ECONOMIC ANALYSIS

of the

STATE OF MINNESOTA

Report to

THE MINNESOTA RESOURCES COMMISSION

1945

IN THREE VOLUMES

Volume II

THE J. G. WHITE ENGINEERING CORPORATION

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I INTRODUCTION

I. INTRODUCTION

In Volume II is presented that factual data which was considered significant in arriving at the findings and conclusions presented in Volume I. Recommendations for remedial action, based upon those findings, are contained in Volume III.

Generally, data presented in this Volume II is in factual form without interpretation or conclusions. The sources as indicated were varied, and included many statistical references published by Federal, State, and local authorities, as well as the results of personal inspections and visits to representative individuals, corporations and institutions familiar with the problems involved. The presentation is not intended to be exhaustive, but rather a

fair sampling, in the time available, of the many varied factors influencing economic conditions and trends in the State of Minnesota.

A considerable amount of the data is in the form of exhibits which are arranged in numerical order and bound under separate cover.

II FUNDAMENTAL CONDITIONS

II. FUNDAMENTAL CONDITIONS

In this Report the geo-physical and geo-political conditions prevailing in Minnesota have been outlined to indicate the importance of certain natural and almost unalterable conditions which definitely limit the scope and opportunity for economic development within the State and therefore must be considered in planning for the future.

A. Geo-Physical

1. Geography and Topography

The State of Minnesota lies along the northern border of the United States, approximately midway between the Atlantic and Pacific seaboards. It is roughly rectangular; approximately 400 miles north-south, 190 to 350 miles east-west, with the eastern boundary concave toward the center. Total area is 84,068 square miles—80,009 land and 4.059 water.

Most of the features of the present land surface of Minnesota are the result of glacial action. Enormous and slowly moving masses of ice invaded Minnesota several times, forming glacial lakes and rivers which eroded or wore down the high lands. As these glaciers receded, they deposited various soils and stones, commonly known as "glacial drift," which form the present surface of most of the State.

The average elevation of the State is about 1,200 feet above mean sea level, with several plateaus rising 300 to 400 feet above this average. Most of these plateaus contain hills rising 200 to 300 feet above the plateau level.

The highest point in the State, in the northeastern corner of Cook County, is 2,230 feet above sea level. The elevation of the Mississippi River at the point where it leaves the State in the southeastern corner is 620 feet. Lake Itasca, the source of the Mississippi, in the north central section of the State, has an elevation of 1,475 feet.

From the high area in Cook County, the remains of a mountain range, known as the Misquah Hills or Giant's Range, extend in a southwesterly direction. This range has a base elevation of about 1,500 feet with summit altitudes

of 1,800 to 1,900 feet and a breadth of about 30 to 35 miles. It slopes steeply in a southeasterly direction down to Lake Superior and more gradually toward the southwest, where it broadens out into a plateau, across the north central part of the State, at an average elevation of about 1,300 feet. Other ranges in the State include the Gunflint Range in Cook and Lake Counties, the Vermilion Range in Lake and St. Louis Counties, and the Mesabi Range in St. Louis, Itasca and Cass Counties. These so-called ranges average from 1,400 to 1,500 feet elevation and run generally in a southwesterly direction. The Cuyuna Range in Aitkin, Crow Wing and Morrison Counties is really a series of low hills of about 1,300 feet elevation or about 100 feet above the bed of the Mississippi River. These ranges form the "divides" which send waters into Hudson Bay, the Saint Lawrence River or the Gulf of Mexico. All of the ranges contain large quantities of iron ore of varying, but generally high iron content.

The principal rivers which established the State's boundaries and influenced its settlement and development, are the Mississippi, the Minnesota, the Red River of the North, the Rainy River, the Pigeon, the Saint Louis and the Saint Croix Rivers. The first important industry, fur trading, was favored by many easy canoe routes with short portages. This topography helped develop the second important industry — lumber — as the fairly level forests and easy access to streams offset the difficult and costly operations with the primitive tools that were available and provided the essential conditions which stimulated the lumber industry's rapid growth.

Agriculture grew both with and after lumbering, favored in about the same way by the "lay of the land," which was easy to cultivate and adaptable to pasture. It was especially adapted to wheat growing, which, together with adequate power sites, was the foundation for the milling industry. The easy country allowed the railroads to cover the State at low cost per mile and greatly expedited the building of direct highways even before the coming of the automobile.

2. Hydrology

This subject includes water in, on, and above the earth, particularly in connection with its supply and distribution, insofar as it affects the economic well-being of the State. Minnesota's water supply affects its trees, plants and agriculture, the levels of its many lakes, the navigation and flow of its rivers and streams, flood conditions, logging, irrigation, reclamation, erosion, drinking water systems for communities and cities, fire lines, sewage disposal, sanitary and storm sewers, drainage, water power, steam and steam systems, process water, and its fish, wild life, and recreational industries.

The intensities of rainfall and depth of snow affect the size of sewers, drains and ditches, the costs of municipal and other drainage systems, the loading

values and costs of roofs, the cost of snow removal in cities and towns and on the highways, and the need for and the costs of the snow fences which are common in all parts of the State. The flood flow of rivers determines the need for and costs of flood control, lake and river control, and the protection of public and private property, in addition to the safety of people, livestock and crops.

a. Precipitation

The amount of water from precipitation in Minnesota normally is adequate for all purposes. Over a period of fifty-three years (1886-1938), the mean annual precipitation for the whole State amounted to 25 inches. However, the average annual amount varies from 20 inches in the northwest corner to 27 inches in the southwest corner, 32 inches in the southeast corner and 30 inches in the northeast corner.

The amount also generally decreases from south to north. Further, a precipitation cycle appears to exist with a variable period of years with less than normal rainfall and snow, followed by another variable period of years with more than the normal amount of precipitation. Droughts occur more frequently in the western than in the eastern half of the State.

As an average annual amount of precipitation of about 18 inches is needed for agriculture, there is danger of a real scarcity of water during the poorer years of a dry period.

Normally there is sufficient precipitation for crops, livestock and human needs, although in the western part of the State serious droughts occur about once in ten years. In the eastern section, droughts occur only about once in twenty years. Nearly two-thirds of the average annual precipitation occurs from the first of May to the end of September. From rainfall records covering a period of about one hundred (100) years, there appear to be recurring cycles of wet and dry periods of from 15 to 25 years. The present year (1944) appears to be a wet period.

Thunderstorms are prevalent throughout the State, averaging 27 per year in the northern, and 37 per year in the southern areas. Tornadoes and high windstorms average 3 per year. Hail storms average from 2 to 4 per year in the northern and southern portion of the State, respectively.

Average annual snowfall varies from 20 inches (unmelted) in the southwestern areas to 70 inches (unmelted) in the northeastern section. Annual damage resulting from storms has been estimated at about $3,000,000 for the years 1937 through 1942. This damage was largely to buildings, agricultural equipment, crops and livestock. At all times fires in forest areas are destructive and dangerous and this menace is especially hazardous in dry years.

b. Evaporation

The evaporation from watersheds, reservoirs, and lakes in Minnesota is an important phase of the cycle, whereby water is picked up by the atmosphere to be returned and distributed as rain, snow or hail. The amount of evaporation varies in different parts of the State, from 20 inches to 38 inches.

c. Transpiration

Measurements of evaporation and transpiration, (the loss of water through growing vegetation) apparently have not been standardized so as to obtain entirely satisfactory or precise values for the loss of moisture from watersheds. However, measurement devices and techniques are in the process of improvement.

"For tentative purposes, the following normal season transpiration may be used as a base value in estimating water losses for the north central portion of the United States:

9 to 10 inches for grains, grasses and agricultural crops;
8 to 12 inches for deciduous trees;
6 to 8 inches for small trees and brush;
4 to 6 inches for coniferous trees.

These quantities represent inches depth of water over the entire area occupied by the given form of vegetation." (Adolph Meyer, Consulting Hydraulic Engineer, "Elements of Hydrology.")

d. Artesian Supply

Along the west side of and paralleling the Mississippi River, from Hastings to the southeast corner of the State, is a strip of land, about five miles wide, with occasional irregular areas extending twenty miles further west. This strip with its extensions, is underlain by Potsdam sandstone, and forms the western edge of what has been called the best artesian well region in the United States. (D. W. Mead, "The Hydro-geology of the Upper Mississippi River Basin.") In this portion of Minnesota, some artesian wells have been driven through the glacial drift and the limestone and sandstone strata into the Potsdam layer.

e. Ground Water

Observations by well drillers and well users indicate changes in ground water levels in Minnesota from 10 to 20 feet. Only two large areas show changes of less than 10 feet — the morainal lake district in Stearns, Todd and Wadena Counties and the area of Dakota sandstone outcrop in Nobles, Murray, Lyon, Lincoln and Lac qui Parle Counties. A 15-foot contour of depression follows the boundary between the morainal lake region, in which the depression is 15 to 20 feet. An area of more than 20 feet depression lies along the divide between the

Red River Basin and the Minnesota River. In western Minnesota the lowering of the head of the ground water level amounted to 5 to 24 feet for observations extending over period of 12 to 43 years. (Report of the Mississippi Valley Committee of the P.W.A., 1934.)

f. Stream Flow

Excepting the smallest tributaries, the list of all Minesota streams totals 400. (Gazeteer of Minnesota Streams. Report of the Water Resources Investigation of Minnesota, State Drainage Commission, 1912.) There are 130 stream-gaging stations of the United States Geological Survey, where readings are made on these streams.

There are reported to be over 11,000 lakes within the borders of the State, many of which have the same names and are near each other. United States reservoirs have been used to control the headwaters of the Mississippi River at or including certain of these lakes, as follows: Leech Lake, Winnibigoshish, Pokegama since 1884; Cross Lake and Whitefish Lake since 1886; Sandy Lake since 1895; and Gull Lake since 1912.

The water level, or "stage," at the reservoirs controlling these lakes also affects the water level in numerous connecting lakes. The United States Forestry Service and local interests have built dams at many of the outlets of these lakes. Operation of these reservoirs has presented a difficult problem involving conflicts between various interests of importance in the State's economy, such as farmers raising hay or crops near the edges of the lakes or reservoirs, lumbermen using sluiceways or streams for floating logs, and the many resort or recreation operators who are developing an important vacation and tourist industry in their vicinities.

Apparently these reservoirs are required only occasionally for navigation uses, though this was the original purpose of water control. From time to time emphasis has been diverted to the maintenance or stabilization of lake levels, through pressure by groups, probably nearest the lakes, without due consideration of other interests such as municipalities and others more remote who advocate maintenance of controlled stream flow and also require water for general supply, sewage disposal, power and other purposes. But little information has been obtained relative to the extent or behaviour of these reservoirs, although the extent to which ground waters may reach any body of water must be known in order to control the body of water properly at its maximum efficiency.

To assist the study of the water supply of the State, there are 369 structures where stage observations may be made on controlled lakes, and 33 places for obtaining stage readings on uncontrolled lakes. These, with the 130 stream-gaging stations, afford 532 stations for observation purposes.

g. Run-off

The general topography of the State is such that most of the gradients are gradual and the run-off is comparatively slight in depth and usually not conducive to flood conditions.

The average run-off of the watershed of the Mississippi River, at Saint Anthony's Falls, for a drainage area of 19,634 square miles was about 4.2 inches per year over a period of 33 years ending in 1932. Annual fluctuations were between a low of 1.4 inches in 1931, and a high of 8.4 inches in 1916. During the period the average annual precipitation for this area was about 24.8 inches.

