediate variables, policies and constraints, or performance measures (Bierman, Bonini, and Hausman, 1991). Decision variables are under the control of the decision maker. Other types of variables affect the model, but their values cannot be determined by the decision maker.

Exogenous or external variables are outside the decision maker's control. Intermediate variables are used to relate decision variables and exogenous variables to performance measures (Bierman, Bonini, and Hausman, 1991). Exogenous and intermediate variables are represented in various places throughout the model.

Using the previously discussed modeling principles, a spread sheet model was developed to simulate costs for an intermodal facility locating on a short line railroad. This model was developed to provide decision makers with an estimate of start-up and annual costs.

Intermodal Facility Costs

Variables represented on sheet one of the model include the initial capital investment. The model is changeable and can be used to estimate costs from a proposed business plan, which includes the size and type of facility. Sheet two has performance measures, which are the total investment costs and annual operating costs. Sheet three includes sensitivity analysis to evaluate costs associated with different levels of investment.

Firm Characteristics

The spread sheet model was developed to evaluate costing options for an intermodal facility. A facility could vary in size, equipment configuration, accommodations (reefer, etc.), and different options requiring different levels of investment. Different levels of investment require different traffic volumes to cover expenses or costs.

The model consists of changeable fixed and variable cost sections to replicate different sizes and configurations of facilities allowing for scenario analysis purposes. This provided a range of investment levels for decision making purposes.

Fixed Costs

The fixed cost portion of the model includes land, track and switches, fence, pavement and concrete, lighting and electrical, building options, equipment options, depreciation, insurance, repair, taxes, and interest. These costs all are changeable within the model, providing a wide range of options. Depreciation, insurance, maintenance and repair, and interest are a percentage of the investment. In the following section these costs are described individually.

Land

Within the land section of the model is the price per acre and the number of acres required. These variables are changeable to accommodate different situations. For instance a company contemplating a facility may already have usable land therefore diminishing the level of investment needed. Conversely, a company may need to purchase land near a source of business, which may be a large investment along with needed improvements. For the base case, land was priced at $2,000 and the number of acres was set at 80. Eighty acres would be more than enough for the facility at 1,742,400 square feet. This would allow for ample storage, and room for loading and unloading. This dollar amount was arbitrary, which could be less or more depending on the location and current use of the land. In rural areas land may be a small portion of the investment needed, but in an urban area, land is a large portion of the investment.

Track and Switches

This section of the model estimates the investment in track and switches. There are six entries possible shown in Table 1. These entries must reflect decisions made at the outset from a business plan. The estimates of track costs and distance are from a 1996 study. The Grand Forks Intermodal Study & Implementation Plan was done by Leeper, Cambridge and Campbell.

Table 1. Track and Switch Costs from the Intermodal Facility Spreadsheet Costing Model

	Column	
Row	**A**	**B**
5	Dollars per foot of track	$100
6	Number of feet	5,000
7	Number of powered switches	2
8	Cost of powered switches	$130,000
9	Number of internal switches	2
10	Cost of internal switches	$80,000

The track portion of the model allows for many different scenarios. Track may already exist and switches may be in place or a new siding may be needed. This section of the model allows for flexibility and entries for different operations. The number and type of switches will vary. If the siding is new, switches will be needed. An existing siding will have switches. Powered switches may not be required. Only two switches would be needed if siding is used in the loading area. Another possibility on a short line is that loading is on a no-traffic section of existing track.

Fence, Pavement and Concrete, Lighting and Electrical

Depending on the level of security and desire to keep children, animals, and other potential problems out of the site, a fence may be required. This section allows varying the length and cost of the fence. It is simply multiplying the number of fence feet times the cost per foot. This could be a rather substantial investment if it is desired to have a secure yard. The base case allows for 3,960 feet of fence. This is enough fence for the perimeter of the yard. The cost is estimated at $10 per foot (Dakota Fence).

Next is pavement and concrete. This section simply allows an entry for the number of acres and the cost of either asphalt or pavement. In some cases a gravel yard may serve instead of pavement or concrete. There also may be a combination possibility of some pavement and the rest gravel. The cost per acre is simply multiplied by the number of acres. However in some cases the entire yard may not be paved. For instance, building space would not be paved.

There is a section for lights, electrical, and reefer hookups. Electrical components will vary with size of the facility and expectations for its type of business. For instance, it may be determined that no reefers will be used or no loading will occur at night, which would lessen the electrical investment. The base case estimates loading lights cost $10,000 each, while reefer hookups are estimated at $2,000 each. The base case calls for six lights and six reefer hookups.