The average run-off of the watershed of the Minnesota River, above Mankato, for a drainage area of 14,600 square miles, was about 3.0 inches per year from 1912 through 1921, with an average annual precipitation during this period of 27.5 inches. The average annual run-off was 1.1 inches from 1922 through 1931, with an average annual precipitation of 23.5 inches during this period for the area. There was a maximum run-off of 5.6 inches in 1919 and a minimum run-off of about 0.2 inches in 1931.

The average run-off of the watershed of the Red River of the North at Fargo, North Dakota, from 1903 through 1933, was about 1.1 inches per year for a drainage area of 6,020 square miles. Precipitation over the area during this period averaged 21.2 inches. During this period the maximum run-off of 4.2 inches occurred in 1916, and the minimum run-off of about 0.15 inches occurred in 1932 and again in 1933.

h. Quality of Water

In many counties in Minnesota, especially along the valley of the Red River of the North, the ground waters are predominantly hard. In many places these may be improved by boiling or softening; in places some of the supply is unsuitable for agricultural purposes, also for drinking or cooking. While all sources should be analyzed for these uses and checked from time to time, those in Kittson, Marshall, Pennington, Polk, Ottertail, Grant and Stevens Counties especially should be watched.

Excessive sulphates, chlorides, bicarbonate of soda, and occasional iron and sulphur are found in many well and other waters, necessitating chemical analysis when contemplated for use for power and industrial process or solvent purposes.

3. Climate

The climate of any area is a most important economic factor, as it influences the type of people that will settle in any locality, their health and energy, food, clothing, buildings, fuel market, their outdoor activities and kinds of recreation.

Climate also determines the species of trees, plants and wild life which will survive and flourish, also the productivity of crops and the agricultural enterprises, and kinds of industry most likely to succeed.

Daily and seasonal temperatures of Minnesota are subject to extreme variations owing to its central location, west of the Great Lakes with prevailing winds which become heated as they blow from the north and west and pick up moisture in their progress toward the east over plateaus extending from the Rocky Mountains. Recorded temperatures range from a low of 59° below zero F., in February 1899, to an exceptional high of 114°F., in July 1927.

Although the average winter temperature in Minnesota is lower than in the neighboring states, the air is somewhat drier. This tends to offset the extreme cold and to provide an invigorating and stimulating season. However, the winters are long and relatively cold, and a large amount of fuel is required during the heating season.

The extreme heat indicated by the maximum recorded temperature is not so serious as might at first appear. Usually the State as a whole is not subject to prolonged periods of high temperature; and the nights are relatively cool. In the northern and northeastern sections, summers are comparatively cool and pleasant, resulting in ideal weather for vacations. In Minnesota, clear days average 154 per year, which is more than for any of the other states bordering the Great Lakes. The average growing period or number of days between the latest killing frost in the spring and the earliest in the fall is long enough to be favorable to agriculture in those sections where suitable soil conditions exist.

The economic influences of climate on forestry, agriculture and industry are discussed more specifically in other sections of this Report.

B. Geo-Political

1. Geographical Location

While the geographical center of the North American Continent is only about 140 miles west of the western boundary of Minnesota, the State extends "farthest north" in the United States and occupies a position somewhat remote from the centers of industry and population, which provide the principal markets of the country and the principal producing facilities to satisfy them. Its geographical location is both an advantage and a disadvantage to Minnesota.

2. Population

There is no necessity or justification for including in this Report an extensive digest of statistics indicating details of the progressively increasing

population of the State. Beginning with 1850 the census reports are definitive, quite complete and generally accessible.

a. Background

An appreciation of past, present and possible future conditions may depend largely upon the composition of the population as well as its number. Consequently, a study of trends as to number and composition of the population of the State was made initially for its value as an index to past and present conditions.

The results of this study of population as a factor of importance in the economic welfare of the State are tabulated in Exhibit II-B-1, and graphically illustrated in Exhibit II-B-2. The following conclusions with respect to population backgrounds were drawn from these Exhibits and various other sources of information.

As of 1890, foreign born population comprised as much as 35.6% of the total. At that time the remainder and principal part of the population was largely derived from "settlers" who had migrated chiefly from North Atlantic coast states, such as the New England States, New York and Pennsylvania. The influx from Maine possessed almost exclusively a lumberman background. New York and Pennsylvania "immigrants" were predominantly interested in agriculture, but included among them undoubtedly were some whose interests were primarily industrial and commercial. Its beginning later than other states would seem to explain why the population increased within the past 50 years somewhat more rapidly than in neighboring states, as shown by Exhibit II-B-3.

As far back as 1870, the United States Commissioner of Statistics was prompted to congratulate Minnesota on the following accessions to its population shown by that census as of "the best blood of Europe."

46,606 from British countries including 21,303 Irish, the latter "of muscular power and gifts of a warm and impassioned nature."

59,390 Scandinavians, "honest, laborious, with sympathy for popular institutions."

48,475 Germans "with an intellectual organism in which massive properties and the tough Saxon fibre needed for laborious research are mingled with the finer qualities of the musician and the prophetic spirit of the poet." (W. W. Folwell, "A History of Minnesota," Vol. III.)

The highest percentage of foreign born population (36.6%) had been reached as far back as 1870, but after 1890, accretions of populations from foreign sources diminished rather rapidly. Nevertheless present family names evidence the marked effect of national origins dating back to the years between 1870 and 1890.

Presuming that the census figures, as charted, constitute a fair indication of origins of population it should be noted that in Minnesota the bulk of foreign born had their background in northern Europe, chiefly in the Scandinavian countries and Germany. It may be assumed that these Europeans were endowed with characteristics normally associated with their native countries, outstanding among which were thrift, industry, honesty, courage and stability. They were nationally clannish, home-builders, and freedom-loving people. Migration to a new land presumably had been motivated only by a desire to establish themselves under more favorable living conditions with greater political and religious freedom. History has it that they tended to be slow in adopting the new ways — inclining rather to cling to customs and ideas of the mother country.

This important part of the population of Minnesota in its early years as a State, has had a distinct bearing on what the State is today, despite the fact that the 1940 census shows the bulk of the population to be of "English Parentage" (ref. United States Census) which includes Scotch, Irish and Welsh. Of this slightly over 75% is native born.

b. Settlement, Growth, Stabilization

Through the passing years, when forest land became farm land, manufacturing had its origin and growth largely as a result of native ingenuity in transforming farm products and local raw materials into products that were saleable within and without the State. When mineral resources invited exploitation, there is every indication that the migratory hunters, lumbermen and others, largely having Canadian and eastern United States background, moved on and were replaced by a growing population of a distinctly more stable nature.

Growth of population and stabilization in Minnesota compares well with neighboring states, as shown in Exhibit II-B-4. The only exception is that of the case of Michigan where, in recent years, population has been increased abnormally as a result of the development of the automobile industry. Incidentally, curves of increasing population of most states show some tendency to flatten out, reflecting the limitation of immigration.

c. Migratory Tendencies

There is no evidence of any inherent or pronounced migratory tendencies within the present population of the State. It is true, as in the case of many sections of the country and in all states, that there has been something of a mass movement, incidental to war activities, towards industrial centers where opportunity for the exercise of latent abilities seemed to beckon. This is exemplified in the case of the shipbuilding activity of the West Coast which is said to have drawn to an appreciable extent upon certain population groups in the State of Minnesota.

III. ECONOMIC DEVELOPMENT IN INDUSTRY

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The term "Public Service Industries" has been applied in this Report to certain industries whose development reflects the development of other and relatively basic industries. Included in "Public Service Industries" are electric power, transportation, fuel supply, commerce and communication.

A. Public Service Industries

1. Power

Power for industrial and residential purposes in Minnesota is supplied largely in the form of electricity generated in steam, hydro and internal combustion engine driven plants, operated by privately or municipally owned utilities. In addition to these, there are some industrial companies which operate their own isolated plants, as well as numerous small farm power installations, but these account for a relatively small part of the State's total requirements.

The power industry in Minnesota suffers natural handicaps from the lack of nearby high grade fuel for steam generation and from the topography and climate of the State, which are not suitable for the cheap development of large quantities of hydroelectric power. The generally flat country near the head waters of the Mississippi River, coupled with only moderate normal annual rainfall and the extremes of stream flow caused by dry months in summer and low temperatures in winter greatly limit the possibilities of hydroelectric generation in competition with high efficiency steam plants, notwithstanding the relatively high costs of fuel.

Despite these handicaps the power business has grown and networks of transmission lines and distribution facilities are generally available at all points where the demands warrant them. It is the declared policy of the major suppliers of power to make such additions and extensions as may be found necessary to supply additional loads as and when required.

a. Electric Power Production

Reports of the Federal Power Commission show the annual kilowatthour production by type of generation and by ownership of plants from 1920 to 1943.

These data are reproduced graphically in Exhibits III-F-1 and III-F-2 and clearly indicate the rapid growth of electrical generation in the State during the last two decades. The graphs also show that most of the increase in electrical energy production has taken place in fuel burning plants rather than in hydroelectric plants and that at the present time privately owned utility plants of both kinds produce more than 75% of the total energy.

Energy production in municipally owned plants does not constitute a large percentage of the total production (10.9% in 1942).

b. Electric Generating Capacity

Electric generating plant capacities from 1920 to 1942 are recorded in Federal Power Commission reports and classified by type of generation and ownership. For purposes of comparison they are summarized for the years 1920 and 1942 in Exhibit III-F-3.

By far the bulk of the increase has taken the form of steam driven capacity. The combined growth of hydro and internal combustion engine driven capacities, although appreciable, is only about 27% of the increase in steam driven capacity.

c. Hydroelectric Development

The United States Geological Survey records the developed Water Power in Minnesota as of January 1, 1938 in plants of 100 horsepower or more as follows:

	Public Utility and Municipal	Manufacturing and Miscellaneous	Total
Number of Plants	47	18	65
Capacity in hp	201,425	67,700	269,125

The figure of 156,779 kw for all hydroelectric plants in 1942 as shown in Exhibit III-F-2 is equivalent to 210,000 hp and checks reasonably well with the figure of 201,425 hp given above, when consideration is given to the dates of the data. It is, therefore, evident that the 67,700 hp shown for Manufacturing and Miscellaneous is not included in the Federal Power Commission figures and probably consists largely of water wheels directly connected to mechanical loads instead of to electric generators.

Most of the streams of Minnesota have been surveyed by the United States Army Engineers with a view to their development for power, navigation, water conservation and flood control. A survey made by the State Planning Board in 1934 indicates that there is a total of perhaps 200,000 hp in undeveloped water power sites in the State, but that the bulk of this is in the northern part of the

State, in the Rainy River and Lake Superior watershed. Attention is called in the above Report to the fact that "Procedure with water power development on any particular river at any given time must depend upon a detailed analysis of the amount of power and the conditions under which it is available, the distance and type of market for the power and costs of competitive power."

It may be assumed that those charged with the generation of power in Minnesota are well aware of the potential water power available, and that up to the present time it has been found cheaper to meet the State's increasing requirements principally through increases in steam generating capacity rather than hydroelectric developments.

d. Utilization of Electric Power

Collection and analysis of complete data on all electric energy utilized in the State did not appear to be warranted by the relative unimportance of the subject. However, through the courtesy of the Northern States Power Company, which is the largest single producer and distributor of electrical energy within the State, detailed records of its operations were obtained.

During the year 1940 this company with its subsidiary companies reported kilowatthour sales of approximately 1,335,000,000 kwhr to over 415,000 customers. In 1943 the total sales were approximately 1,793,000,000 kwhr to about 431,000 customers, indicating the effect of war conditions on the use of electric power in Minnesota. The company serves customers outside of Minnesota as well as within the State, and its records do not segregate the output by States, but it was said that the bulk of the business is within the State and that unit statistics derived from the data would reasonably represent conditions for the Minnesota part of the business.

The following tabulation indicates the energy sold by this company during 1940 and 1943 to each class of business, with percentages of the totals for each class.

ENERGY SALES — NORTHERN STATES POWER COMPANY AND SUBSIDIARIES

Class of Business	Kilowatthours 1940	Per Cent of Total	Kilowatthours 1943	Per Cent of Total
Residential	406,529,966	30.4	474,609,416	26.5
Rural	13,563,172	1.0	20,209,774	1.1
Small Light and Power	308,527,844	23.1	323,622,062	18.1
Large Light and Power	425,725,797	31.9	768,965,495	42.8
Public Street & Highway Lighting	31,379,536	2.4	35,887,697	2.0
Other Sales to Public Authorities	58,036,478	4.3	59,333,251	3.3
Sales to Other Electric Utilities	87,549,710	6.6	105,218,281	5.9
Sales to Railroads & Railways	4,078,935	0.3	5,136,658	0.3
Total	1,335,491,438	100.0	1,792,982,634	100.0

This tabulation indicates clearly the effect of war conditions on industrial power use in Minnesota as reflected by the energy used under the classification "Large Light and Power." Energy use in this classification increased approximately 80% during the three-year period as compared with 17% for Residential, 49% for Rural, and 5% for Small Light and Power. The relatively large increase in the Rural classification probably reflects agricultural prosperity and the small increase in the Small Light and Power classification probably reflects wartime restrictions and economies in the commercial stores and small businesses not directly connected with the war effort and subject to rationing.

Despite the large increase in annual output caused largely by war conditions, the company's 1943 reported system peak load of approximately 390,000 kw was well within the total installed generating capacity of about 541,000 kw reported as available for supplying the load. The installation of an additional 50,000 kw generating unit at the company's High Bridge steam station at St. Paul was in progress at that time. With its completion adequate power supply for the company's customers should be well assured for some time to come.

The trend of electric power use both in commercial and industrial establishments in the State is indicated by Exhibit III-F-4 which shows the energy used annually for these purposes by the combined customers of three of the large privately owned utility systems operating in the State, expressed as percentages of the use in 1934. The overall effect of war conditions is indicated by the more rapidly rising trend subsequent to 1940. It is not improbable that the rising trend indicated between 1938 and 1940 was somewhat influenced by world conditions prior to the United States entry into the war. The trend of industrial use of power will probably depend largely on industrial conditions in the State, but, on a unit output basis of manufactured products, it is probable

that the use of electric power will increase as new devices are developed and the advantages of electricity are more fully recognized.

The increasing use of electrical energy for residential purposes is indicated in Exhibit III-F-5 which shows the average kilowatthours used per annum per residential customer for each of three large privately owned utilities operating in Minnesota, together with similar data for the United States as a whole as pubblished by The Edison Electric Institute. Domestic use of electricity in Minnesota appears to be above the United States Average and increasing more rapidly. This trend will probably continue upward as more domestic appliances are sold and their convenience recognized.

e. Publicly Owned Utilities

The 1941 Directory of Electric Utilities in the United States, published by the Federal Power Commission, lists 222 electric utilities in Minnesota, of which 182 are denoted as publicly owned. However, we are informed that only about one-third of the publicly owned systems generate their own energy requirements, the remaining two-thirds purchasing their requirements from privately owned utilities through transmission lines.

Many of the municipally owned plants are relatively small and for this reason are probably expensive to maintain and operate as compared with large ones. It is not improbable that careful factual surveys of total costs of generating energy in these small plants (including interest and amortization charges) might reveal that energy requirements could be purchased from transmission systems at less cost than is incurred under present conditions. Because of the higher efficiency of large units, this method of operation should result in a marked reduction in the quantity of fuel required and, since Minnesota depends on other states for its fuel, there should be a corresponding reduction in the total payments going outside of the State for fuel.

f. Electric Rates

The Federal Power Commission has published voluminous data on electric rates throughout the United States. Exhibits III-F-6 and III-F-7 are plotted from these data and give comparisons of the monthly charge and average rate in cents per kilowatthour for various kilowatthour consumptions under residential rate schedules existing in a total of 50 cities in Minnesota and the neighboring states of Ohio, Iowa, Illinois, Michigan, Indiana, Missouri, Kansas and Wisconsin. These graphs indicate wide variations in the monthly bills for a given consumption, but further indicate that the rates in Minnesota cities are fairly comparable with those in the neighboring states.

Similar data, covering commercial and industrial power rates, have been published by the Federal Power Commission and are available to those inter-

ested. It is not feasible to make direct comparisons of individual power rates except for specific conditions of service and with due consideration of service and load conditions in the area served. For these classes of service there are usually several alternate rates available to the user and he is at liberty to select the one best adapted to his particular needs.

Notwithstanding the fact that generating costs are somewhat higher in Minnesota than in many other states, the cost of electric power for manufacturing, as indicated by the U. S. Census of Manufactures (1939), represents a smaller element of the total value of manufactured products of Minnesota than of the United States Average (0.66% in Minnesota as compared with 0.82% United States Average). In view of the low percentage of the total value it is evident that the cost of electric power cannot be considered as relatively unfavorable to manufacturing in Minnesota, except possibly in some isolated cases.

g. Employment

From the standpoint of employment, the electric power industry cannot be classed as an important factor in the State's economy. According to the U. S. Census for 1940 the industry employed 5,872 persons. The true importance of the industry lies in its ability to provide relatively inexpensive power, in conveniently usable form, when, where and as it is required.

2. Transportation

Transportation of goods and persons is one of the most important factors in the economy of the State. The accessibility and adequacy of transportation facilities affect the marketability of existing products of the soil, forests, mines and factories and are important elements in appraising the desirability of the State as a location for new industries.

In the early days, Minnesota had substantial advantages because St. Paul was at the head of navigation on the Mississippi River, and the State, at Duluth, had access to the Great Lakes. The first great change in this position came shortly before the turn of the century and was caused by continuous expansion and improvements of the railroads, resulting in steadily decreasing costs to the consumer. The railroads practically eliminated the Mississippi River as an important factor in the transportation facilities of the State.

The second great change, which demonstrated that railroads were not the last improvement in transportation, came soon after the last war as a result of the development of the automobile and automotive truck, which offered local transportation and delivery and have become increasingly important and steadily growing means of long-haul transportation.

The third development has been that of aviation. This began to be impor-

tant for passenger traffic during the 1930-1940 decade, but its possibilities for freight and express transportation had not been developed prior to the present war. However, war necessity has demonstrated that, in the post-war period, aviation may become an important factor in freight transportation, especially for the types of goods in which the end product has been reduced into small and valuable bulk by complex and extensive manufacturing processes. These types of goods are referred to in this report as preferred or more or less non-competitive.

If the cost of aerial transportation for such products can be made competitive with those of the railroads and trucks, it will be of far-reaching importance to Minnesota by reducing the transportation time element and to some extent counteracting the State's "rim-of-the-wheel" location with respect to its markets.

The following paragraphs give an indication of the adequacy, extent, and relative importance of the various types of transportation, as shown by the volume and kind of traffic which they carry.

a. Steam Railroads

A report of the Minnesota State Planning Board, Part 1, issued in November 1934, includes a map of the State (Plate XIX) giving the location of railroads and showing areas distant between 5 and 10 miles from a railroad line. It also shows areas distant 10 miles or more from a railroad line. The changes since this map was prepared have been relatively slight. The map shows that there are practically no points in Minnesota that are over 10 miles from a railroad, except a few large areas in the forest section of the State.

There are in the State of Minnesota 13 Class 1 steam railroads, of which 12 may be termed trunk line railroads. The total single track main line mileage of all steam railroads in the State is over 8,300 miles at the present time. During the 1880's and early '90's, the extension of lines was rapid. Since 1915 the total mileage has remained nearly constant, although there has been some new construction and some abandonments.

The following tabulation lists the Miles of Steam Railroad, the Land Area, and Land Area per Mile of Railroad for Minnesota and 7 other selected states for the year ending December 31, 1942.

RAILROAD MILEAGE IN MINNESOTA AND SEVEN SELECTED STATES, DECEMBER 31, 1942

State	Miles Steam Railroad (1)	Land Area—Square Miles Total (2)	Per Mile of R. R.
Minnesota	8,371	80,009	9.54
Michigan	7,176	57,022	7.95
Wisconsin	6,540	54,715	8.38
Iowa	8,906	55,986	6.29
North Dakota	5,262	70,054	13.30
South Dakota	3,988	76,536	19.20
Nebraska	5,877	76,653	13.05
Kansas	8,479	82,113	9.70
Average	—	—	10.92

Source: (1) I.C.C. Statistics of Railroads in the United States.
(2) Statistical Abstract of the U. S. 1942.

Tonnages carried by all Class 1 steam railroads are reported to both the Interstate Commerce Commission and to the Minnesota Railroad and Warehouse Commission. Carload tonnage is given for each of the I.C.C. commodity numbers while the less-than-carload is given as a total for all such numbers. The less-than-carload is so small as compared with carload as to be inconsequential on a tonnage basis. Tonnages are also reported under separate headings for tonnage "Carried", tonnage "Originated" and tonnage "Terminated" in Minnesota. In studying these statistics, it should be observed that:

1. These figures may not be added because the tonnage terminating is partly included in the tonnage originating, and vice versa. Likewise, the tonnage carried includes shipments that pass through the State without either originating or terminating therein.

2. There is some duplication in the figures. For example, grain may be shipped to an elevator and then reshipped to its ultimate destination.

3. There is need for analysis of some of the tonnage movements. For example, iron ore which originates in Minnesota and moves to Duluth is not shown as terminating in the State. Likewise, although much coal moves by boat to Duluth-Superior docks, it is not shown as originating in Minnesota, although the rail haul starts there, so far as the State is concerned.

4. Tonnages originating in the State may terminate either within the State or in other states; and likewise tonnages terminating in the State may originate within the State, or in other states. It is not possible, from the data, to trace individual shipments from origin to destination.

Giving due consideration to these qualifications, the tonnages by commodities present a fair picture of the net movements, whether "exports" or "imports".

The combined tonnages of all classes of commodities for Minnesota by years for the period 1928 through 1943 are tabulated below:

CARLOAD REVENUE FREIGHT—CLASS 1 RAILROADS—MINNESOTA
1,000's Tons (2,000 lb.)

Year	Carried	Originated	Terminated
1928	107,422	63,255	36,593
1929	114,634	72,309	29,299
1930	94,497	57,262	26,793
1931	63,604	34,758	21,986
1932	38,728	14,507	18,618
1933	52,848	28,383	17,546
1934	55,631	29,851	17,075
1935	63,211	34,677	18,280
1936	85,594	52,027	20,855
1937	103,810	67,930	21,554
1938	60,000	28,781	19,524
1939	83,882	50,145	20,638
1940	105,920	67,992	21,617
1941	133,884	87,318	24,285
1942	157,529	102,591	25,226
1943	163,676	100,185	29,357

Tonnage carried and tonnage originating have been plotted by years in Exhibit III-E-1.