Table 2. Fence, Pavement, and Lighting and Electrical from the Intermodal Facility Spreadsheet Costing Model

Column		
Row	A	B
14	**Fence**	
15	No of fence feet	3,960
16	Cost of fence per foot	$10
17		
18	**Pavement or Concrete**	
19	Acres of Pavement	40
20	Cost per acre of pavement	$1,000
21		
22	**Lighting and Electrical**	
23	No of lights	6
24	Cost of lights	$10,000
25	No. reefer hookups	6
26	Cost of hookups	$2,000

Building Options

This section includes size and cost of the building, and costs of water and sewer to the building. The building cost is based on square footage times the size of the building. The building estimate is 1,500 square feet at $50 per square foot.

Water and sewer lines are cost per foot times the length of the line. Water and sewer are based on the use of city water lines and sewer. If built in a rural area, additional costs for a well and septic system would exist. The sewer is estimated at $20 per foot and water is estimated at $15 per foot. Building options are determined by the decision maker and may or may not exist. Some facilities may be able to be operated from an existing building, lowering overall costs.

Table 3. Building Options from the Intermodal Facility Spreadsheet Costing Model

	Column	
Row	A	B
28	**Building Options**	
29	Sq ft of building	1,500
30	Cost per square foot	$50
31	Feet of water line	1,000
32	Cost per foot	$15
33	Feet of sewer line	1,500
34	Cost of sewer line	$20

Equipment Options

Within the equipment portion of the model the decision maker has the options of lifters, hustlers, forklifts, and chassis. The decision maker may choose the number of each and a cost factor associated with each piece of equipment. The cost factor would depend on equipment choices. New versus used equipment and if the equipment is used if reconditioning was necessary. There also is a fuel consumption entry. This cell is linked to the variable cost portion of the model. This section gives the decision maker choices of different equipment depending on the size and type of facility to be built.

Table 4. Equipment Choices from Intermodal Facility Spreadsheet Costing Model

	Column	
	A	B
Rows	**Equipment Options**	
36	Number of lifters	1
37	Cost of container lifters	$500,000
38	Fuel consumption/hr	5
39	Number of hustlers	1
40	Cost of hustlers	$50,000
41	Fuel consumption/hr	5
42	Number of forklifts	0
43	Cost of forklifts	$25,000
44	Fuel consumption/hr	2
45	Number of chassis	2
46	Cost of chassis	$5,000

Office Equipment

Another portion of the model gives the decision maker the option of making entries for office equipment. There is a section for furniture and electronics. The decision maker can enter zero if a category is not valid. This may happen where a short line railroad or third party uses existing offices or office equipment to operate the intermodal facility.

Table 5. Office Equipment from Sheet One of the Intermodal Spreadsheet Costing Model

Column		
Rows	**A**	**B**
1	Computer	$2,500
2	Fax Machine	$300
3	Phones	$1,000
4	Communication Equipment	$1,000
5	Desk	$500
6	Chairs	$200
7	Counter	$500

Depreciation, Equipment, Taxes, Insurance, Interest, and Maintenance and Repair

This section of the model uses percentages and time to determine costs associated with different levels of investment. The method allows a decision maker to adjust percentages or the time factor for different interest, insurance, or depreciation rates.

Depreciation is divided into facility and equipment to allow for different estimated useful life (EUL). The decision maker can adjust time for different types of equipment or facilities. Depreciation is the cost of using up capital and should reflect the portion of useful life used during a specified time period (Fess and Warren, 1990). Equipment and the facility were depreciated on the straight-line basis. Depreciation was calculated by subtracting the salvage value from the purchase price and dividing this figure by the EUL. Salvage values and EULs are difficult to estimate. Salvage value primarily depends on the condition of equipment and type of maintenance performed.

Taxes and insurance are related to a percentage of value of the investment. The tax levied may vary by location and different types of taxes imposed. Insurance also may vary with location and company of issue. These variables also are adjustable by the decision maker.

Interest rates and terms vary depending on the level of investment and the risk perceived by the lender. The rate and term can be changed by the decision maker to meet different levels and lengths of financing. A rate also is used for return on investment and/or a hurdle rate. It is common for companies to set a desired return for investments, or hurdle rate, which is used to screen potential investments.

Maintenance and repair costs vary with use. With higher use there are higher costs. A percentage of the value of the equipment times a rate per hour will provide an estimate of the cost of maintaining the equipment. This is variable in the model. Higher levels of repair would be associated with older or used equipment. The maintenance and repair formula is based on new price for equipment. The farther the cost of equipment deviates from new cost the higher maintenance and repair.

Variable Cost Components

The next part of the model is the variable cost components. This includes a section for direct and indirect labor costs. Other costs included in the variable cost portion are electricity, water, sewer, building insurance, office supplies, and accounting services.