The tabulations and this exhibit show that tonnage carried and tonnage originated in Minnesota both follow the same general trend from 1928 to 1942. From 1929 to 1932 there was a sharp decrease caused by the depression, but from 1932 to 1937 there was a recovery that brought the tonnage of 1937 back almost to the level of 1929. There was another drop in 1938, but this was of short duration. From 1938 to 1942 there was a material increase which raised the tonnage carried in 1942 to 37%, and the tonnage originated to 42%, above the respective figures for 1929.

Considering the period from 1932 to 1939, the figures and graph show that despite the decrease from 1937 to 1938, the long term trend was definitely upwards. For freight carried, the tonnage for 1943 showed a slight increase, 3.9%, over that of 1942, and about 2.3% decrease for tonnage originated.

Tonnages of individual commodities for the year 1940, the last before the war, are summarized by groups as follows:

SUMMARY OF MINNESOTA FREIGHT TONNAGES, 1940

	1940—Tons Originated	Terminated
Group 1. Products of Agriculture	7,568,148	7,548,790
Group 2. Animals and Products	1,285,950	539,038
Group 3. Products of Mines	55,632,001	6,267,504
Group 4. Products of Forests	539,038	1,051,848
Group 5. Manufactures and Miscellaneous	2,966,462	6,209,931
Totals	67,991,599	21,617,111

Products of Agriculture show a total of 7,568,148 tons originated and 7,548,-790 tons terminated. Wheat constitutes the largest single commodity movement, 1,243,079 tons originated and 3,623,922 terminated. The large difference in tonnage is due to wheat grown in other states which is brought into Minnesota for milling and for movement through Duluth-Superior lake shipment. If wheat tonnage is subtracted, the respective totals are 6,325,069 tons originated and 3,924,868 tons terminated. In the agricultural group Minnesota originated more of nearly every product than was terminated in the State. Exceptions are fresh vegetables, citrus fruits, cotton, peanuts and fresh fruits.

Animals and Products show 1,285,950 tons originated and 539,038 terminated. For hogs, fresh meats, cured meats, packing house products, poultry, eggs, butter, cheese, hides, and products not otherwise specified, Minnesota originated more tonnage than terminated in the State. Minnesota originated a large tonnage of cattle and calves but terminated nearly twice as much, the difference coming from other states to the state's processing plants.

Products of Mines show 55,632,001 tons originated in 1940 and 6,267,504 tons terminated. Over 98% of tonnage originated was iron ore, and over 75% of tonnage terminated was fuels.

For all Products of Forests Minnesota originated 539,038 tons and terminated 1,051,848 tons. In tonnages of logs, pulpwood and forest products not otherwise specified, Minnesota originated greater tonnage than was terminated. However, for posts, poles, piling, ties, fire wood, lumber, shingles and lath, boxing, crating, cooperage and veneer, Minnesota's imports exceed exports.

For Manufactures and Miscellaneous, 2,966,462 tons originated and 6,209,-931 tons terminated. By far the largest tonnage terminated was petroleum products.

In Exhibits III-E-2, III-E-3, III-E-4, III-E-5 and III-E-6, the tonnages originating and terminating in Minnesota for each of the five major groups of commodities in the I.C.C. Classification are plotted for each year from 1928 through 1943.

Revenue passengers carried by the Class 1 steam railroads in Minnesota for each year from 1922 through 1943 were:

RAILROAD REVENUE PASSENGERS

Year	Passengers	Year	Passengers	Year	Passengers
1922	10,552,000	1929	4,342,000	1936	2,848,000
1923	9,135,000	1930	3,171,000	1937	2,897,000
1924	7,561,000	1931	2,235,000	1938	2,470,000
1925	6,759,000	1932	1,780,000	1939	2,450,000
1926	6,172,000	1933	1,808,000	1940	2,443,000
1927	5,947,000	1934	2,342,000	1941	2,656,000
1928	4,664,000	1935	2,440,000	1942	4,043,000
				1943	6,761,000

Source: Minnesota Railroad and Warehouse Commission.

These figures are plotted in Exhibit III-E-7. The table and graph show that the passenger traffic decreased steadily from 1922 to 1932, when the number of passengers carried was only 17% of the number in 1922. From 1932 the trend was upward to 1937, but after this date it declined slightly until 1940. From 1940 to 1943 the trend has been upward. Passengers carried in 1943 were about 64% of the number carried in 1922, but were nearly four times the number in the minimum year. Declines in railroad passenger traffic have been due primarily to the development of motor transportation through use of the private automobile and bus service. This trend was not confined to Minnesota, but was nationwide. The increase during the pre-war years from 1932 to 1938 was due to the recovery from the low point of the depression. The large increase in the war years was due to increased business and industrial activity and to the restrictions in the use of motor fuels and tires.

b. Great Lakes Carriers

The navigation season on Lake Superior is limited by the severe winter climate to about 228 days per year (1870-1940 average), but navigation on the Great Lakes is not affected by tides, droughts or freshets.

The chief lake port in Minnesota is Duluth which, in combination with Superior in Wisconsin, forms the port of Duluth-Superior. This port is well known as one of the great ports of the country and ranks second only to New York in tonnage handled, principally on account of large shipments of iron ore. Dock facilities for handling great tonnages of bulk products have been highly developed and ships designed especially for these products are used in their transportation.

Shipments, which are largely iron ore, vary with the activities of the steel industry, both in peace and in war. Receipts, which are largely coal, show much less variation than shipments, because heating requirements are relatively constant, and large changes in tonnages would be principally confined to industry and the railroad carriers.

The following table lists tonnages shipped and received and totals, also number of vessels by years from 1900 to 1940. The graphs in Exhibit III-E-10 are plotted from the figures in this tabulation.

PORT OF DULUTH-SUPERIOR
TONNAGES OF RECEIPTS AND SHIPMENTS (SHORT TONS)
1900 THROUGH 1940

Year	Receipts	Shipments	Total Receipts and Shipments	Number of Vessels
1900	3,085,184	8,640,061	11,725,245	—
1901	3,371,213	9,602,160	12,973,373	—
1902	3,277,797	14,227,996	17,505,793	—
1903	4,739,865	13,226,853	17,966,718	—
1904	4,383,811	12,233,206	16,617,017	—
1905	4,212,704	18,463,441	22,676,145	—
1906	6,147,714	23,023,507	29,171,221	11,185
1907	7,840,023	26,946,682	34,786,705	10,736
1908	6,594,915	17,202,247	23,797,162	7,992
1909	6,815,410	25,713,891	32,529,301	10,503
1910	9,520,990	27,163,588	36,684,578	11,571
1911	9,424,962	21,247,884	30,672,846	9,638
1912	9,705,999	31,768,777	41,474,776	11,846
1913	12,165,608	34,709,808	46,875,416	11,925
1914	10,616,492	22,919,212	33,535,704	9,712
1915	9,713,245	30,781,427	40,494,672	10,764
1916	11,045,855	41,131,478	52,177,333	12,445
1917	12,242,814	40,169,010	52,411,824	11,577
1918	12,489,867	41,256,491	53,746,358	10,908
1919	10,183,694	32,711,987	42,895,681	9,135
1920	10,562,130	36,246,483	46,808,613	9,283
1921	11,340,028	18,743,527	30,083,555	5,638
1922	6,985,227	31,216,847	38,202,074	9,106
1923	14,171,342	45,103,470	59,274,812	12,428
1924	10,398,654	35,018,302	45,416,956	9,783
1925	11,204,464	40,130,177	51,334,641	11,553
1926	11,780,221	41,915,084	53,695,305	11,495

(Continued on next page)

Year	Receipts	Shipments	Total Receipts and Shipments	Vessels of Number
1927	13,816,115	38,896,154	52,712,269	10,259
1928	11,733,134	41,471,201	53,204,335	10,378
1929	12,129,587	48,256,180	60,385,767	10,835
1930	11,246,557	34,479,528	45,726,085	8,189
1931	8,765,504	17,692,025	26,457,529	4,975
1932	6,615,463	3,904,341	10,519,804	2,709
1933	7,251,014	15,328,454	22,579,468	4,482
1934	9,227,984	16,322,197	25,550,181	5,116
1935	8,169,604	21,015,164	29,184,768	5,619
1936	11,773,803	32,762,735	44,536,538	7,974
1937	11,227,050	45,911,529	57,138,579	10,271
1938	7,987,742	15,072,888	23,060,630	4,183
1939	8,111,788	29,936,618	38,048,406	6,900
1940	8,829,857	45,317,838	54,147,695	9,721
Total	370,905,430	1,147,880,448	1,518,785,878	

Receipts and shipments for 1940 are listed below in their order of values.

PORT OF DULUTH-SUPERIOR, CHARACTER OF MAJOR RECEIPTS AND SHIPMENTS, 1940

Order of Value	Receipts	Shipments
1	Bituminous Coal	Iron Ore
2	Automobiles	Wheat
3	Gasoline	Butter
4	Rubber and Tires	Flaxseed
5	Iron and Steel	Flour (wheat)
6	Fuel Oil	Corn
7	Canned Goods	Copper
8	Anthracite Coal	Wool
9	Limestone and Limestone Products	Scrap Iron
10	Glass and Glassware	Lime
11	Liquors—alcoholic	Iron and Steel
12	Linoleum	Barley
13	Kerosene	Eggs
14	Confectionery	Poultry
15	Twine and Cordage	Rye

Of the total 1940 receipts, coal, limestone and gasoline accounted for 93% of the total tonnage, and of the total 1940 shipments, iron ore, grains, flaxseed

and flour accounted for 98% of the total tonnage. Iron ore alone was 92½% of the total shipments.

Great tonnages of coal are brought to Duluth-Superior by the ore boats on their return trips from Lake Erie Ports. The coal is graded and reshipped by rail to the Twin Cities and to nearly all parts of the State. This movement of coal is one of the principal means of coal supply for Minnesota.

Two Harbors, about 25 miles northeast of Duluth, is also an important lake port from which large tonnages of ore are shipped.

Bulk tonnage traffic on the Great Lakes has been highly developed and has demonstrated the economy of such water-borne movement. The development of the St. Lawrence waterway to sufficient depth might have a far reaching effect on bulk Lake traffic by bringing ocean-going ships to the Great Lakes and to Duluth-Superior. The lake carriage of goods has offered lower Rail-Lake and Rail-Lake-Rail rates than all-rail rates for like shipments. This factor has been beneficial to Minnesota.

However, the carriage of so-called package freight on the Lakes has not been so highly developed as has bulk freight movement. It has been suggested that the development of this package freight traffic has been retarded by the lack of suitable water carriers. It is claimed that ships can be designed for the rapid and economical handling of package goods, which will realize the economy of water transportation for this type of traffic to a much greater extent than heretofore. The design and construction of ships for such service by private interests should be based on economic study of all factors involved, including the level and permanency of the respective freight rates. Such a study is beyond the scope of this Report.

c. River Carriers

The Upper Mississippi River has been improved by the United States Government so as to provide a nine-foot minimum channel between St. Louis and the Twin Cities. This improvement, which is stated to have cost $150,000,000, required the construction of 26 locks and dams along the 673 miles of channel. At its southern end it connects with the great system of inland waterways and at its northern end it has terminals at St. Paul and Minneapolis. St. Paul has extensive dockage facilities, but at Minneapolis the dockage facilities are limited by the topography of the land in the neighborhood of the Washington Avenue bridge.

There is ample river frontage above the Falls of St. Anthony suitable for harbor development. To carry the waterway above the Falls requires construction of a dam and lock below the Falls; the building of a lock over the Falls; and dredging below the dam, between the dam and Falls and above the Falls for a

distance of three miles. In 1934, the Board of Engineers in its report estimated the cost of the proposed improvement as $7,779,999, with $55,000 annually for operation and maintenance. The estimated cost to local interests was $1,774,000 for alterations of bridges and adjustments to utility structures. No construction work has been done on this extension. The navigation season at the Twin Cities is stated to be from April 1st to December 1st, a period about three weeks longer than the normal navigation season on the Great Lakes. The nine foot channel project was adopted and authorized in 1930, and by the 1939 season it was in operation except for Dam 24 at Clarksville, Missouri.

Tonnage records are collected and compiled by the District Engineer, U. S. Army, at St. Paul, and are available from 1935 to 1942, but since 1942 their issue has been "Restricted."

UPPER MISSISSIPPI WATERWAYS
MINNESOTA TONNAGES (2,000 LB.)

	RECEIPTS			
Year	St. Paul	Mpls.	Other Minn.	Total
1935	56,818	90,762	10,467	158,047
1936	23,608	77,549	6,377	107,534
1937	99,654	95,507	6,997	202,158
1938	294,288	202,259	11,946	508,498
1939	323,363	234,412	50,837	608,612
1940	566,954	346,092	79,741	992,787
1941	632,232	496,517	117,672	1,246,421
1942	579,534	558,087	119,924	1,257,545

	SHIPMENTS			
Year	St. Paul	Mpls.	Other Minn.	Total
1935	11,343	19,149	74	30,566
1936	9,400	19,976	7	29,383
1937	5,530	17,420	149	23,099
1938	4,672	17,031	229	21,932
1939	10,218	44,938	1,611	56,767
1940	31,527	30,201	3,525	65,253
1941	31,040	34,270	4,180	69,490
1942	45,987	41,120	2,905	90,012

Total receipts have grown rapidly, increasing 700% in the 1935-1942 period, and doubling in the 1939-1942 period. Growth since 1941 has undoubtedly been retarded by need for more floating equipment, caused in part at least, by its diversion to services more closely associated with the war effort.

Of the receipts, coal, coke, burner oils and gasoline account for approximately 85% of the total tonnage, the remaining 15% being made up of miscellaneous cargo. Principal items in the miscellaneous list are denatured alcohol, sulphate of alumina, barrels, beer, binder twine, coffee, soaps, glass bottles and jars, window glass, acids, agricultural implements, liquors, stoves and ranges, rice, iron and steel, cotton linters, oyster shells, sugar and chemicals.

Tonnage shipments have been much less than the receipts. For 1942, they were only 7½% of receipts or about 6⅔% of the total. The principal commodities shipped were grain, grain products and scrap iron which together, accounted for 95% of the 1942 total tonnage. Miscellaneous outbound cargo includes canned goods and other food products.

From the traffic records it is evident that the traffic on the waterway is principally in bulk commodities and is largely a one-way movement. The waterway offers low cost transportation for low priced bulk products for about seven to eight months of the year and as such its use may be expected to increase after the war when floating equipment is once more available in quantity. Its use for other than bulk cargoes that may be easily stored is affected by the limited transportation season, the length of time consumed in transit, the inflexibility of its terminals and the cost and inconvenience of terminal handling as contrasted with other transportation agencies. So far it also has lacked some special services made available by other carriers. The extent to which waterway traffic will serve in fields other than bulk products will depend upon numerous factors which vary with the industry and shipper. Generally speaking, a continued growth in traffic is to be expected if adequate and suitable shipping facilities are offered. The effect of low cost water transportation upon the general freight rate situation should be favorable for producers and for industry in Minnesota.

d. Highways

The operation of motor vehicle carriers and of private automobiles depends to a large extent upon the adequacy of the State's highway system. A comprehensive survey was made by the Minnesota Highway Planning Survey assisted by the Works Progress Administration of the Federal Works Agency, and published in 1942 under the title "Minnesota Highway Facts". The following discussion is based in large part on this document, conferences with the State Highway Planning Board, and revisions when more recent data became available.

Mileage of roads, divided between State, County and Local roads and streets, as well as mileage of Rural Highways by Surface Types, are shown in the following tables.

HIGHWAY MILEAGE
(as of December 31, 1942)

System	Miles	Percent of Total
Rural Trunk Highways	9,954	8.2%
Rural County (State aid — County aid and County Roads) Roads	42,076	34.9%
Local Rural Roads — Est.*	57,500	47.6%
Total	109,530	90.7%
Municipal streets, including extensions of State and County Roads	11,225	9.3%
Total	120,755	100.0%

* Estimated township Roads and Minor Local Roads not found on other systems.

MILEAGE OF RURAL HIGHWAYS BY SURFACE TYPES, 1936-1937

Surface	Miles	Percent of Total
Pavement	2,749.9	2.5
Other dustless	5,713.2	5.2
All dustless	8,463.1	7.7
Non-dustless	65,769.9	60.0
All surfaced roads	74,233.0	67.7
Graded and drained	21,337.4	19.5
Unimproved	13,960.0	12.8
All unsurfaced roads	35,297.4	32.3
All rural roads		

The Highway Planning Survey states:

"Early two-lane pavements were 16 feet or sometimes less. Eighteen feet was established as a minimum in Minnesota before any large mileage was built and 20 feet was made the standard in 1928. In 1940 the State began building 22-foot two-lane pavements . . . Widths of gravel and bituminous roads have also increased from time to time and on Trunk Highways these roads are usually wider than paved surfaces.

"Widening or rebuilding the old 18-foot pavements constitutes one of the greatest tasks confronting Minnesota highway officials."

As of 1942, the date of its report, The Highway Planning Survey recorded 284 excessive grades, 6,257 excessive curves and 15,777 restricted sight distances on the Trunk Highway System. Since then there have been changes in standards and traffic characteristics so that some modification in these figures would be in order. However, correction of the existing deficiencies still is a major problem.

In its survey of the bridges of the State, the Highway Planning Survey states:

> "Out of 8,604 bridges of more than 20-foot clear span or spans inventoried by the Planning Survey on all rural highways and municipal extensions of State and County highways, 794 were reported in poor and 1796 in only fair condition. Nearly one-fourth of the bridges were less than 16 feet wide, four-fifths were less than 20 feet wide. On the Trunk Highways there were 55 bridges less than 16 feet wide and 395 less than 20 feet wide."

The engineers were advised by the Planning Survey that while there has been some correction of the bridge situation, the foregoing statements may be considered as fairly accurate for present conditions.

After discussion of the figures on bridge widths and condition, as well as their carrying capacity, the Planning Survey stated:

> "The bridge situation is not as serious as these figures might indicate; most of the narrow bridges and those in poor condition are on roads with light traffic. The distribution of substandard bridges by highway system is shown in Table 33.* Weak and narrow bridges are usually posted with appropriate warning signs. But while the percentage of traffic affected by inadequate bridges is not as large as the number of such bridges would suggest, it is clear that the State and its subdivisions face a tremendous task of bridge construction and reconstruction to make all their bridges safe and adequate to present and future traffic."
>
> * Not here reproduced.

also:

> "There are 9,736 railroad grade crossings and 850 railroad grade separations on all roads, rural and urban, or eleven times as many grade crossings as separations."

We are advised that since that date there has been some correction of conditions, principally in installation of signal protection.

The foregoing statements of highway conditions in Minnesota, however, are only part of the picture. In every state there exist conditions requiring improvement. A fairer view is obtained by considering the extent to which the State is served by its highways, their accessibility to its residents, and how they compare with highways in neighbor states of similar economic status.

With respect to coverage of the State by rural highways, the following tabulation taken from the Highway Planning Survey 1942 Report, is illuminating.

RATIO OF RURAL ROAD MILEAGE TO POPULATION AND AREA
FOR EIGHT STATES AND MINNESOTA, 1940

State	Persons per Miles of Road	Miles of Road per sq. mile land area
Iowa	24.9	1.8
Kansas	14.1	1.6
Michigan	57.4	1.6
Missouri	32.4	1.7
Nebraska	13.1	1.3
North Dakota	5.8	1.6
South Dakota	6.4	1.3
Wisconsin	38.2	1.5
Average	23.0	1.5
Minnesota	25.6	1.4

Measured by persons per mile of road, it appears that Minnesota stands at about the average of the 8 selected states. Measured by miles of road per square mile of land area, the State is likewise at about the average of the 8 states. From these statistics it is evident that, so far as total highway mileage is concerned, the State is well equipped.

Total mileage, of course, is not the complete story. Types of highway also are important. The following tabulation, published by the Highway Planning Survey in its 1942 report, shows the precentage of Rural Roads by general surface types in 8 selected states and in Minnesota:

PERCENTAGE OF RURAL ROADS BY GENERAL SURFACE TYPES
IN EIGHT SELECTED STATES & MINNESOTA

State	Date of Inventory	Pave-ment (a)	Other Dust-less (b)	Non-Dust-less (c)	Total Sur-faced	Grd. & Drd. (d)	Total Impvd. (e)	Total Un-Impvd.	Total
Iowa	Dec. '37	4.8	0.5	34.4	39.7	40.1	79.8	20.2	100.0
Kansas	Dec. '36	1.4	2.6	19.3	23.3	1.6	24.9	75.1	100.0
Michigan	Dec. '36	5.9	4.7	53.1	63.7	23.8	87.5	12.5	100.0
Missouri	Dec. '36	3.4	2.7	25.2	31.3	51.8	83.1	16.9	100.0
Nebraska	Dec. '36	1.0	0.9	16.3	18.2	9.3	27.5	72.5	100.0
N. Dakota	Jan. '38	(f)	0.6	15.2	15.8	17.5	33.3	66.7	100.0
S. Dakota	Jan. '37	0.2	0.9	18.4	19.5	40.5	60.0	40.0	100.0
Wisconsin	Dec. '36	6.0	7.0	58.4	71.4	23.9	95.3	4.7	100.0
Average		2.7	2.3	28.6	33.6	25.7	59.3	40.7	100.0
Minnesota	Dec. '36	2.3	3.3	50.0	55.6	33.8	89.4	10.6	100.0

(a) Portland cement concrete, brick, stone block, wood block, asphalt block, sheet asphalt, rock asphalt, bituminous concrete, and bituminous penetration.
(b) Plant mixed bitumen without precise control, road mix or mixed-in-place bitumen, and bituminous surface treated gravel or stone.
(c) Plain macadam, gravel, traffic-bound crushed stone, slag, chert, caliche, iron ore, chat, sand-clay, and top soil.
(d) Natural earth aligned and graded to permit reasonably convenient motor vehicle use and sufficiently drained to prevent serious impairment of roads by surface waters.
(e) Primitive roads and trails usable by four-wheel vehicles, and natural earth roads which may or may not have been bladed and which do not conform to graded and drained earth roads as regards alignment, grade, and drainage.
(f) Less than 0.05 per cent.

SOURCE: Data for 8 states reported in "Public Roads" Vol. 21, October 1940, P. 142.

While the dates of the inventory of roads for the foregoing are 1936 and 1937, it is probably fairly representative of comparative present conditions.

Based on this inventory, Minnesota's situation as regards types of highways is not unfavorable. Roads with pavements are 2.3% of all rural roads in Minnesota as against 2.7% for the average of the 8 states. Other dustless roads are 3.3% as against the 2.3% average. Non-dustless surfaces in Minnesota are 50% as against the 28.6% average. Total surfaced are 55.6% against 33.6% average, and total improved are 89.4% against 59.3% average. Unimproved roads in Minnesota are only 10.6% against 40.7% average.