Wages and Indirect Costs

This portion allows for the number of employees, hourly rate, hours worked, and weeks per year worked. Indirect costs cover workers compensation, social security match, and benefits. Workers compensation, social security match, and benefits are based on a percentage of wages. There also is a section for management and sales staff, which is based on the cost of hourly employees. This variable is difficult to estimate and would vary according to the type of facility and the business plan of a proposed facility. If the facility is based on a few businesses or a single business, there may be no need for management or sales staff. Another scenario may include the use of existing staff to manage and sell the services of the intermodal facility. The model is set to record management and sales costs at half of total wages. This results in a manager's annual salary of $45,000.

Electricity, Water and Sewer, Building Insurance, Office Supplies, and Accounting Services

Other costs included in the variable cost portion are electricity, water, sewer, building insurance, office supplies, and accounting services. These costs would vary depending on the type of facility built, the size of the building, and if the facility was run using existing staff and facilities. If an existing facility is used, costs should be portioned equally to use.

Electricity, water, sewer, office supplies, and accounting services depend on volume used. Insurance would be a percentage of value and would depend on the value of the building.

Table 6. Variable Cost Components of the Intermodal Spreadsheet Costing Model

Column		
Rows	**A**	**B**
1		
2	**Variable Cost Components**	
3	No. of Salaried Employees	2
4	Salary	$25,000
5	No. of Hourly Employees	2
6	Hourly rate	$10
7	Hours Per Week	40
8	Weeks Per Year	52
9	Fuel Cost / Gallon	$1
10	Workman Comp	5%
11	Social Security match	7%
12	Benefits	7%
13	Management and Sales	50%
14	Electricity	$100
15	Water	$50
16	Sewer	$20
17	Insurance	.5%
18	Office Supplies	$500
19	Accounting	$2,500

APPENDIX 10

Air Freight Volume in North Dakota

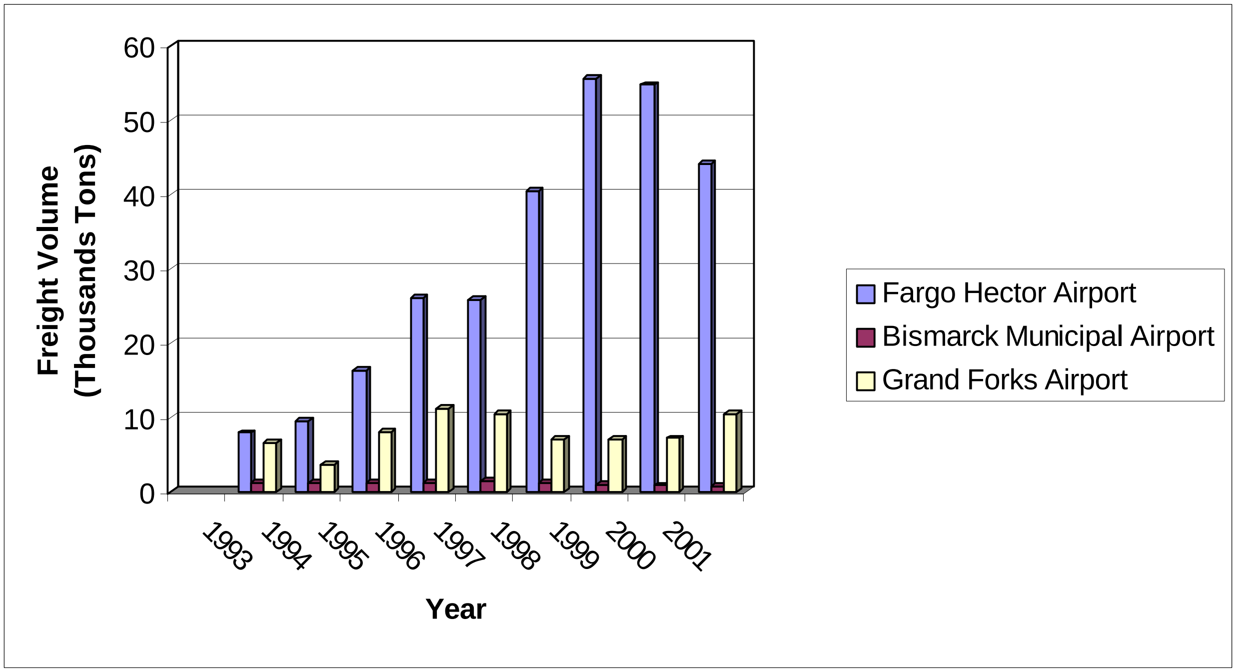

Figure 1. **Air Freight Volume from 1993 to 2001**
(Source: Data was Collected from the Each of the Airports)