In types of high grade pavement, Minnesota is generally superior to Kansas, Nebraska and the two Dakotas, about equal to Iowa and Missouri, but inferior to Michigan and Wisconsin.

As regards accessibility of Trunk Highways the Planning Survey stated in its report:

"Trunk Highways directly serve 620 incorporated places containing 98 per cent of the municipal population of the State. There are 133 cities and villages

not directly served by Trunk Highways, only one of which has more than 1,000 population. Thirty-eight of the places not served by Trunk Highways are within a mile of a Trunk Highway and 113 are on state-aid roads.

"Ten per cent of the farm units and other rural all-year dwellings are located directly on a Trunk Highway, 27 per cent within a mile of a Trunk Highway and 84 per cent within five miles. Sixty-seven per cent of the rural all-year dwellings are located directly on surfaced roads, gravel or better, 92 per cent within a mile and 99 per cent within three miles; 94 per cent are located on improved roads, surfaced or unsurfaced, and more than 99 per cent are within a mile of an improved road."

While there have been some improvements since the date of the Planning Survey report, the foregoing statement is considered by the Planning Survey to be fairly representative of present conditions.

From the foregoing it is evident that Minnesota is equipped with a highway plan which well serves its population. However, based on the investigation of the Highway Planning Survey, Minnesota has much work to do in widening highways, improving surfacing, and in modernizing bridges. In Minnesota, as in other states, there are many grade crossings with steam railroads, but as the Planning Survey justly states:

"Since elimination of all grade crossings is a task too great for one generation, sound policy indicates removal in order of hazard rating, protection of others by adequate signs and signals."

Highways upon which motor truck and motor bus routes operate are shown on a map prepared by the State Highway Planning Survey in 1944. This map can be studied by those interested. The routes included are those of the regular carriers, and do not cover the irregular or contract carriers which may operate over any route. Examination of the map shows that the motor trucks and buses cover the State adequately.

e. Public Motor Vehicle Carriers

Public Motor Vehicle Carriers report to the Minnesota Railroad and Warehouse Commission. There are several classes of these carriers, viz:

Class 1 Carriers — Those whose annual revenues are $100,000 or more.

Class A Carriers — Those fixed terminal carriers whose annual revenues are in excess of $20,000 and less than $100,000.

Class B Carriers — Those fixed termini carriers whose annual revenues are less than $20,000.

Contract and Irregular Route Carriers — Those whose annual revenues are $25,000 and less. This class is subdivided into two groups, viz: those whose annual revenues range from $1,200 to $9,999 and those whose annual revenues are $10,000 and over.

In reporting tonnages motor carriers are not required to divide the totals

into the various commodities, nor to segregate tonnages handled in Minnesota from those of their entire system.

Data on system operations have been obtained from the Minnesota Railroad and Warehouse Commission for number of carriers and for annual tonnages, from 1939 to 1943, handled by motor carriers of property who operated in whole or in part in the State of Minnesota.

NUMBER OF MOTOR CARRIERS IN MINNESOTA

Class	Group	1939	1940	1941	1942	1943
I	I	27	27	27	27	27
	II	24	34	48	52	47
	Total	51	61	75	79	74
A	I	17	17	17	17	17
	II	24	44	47	37	43
	Total	41	61	64	54	60
B	I	22	22	22	22	22
	II	13	14	18	19	13
	Total	35	36	40	41	35
I-A-B	I	66	66	66	66	66
	II	61	92	113	108	103
	Total	127	158	179	174	169

REVENUE TONS CARRIED

Class	Group	1939	1940	1941	1942	1943
I	I	1,838,314	2,076,194	2,637,833	2,936,652	3,308,684
	II	1,513,002	2,400,947	3,283,246	3,264,404	3,219,315
	Total	3,351,316	4,477,141	5,921,079	6,201,056	6,527,999
A		95,601	110,183	117,238	109,119	146,434
	II	154,478	296,385	397,381	211,279	441,232
	Total	250,079	406,568	514,619	320,398	587,666
B	I	33,416	34,004	40,398	61,249	102,126
	II	18,744	18,335	28,570	32,441	30,521
	Total	52,160	52,339	68,968	93,690	132,647
I-A-B	I	1,967,331	2,220,381	2,795,469	3,107,020	3,557,244
	II	1,686,224	2,715,667	3,709,197	3,508,124	3,691,068
	Total	3,653,555	4,936,048	6,504,666	6,615,144	7,248,312

Group I — Includes the carriers that operated in and filed annual reports with the M. R. & W. C. each year since 1938 to and including 1943.
Group II — Includes all other carriers.

The Minnesota Railroad & Warehouse Commission advises that a check made of the annual reports of the 74 Class 1 carriers discloses that carriers who transport 62% of the aggregate tonnage, reported Minnesota traffic as 24.88% of their total. It is assumed that the Minnesota proportion was the same for the remaining carriers. For Class A and B Carriers, the Minnesota tonnage is actual. The System and Minnesota tons carried were thus determined to be as follows.

TONNAGES OF MINNESOTA MOTOR CARRIERS, CLASSES 1, A AND B.

	Entire Systems Tons	Minnesota Tons	Minnesota %
74 Class I Carriers	6,527,999	1,623,999	24.88
60 Class A Carriers	587,666	422,652	71.92
35 Class B Carriers	132,647	131,517	99.15
Total	7,248,312	2,178,168	

The foregoing tonnages do not include contract and irregular-route motor carriers of property. Statistics for these carriers covering operations on routes within and outside of Minnesota have been supplied by the Railroad and Warehouse Commission for the years 1940, 1941 and 1942. Inasmuch as there are approximately 2,300 licensed operators in this class and because of the number of incomplete returns and the large number whose annual revenues were less than $1,200, the compilations were confined to the carriers whose returns were complete and whose annual revenues were $1,200 or more. The values are tabulated below.

CONTRACT AND IRREGULAR CARRIERS (over $1,200)

Year	No. of Carriers	Tons Carried
1940	1,328	1,079,700
1941	1,033	802,901
1942	942	1,026,248

This tonnage has not been separated between Minnesota and other states. Allowing for the tonnage carried by the large number of carriers not included in the foregoing statement, and considering the large tonnage of livestock handled to the St. Paul area, it is probably reasonable to assume that a total of about 500,000 tons per annum was handled by the contract and irregular-route carriers in Minnesota during the last year. If this is combined with the tonnage handled by Class 1, A and B carriers, there is a total of about 2,700,000

tons carried annually by motor carriers of property in Minnesota. From a purely tonnage viewpoint, the motor carriers were not a large factor in the freight haulage situation. However, from the viewpoints of convenience to shippers and of the classes of freight handled, their importance is greater than the tonnage figures would indicate.

Considering the number of regular carriers, (169), the extensive coverage of the State by truck routes and the large number of contract and irregular-route carriers, it may be stated that the State is well served by motor truck operations.

Motor carriers of passengers in Class 1, A and B report to the Railroad and Warehouse Commission on both local service and inter-city service. "Local" applies to service within a given or adjoining metropolitan area and "Inter-City" to over-the-road, inter-city service.

In the year 1943, there were four Class 1, seven Class A, and sixteen Class B companies that reported in inter-city service; and six Class 1, three Class A and thirteen Class B companies that reported in local service.

Returns shown are for the entire systems including both intra-state and inter-state operations. This method of reporting makes it impossible to distinguish the strictly Minnesota traffic from the inter-city figures.

The following tabulation lists the number of revenue passengers carried as reported by Class 1, Class A and Class B companies, for the years 1939-1943.

REVENUE PASSENGERS CARRIED

Year	Local Service	Inter-City Service
1939	14,302,327	7,620,118
1940	13,366,296	7,113,439
1941	24,724,030	7,796,908
1942	30,501,704	12,397,871
1943	41,020,455	17,306,123
1943*	44,785,298	27,943,400

* The figures for 1943 include passengers of:
Minneapolis Street Railway Co. 9,133,980
St. Paul City Railway Co. 4,366,868
and 12 bus companies which were not included in preceding 1943 figures and probably not for previous years.

The large increases in both local and inter-city traffic reflect the war conditions heretofore discussed under railroad passenger traffic.

f. Private Motor Vehicles

With respect to private automotive transportation in Minnesota, the following tabulation indicates the population; motor vehicle registrations of passenger cars, buses and trucks, combined; and the number of vehicles per 1,000 persons.

Year	Population Thousands	Motor Vehicle Registration Number	Vehicles per 1,000 Persons Number
1921	2,413	328,624	136
1922	2,430	380,557	157
1923	2,448	448,187	183
1924	2,465	503,307	204
1925	2,482	569,694	230
1926	2,499	630,285	252
1927	2,517	646,682	257
1928	2,534	673,613	266
1929	2,551	720,399	282
1930	2,572	733,012	285
1931	2,600	720,401	277
1932	2,622	683,397	261
1933	2,643	679,030	257
1934	2,665	697,466	262
1935	2,688	726,771	270
1936	2,707	783,226	289
1937	2,725	822,374	302
1938	2,749	821,045	299
1939	2,744	840,058	303
1940	2,792	871,212	312

The total vehicles and vehicles per 1,000 population are plotted in Exhibit III-E-8. Trends have been steadily upward throughout the period up to the year 1940. Since 1940 manufactre and sale of motor vehicles have been restricted.

Population, motor vehicles and vehicles per 1,000 population for Minnesota and seven selected states, for the year 1940 were:

1940 POPULATIONS AND MOTOR VEHICLE REGISTRATIONS, MINNESOTA AND SEVEN STATES

State	Population Thousands	Motor Vehicle Registration	Vehicles per 1,000 Population
Minnesota	2,792	871,212	312
Iowa	2,538	793,969	313
Kansas	1,801	582,668	323
Michigan	5,256	1,552,561	296
Nebraska	1,316	412,116	313
N. Dakota	642	182,287	284
S. Dakota	643	195,667	305
Wisconsin	3,138	900,915	288

For the year 1940 the motor vehicles of all types in Minnesota, including motor cycles, snowmobiles and trailers were classified as follows:

Passenger Cars and Buses	746,749
Trucks	124,463
Sub-total	871,212
Trailers	39,098
Motor cycles and snowmobiles	2,576
Total	912,886

From the above tables it is apparent that so far as number of motor vehicles is concerned, Minnesota is well equipped and fairly comparable with neighboring states.

g. Aviation

Northwest Airlines, Inc., ranks fifth among the domestic commercial air transport lines in the United States. It was incorporated in Minnesota in 1927, consolidating operations of the former Jefferson Transportation Company, Universal Airlines and Northwest Airways — pioneers in aviation in Minnesota.

Northwest Airlines, Inc., is the largest air transportation company in the Northwest, having its headquarters in St. Paul. Its present eastern terminus is Chicago, Ill., and it has western termini at Seattle, Washington and Portland, Oregon. Its major stations include Milwaukee and Madison, Wisconsin; Minneapolis, St. Paul and Rochester, Minnesota; Fargo, Minot and Bismarck, North Dakota; Winnipeg, Canada; Billings, Butte, Helena, Great Falls and Missoula, Montana; and Spokane, Yakima and Wenatchee, Washington.

At the outbreak of World War II the company turned over a large number of its planes to the Federal Government. It has a distinguished war record. Over 1900 of its former employees have entered the armed forces.

The company has a large plant at Holman Field, in St. Paul, which for about two and one half years, has been engaged in aircraft modification for war purposes and probably will be a maintenance and supply base after the war.

Northwest Airlines has numerous contracts with the government. These contracts have caused the company to increase its number of employees from prewar 881 to over 10,000 with a peak of 10,349.

The following statistics indicate the rapid and sustained growth of the company's transportation business up to the beginning of World War II.

NORTHWEST AIRLINES RECORD

Fiscal Year Ending June 30	Number of NWA Passengers Originating at Minn. Points	Number of NWA Passengers Terminating at Minn. Points	Average NWA Passenger Fare Cents per Mile	Average Length in Miles of Trip per NWA Passenger
			**	**
1935	4,656	4,552	4.66	412
1936	5,904	6,055	4.60	435
1937	8,339	8,428	4.57	442
1938	9,881	10,093	3.92	457
1939	14,306	14,384	3.81	466
1940	26,659	25,998	4.20	459
1941	36,837	36,214	4.24	466
1942	37,002	36,205	4.63	574
1943	21,364	20,164	4.92	682
1944	34,941	35,894	—	—

** Calendar Years.

Year	NWA System Express Pound Miles	Est. Avg. cost to shipper all NWA shipments (cents per lb. mile)	Mail Carried by NWA Pound Miles
1935	36,358,467	.03407	315,817,803
1936	84,322,804	.03240	671,011,789
1937	110,394,731	.03059	841,274,933
1938	142,710,897	.02917	1,116,975,430
1939	202,102,089	.03027	1,166,518,244
1940	259,447,189	.02983	1,370,076,043
1941	416,048,017	.02729	1,871,311,191
1942	856,605,160	.02974	2,528,042,954
1943	1,000,634,952	.02586	4,005,180,807
1944	591,598,104*	.02337*	—

* January through July only.

The company's recent application to the Civil Aeronautics Board to extend its lines into New York City via Milwaukee, Detroit and Cleveland, but by-passing Chicago, has been approved. Applications also have been filed for a route extension from Seattle, Washington, to Portland, Oregon, and from Chicago, Illinois, to Washington, D.C. via Dayton, Ohio. Other applications have been filed for ten additional route extensions. These involve three within the northwestern continental United States and others from Seattle to Honolulu and in and through Alaska, some of which go as far as China, Japan and India.

Mid-Continent Airlines is another important air transportation system which enters Minnesota from the south and terminates at Minneapolis. It is much smaller than Northwest Airlines, and serves a large part of the Mississippi Valley region, including Kansas City, St. Louis and Tulsa. A branch extends northward from Minneapolis to Minot, North Dakota. The company has filed applications for extensions to Dallas, New Orleans and Atlanta, and eastward from Minneapolis to Milwaukee, Chicago, Indianapolis and Detroit with many intermediate stops. The only foreign extension projected is a route to Regina, Canada.

Growth of this company during the last five calendar years is shown and compared with that of Northwest Airlines by the following operating records.

(Continued on next page)

OPERATIONS RECORDS — AIRLINES IN MINNESOTA

NWA = Northwest Airlines, Inc.
M-CA = Mid-Continent Airlines, Inc.

	1939		1940		1941		1942		1943	
	NWA	M-CA	NWA	M-CA	NWA	M-CA	NWA	M-CA	NWA	M-
Passenger Revenue ($1000)	969	180	1,753	278	2,324	413	2,663	335	2,364	52
Percent Seats Sold	46.0	37.6	44.0	36.5	45.2	37.0	59.0	45.9	75.6	6
Mail Revenue ($1000)	1,551	454	1,770	585	1,852	788	1,971	628	1,495	61
Other Oper. Revenue ($1000)	75	9	117	14	162	15	289*	20	906*	2
Total Oper. Revenue ($1000)	2,595	643	3,640	877	4,338	1,216	4,923*	983	4,765*	1,16
Percent Oper. Ratio	110.1	93.8	92.1	105.2	89.9	114.6	91.9	94.8	87.7	8
Federal Taxes ($1000)	Nil	7	68	Nil	100	Nil	250	Nil	279	6
Net Income	d 112	33	296	d 46	327	d 179	485	69	300	17

* Includes fees from cost-plus-fixed-fee contracts.
d = Deficit.
Source: Airlines — 1944 — Merrill Lynch, Pierce, Fenner and Beane.

In 1943, Minnesota established a State Department of Aeronautics, having control of aviation activities throughout the State except those within a circular area having a 25 mile radius from a center midway between Minneapolis and St. Paul. This area is controlled by the Metropolitan Airports Commission which was instituted by a law which became effective July 6, 1943, and which at present pertains chiefly to the Twin Cities.

These two agencies have made comprehensive studies in connection with the present and future operation and control of landing fields and airports. Planning is proceeding along coordinated scientific lines. A long term plan is being prepared for development of municipal airports and surveys, and plans are in preparation for fifteen airports which will be started in a small way and later expanded, if justified. The State is financially assisting this program.

The air mindedness of the people of Minnesota and the need for statewide control is evidenced by the map in Exhibit III-E-11 which indicates the location or status of airways and airports within the State as of September 1944.

A recent poll published by the Minneapolis Sunday Tribune indicated that there are 154,000 families in the State who would like to own planes and felt they were financially able to purchase and operate them. L. L. Shroeder, Minnesota Aeronautics Commissioner, predicts the possibility of there being 6,000 airplanes in the State by 1950. On January 1, 1944, there were 2,628 pilots and 556 planes privately owned (excluding those in the military or naval services). In 1940 there were 833 privately owned aircraft. The decrease indicated probably is due to war conditions.

h. Freight Rates

In considering freight rates as related to industrial location it is helpful to distinguish between several types of industry. There are two broad classifications, Extractive and Manufacturing.

Extractive industries, like mining and lumbering, operate where the resources exist.

Manufacturing industry may be divided into four groups:

1. Industries that tend to locate near raw materials. Loss of weight in processing the raw materials is frequently a major factor, on account of savings in transportation costs.
2. Industries that tend to locate near their markets. Among others, such industries include those drawing raw materials from a number of sources and those producing perishable products.
3. Industries drawn towards raw materials or towards markets,

depending on the relative costs of freight rates on raw materials and on finished products.

4. Industries based chiefly on electric power, labor costs, or especially skilled labor, in which cases freight rates are of little influence.

Many activities of the personal service class are local in character and are based primarily on population. They are not directly affected by freight rates. From the foregoing it is apparent that in a number of industries freight rates are a factor of lesser importance and therefore they will not have controlling influence on industrial location. Furthermore, for manufacturing industries producing a high class, high value product, freight rates constitute a relatively small proportion of the total production and marketing costs. Small differences in rates would be even less important. However, the general importance of freight rates should not be under-rated. In many industries it is a major factor.

Transportation charges covering traffic between the states are under the jurisdiction of the Interstate Commerce Commission. This Commission, being a Federal body, must give consideration to the business and economic conditions existing throughout the United States as a whole, in establishing rates for interstate traffic. Since the railroads transport the bulk of this traffic, the Commission's primary interest has been in establishing rates for these carriers, although, in their studies, rates for other types of carriers have not been neglected.

At the present time, the Commission is studying the advisability of major changes in the freight rate structure throughout the country. Minnesota appears to have been well represented in the proceedings and it may be assumed that the Commission's decision will be fair and reasonable. The problem is exceedingly complex and is beyond the scope of this Report.

In general, there are two major divisions of rates, Class Rates and Commodity Rates, which in turn are further subdivided into various classes and commodities. The country as a whole is divided into five "territories" and in some cases these are further subdivided into "zones". This subdivision is shown by the map, Exhibit III-J-10. Roughly uniform rates for each class of freight appear to apply on a ton-mile basis throughout each zone, but there are numerous classification "exceptions". Commodity rates are sometimes made a percentage of the Class rates. At other times, they are built up of base rates and a system of differentials, or they may consist of point-to-point rates adjusted to meet the needs of some particular shippers or competitive conditions. It is virtually impossible to generalize about Commodity rates because they are constructed on so many different bases and are of varying importance.

Those interested in studying rates further are referred to a comprehensive study made by the Board of Investigation and Research, Transportation Act 1940. This study was instituted in December 1941, and reports thereon issued, first in "Summary Report on Study of Inter-territorial Freight Rates", transmitted to the President and the Congress on March 30, 1943, House Document No. 145, 78th Congress, 1st Session; and later in "Report on Inter-territorial Freight Rates", transmitted September 21, 1943, House Document No. 303, 78th Congress, 1st Session.

From interviews with traffic men in Minnesota, it appears that the rate situation in the State generally is favorable in relation to other states in the same territory and advantageous wherever rail-lake rates apply. Some commodities have favorable rates in the Western Trunk-Line Territory, in which Minnesota is located.

The Carriers are vitally interested in the prosperity and development of the territory they serve. In the past they have often adjusted rates to meet the needs of shippers, and a cooperative spirit and policy toward industrial development may be assumed. However, in the future as in the past, individual rates considered by Minnesota's representatives to be inequitable should be investigated and relief sought when deemed warranted.

A system of rail-and-lake rates differentially related to the all-rail rates was prescribed by the Commission between the eastern portion of Official Territory and points in Western Trunk-Line Territory. These rates apply chiefly through the Lake ports of Duluth, Chicago and Milwaukee in the West, and the Lake Erie Ports of Cleveland and Buffalo. The differentials are constructed broadly on the principle that as the water haul becomes a smaller proportion of total distance the differential under all-rail rates should decrease.

Examples of such rates are:

	First Class	
	All-Rail Cents per 100 Pounds	Rail-Lake Cents per 100 Pounds
From New York to Duluth	253	184
to Twin Cities	253	216
to Chicago	177	160

River-to-river port rates are generally about 20% less than all-rail and about 15% less than combined rail-and-river.

Transportation rates covering traffic within the State are under the jurisdiction of the Minnesota Railroad and Warehouse Commission, except insofar as such rates might be deemed to conflict with similar rates for interstate traffic.

The State rates for steam railroads in Minnesota are made in accordance

with a distance scale. The first class rates are given in cents per 100 pounds, and other classes bear a fixed relationship to first class.

State motor truck first class rates are made in accordance with a distance scale and are equivalent to the Interstate Commerce Commission first-class steam railroad rates for Western Trunk-Line Territory, Zone I, excluding Ex Parte 123 increases, but including the 6% increase.

i. Employment

Employment in transportation in Minnesota, as reported in the United States Census for 1940 is tabulated below.

EMPLOYMENT IN MINNESOTA'S TRANSPORTATION INDUSTRIES, 1940

Transportation	Employed Excl. Emer. Work			Seeking Work — Experienced			
	Male	Female	Total	Male	Female	Total	
Air	432	61	493	28	2	30	
Railroads	28,983	1,331	30,314	3,484	68	3,552	Inc. Repair Shops
Railway Exp.	690	31	721	27	2	29	
St. Ry. & Bus	3,466	154	3,620	166	8	174	
Trucking Ser.	10,291	364	10,655	1,528	14	1,542	Inc. Warehousing
Water Trans.	913	14	927	826	9	835	
Other Trans.	1,538	99	1,637	130	6	136	Pipe Line, Taxi, Other
Total	46,313	2,054	48,367	6,189	109	6,298	

3. Fuel Supply

Minnesota has no deposits of coal, oil, lignite or natural gas, other than a narrow coal seam that never has been mined. Its development is believed to be commercially impracticable. The State has large deposits of peat, but these are virtually unused at the present time.

The absence of deposits of high grade fuel in or near Minnesota is an extremely pertinent factor in the State's economy. While a large percentage of the State's rural population uses fuel from the forests for domestic purposes, wood is not well adapted for producing heat for industrial purposes nor for the generation of power. Neither is it particularly convenient for use as a domestic fuel. As a result of these conditions, industry generally and most of the urban population of the State use fuels imported from other states and are handicapped by the large, though necessary, costs of their transportation.

a. Coal

Coal is brought into Minnesota in several ways. A large tonnage moves by way of the Head-of-the-Lakes Docks. This coal is brought up the Lakes by

the ore boats on their return trips from Lake Erie ports. Much the larger part of this is bituminous coal originating in the Appalachian coal producing districts of Ohio, Pennsylvania, West Virginia and eastern Kentucky, together with small tonnage from Virginia and Tennessee and a small amount from north-eastern Pennsylvania. All of these coals are stored and graded at the Duluth-Superior and Ashland-Washburn docks, and are shipped by rail to consumers in Minnesota, Wisconsin and the Dakotas.

Coal also moves by barge on the Mississippi River from the Illinois fields into Minnesota towns located on the river as far north as St. Paul and Minneapolis. A small tonnage of Illinois barge coal reaches Stillwater, Minnesota, on the St. Croix River.

Coal from Illinois, Indiana and western Kentucky, as well as some Pocahontas coal reaches the State by all-rail routes. A relatively small amount of coal is received as far north as the Twin Cities from mines located in Arkansas and Oklahoma. A rather insignificant tonnage of Montana coal, and lignite produced in North Dakota, comes into the extreme western part of the State.

The following tabulation lists shipments of coal in short tons from Duluth-Superior and Ashland-Washburn docks for the period 1934 through 1943. Minnesota tonnages are shown separately where obtainable.

SHIPMENTS OF COAL IN SHORT TONS
FROM DULUTH-SUPERIOR AND ASHLAND-WASHBURN DOCKS

Year	Anthracite		Bituminous				Anthracite and Bituminous
	Total	Minnesota	Total	Minnesota	Railroads	Other	
(Col.) 1	2	3	4	5	6	7=4—(5+6)	8=2+4
1934	234,676	—	7,126,610	—	—	—	7,361,286
1935	236,970	—	7,285,045	—	—	—	7,522,015
1936	291,818	—	8,647,431	—	—	—	8,939,249
1937	283,635	—	8,511,527	—	—	—	8,795,162
1938	205,908	—	6,656,336	—	—	—	6,862,244
1939	209,928	93,233	6,785,528	3,701,957	1,766,002	1,317,569	6,995,456
1940	199,291	80,176	7,350,153	4,016,182	1,874,788	1,459,183	7,549,444
1941	190,873	69,571	7,468,774	3,924,005	1,973,095	1,571,674	7,659,647
1942	232,439	80,202	8,577,035	4,356,901	2,217,685	2,002,449	8,809,474
1943	326,819	88,361	9,867,130	4,479,813	2,538,080	2,849,237	10,193,949

The total tonnages shown in Columns 2, 4 and 8 of the above table are plotted in Exhibit III-G-1. Considering the total tonnage distributed from the Head-of-the-Lakes to Minnesota and adjoining states, it will be observed that between 1934 and 1940, while there were variations in amount, there was no indication of a permanent increase or decrease in the annual use of coal. Since

1940 the tonnage has increased each year until that of 1943 is 35% higher than 1940. This large increase is undoubtedly due to war activity, both in industry and in railroad traffic.

Columns 3 and 5 of the foregoing tabulation show the coal delivered directly to Minnesota in the 1939-1943 period. It is not possible from the record to separate the tonnage delivered to the railroads between the tonnage used in Minnesota and that used in adjoining states. However, an estimate based on the ratio between the total tonnage of freight originated in Minnesota and the total tonnage originated in Minnesota and three adjoining states, indicates that Minnesota should be allocated at least 75% of this railroad coal. This ratio is used in Exhibit III-G-2, which indicates the coal shipped into Minnesota from the Head-of-the-Lakes, by barge on the Mississippi River, and by all rail movement.

While Exhibit III-G-2 shows the bulk of tonnage coming into Minnesota, it does not include the shipments of Arkansas, Oklahoma and eastern coals moving all-rail, nor does it include the Steel Corporation tonnage at Duluth. From available information, the total Steel Corporation tonnage of coal at Duluth for railroad, mine and mill operation may be taken at approximately one million tons for the last year.

Unfortunately, the records showing shipments of various coals into the State of Minnesota are incomplete, except for the three years of 1939, 1940, and 1941. However, the records of tons of revenue coal terminated in Minnesota are available from the reports of Class 1 Railroads to the Interstate Commerce Commission and the Minnesota Railroad and Warehouse Commission. These figures are listed in Column 11 of Exhibit III-G-2. They check fairly closely with the sum of the tonnages given in Columns 2, 3 and 9, for railroad revenue coal. It appears that the receipts of coal in Minnesota remained fairly level from 1934 to 1940, since which time they have increased markedly.

Costs of coal naturally depend on mine cost and freight. Minnesota's geographical location requires longer haul for coal there and consequent higher costs than for cities further east and south, though modified to some extent by available water transportation on lake and river. This low cost water-borne transportation in effect moves the mines closer to Minnesota than would otherwise be the case.

Exhibit III-G-3 shows the cost of coal per ton for various sizes supplied from the Head-of-the-Lakes. Under each size is given a high and a low cost, depending on the kind and grade of fuel. While the B.T.U. values of the various coals depend on a number of factors, such as the particular mine and the preparation, such as sizing, washing in some cases, and dry cleaning in others, an approximate range of heating values may be stated as 13,600 to 15,000 B.T.U.

The cost delivered at selected Minnesota towns, includes the price at the dock plus carload freight from Duluth to destination. Prices at Duluth docks are stated to be O.P.A. maximum prices. Illinois screenings F.O.B. cars at river docks in the Twin Cities are priced at $6.05 per net ton.

Costs of coal for selected Minnesota points are listed in the following tabulation. These costs are for southern Illinois screenings and are obtained by adding the carload freight to destination to ceiling prices at the mines.

COAL PRICES PER TON — SOUTHERN ILLINOIS SCREENINGS

Delivered at	Low	High
Ceiling Prices F.O.B. Mines — $2.10 to $2.40		
Albert Lea	5.25	5.65
Bemidji	7.23	7.53
Brainerd	6.66	6.96
Fairmont	5.79	6.09
Grand Rapids	7.40	7.70
Hibbing	7.47	7.77
International Falls	7.23	7.53
Mankato	5.25	5.65
Montevideo	6.18	6.48
Moorhead	7.18	7.48
Morris	6.56	6.86
Pine City	6.30	6.50
Red Wing	5.61	5.91
Rochester	5.25	5.65
St. Cloud	6.26	6.56
Thief River Falls	7.49	7.79
Tracy	5.86	6.16
Winona	5.60	5.90
Worthington	6.10	6.40

It is impossible within the limits of available space to list comparative prices for all the various grades of coal at the various points in adjoining states that might be considered competitive with Minnesota. The following tabulation is illustrative of the variation with local conditions.

COAL PRICES OTHER CITIES

City	Approx. B.T.U.	Cost per Ton
Omaha	12,500-13,000	$4.40 - $5.76
Chicago	12,200-14,150	3.59 - 6.03
Buffalo	14,000	5.24 - 5.74
St. Louis	9,500-15,500	2.95 - 7.22
Des Moines	10,500-12,000	4.35 - 5.25
Detroit	12,400-13,400	4.71 - 5.74

It is misleading to attempt to generalize regarding comparative coal prices in Minnesota and in her neighbor states. Each specific location, each size and type of service, and each quality and quantity of coal required must be given individual consideration.

However, it can be said that while the costs of coal are higher than for areas nearer to the producing mines, many varieties of coals of various grades and sizes are available to meet the requirements of individual industries. For many types of operating industries the higher costs of solid fuel are a relatively minor factor in their economic equation, and for many types of prospective industries they would not be a deterrent.

There is also a considerable tonnage of coke used as fuel in the State. It is stated that in a normal year about 200,000 tons are used in the Twin City area. It is probable that the bulk of coke tonnage is derived from coal already included in the coal tonnages, and that direct importations of coke are of relatively small amount.

b. Liquid Fuels

Oil and oil products move into Minnesota in four principal ways:

1. By river barge to docks, thence by tank car or truck.
2. By Great Lakes Pipe Line to Minnesota Transfer near Minneapolis, thence by tank car or truck.
3. By tank car.
4. By tankers to Head-of-the-Lakes, thence by tank car or truck.

There is a small refinery southeast of Minneapolis, using Wyoming crude received by tank car.

The following tabulation shows the annual shipments of Petroleum Products into Minnesota for the period 1928 through 1943.

GALLONAGE SHIPMENTS OF PETROLEUM PRODUCTS INTO MINNESOTA—1928 THROUGH 1943

Year	Gasoline	Kerosene	Fuel Oil & Distillates	Farm Tractor Fuel	Total	% Increase
1928	310,589,373	39,316,492	24,399,533	—	374,305,398	—
1929	357,903,459	41,523,772	36,656,033	—	436,083,264	16.6
1930	401,441,670	37,858,631	46,059,211	—	485,359,512	11.4
1931	441,746,269	30,730,994	48,189,995	—	520,667,258	7.1
1932	401,080,799	31,694,748	69,540,495	—	502,316,042	—3.5
1933	401,723,844	32,191,814	76,628,928	—	510,544,586	1.6
1934	431,545,341	30,215,127	86,643,452	—	548,403,920	7.4
1935	456,444,171	31,516,644	107,145,002	—	595,105,817	8.7
1936	493,642,184	33,436,073	136,453,408	—	663,531,665	11.2
1937	522,832,430	34,080,382	155,755,002	—	712,667,814	7.4
1938	544,858,956	30,169,445	157,566,003	—	732,594,404	2.8
1939	566,846,430	29,031,414	176,953,100	5,512,692	778,343,636	6.2
1940	601,501,385	28,021,204	217,455,737	12,576,331	859,554,657	10.4
1941	635,363,576	18,807,576*	225,515,494	17,058,520	896,745,488	4.4
1942	569,675,636	—	257,782,627	18,502,018	845,960,281	—5.6
1943	464,241,811	—	246,426,371	22,989,819	733,658,001	—13.4

* Effective September 1, 1941, kerosene included in definition and specification of fuel oil.

From this tabulation it appears that the total shipments of Petroleum Products into Minnesota practically doubled between 1928 and 1943. The average annual rate of increase was 4.8%. From 1932 to 1939 the trend was constantly upwards, increasing 55% during the period. Fuel Oil and Distillates, including Kerosene, shipped into Minnesota increased approximately 300% in the 1928-1943 period.

The Petroleum Products shipped into Minnesota have been plotted by years in Exhibit III-G-4. This illustrates forcefully the great increase that has taken place in the use of this type of fuel.

Exhibit III-G-5 shows typical current tank wagon posted prices for various petroleum products, delivered at nine selected Minnesota points distributed throughout the State, and offers a fair picture of prices of liquid fuels in various localities.

The following tabulation shows the prices of Petroleum Products in the Twin Cities, Duluth, and representative cities in adjoining states. The prices are ceiling and include taxes, if any.

TANK WAGON PRICES IN CENTS PER GALLON

City	Regular Gasoline	Kerosene	No. 2 Fuel Oil	Diesel Oil
Twin Cities, Minn.	17.4	10.6	9.1	8.1
Duluth, Minn.	17.7	10.9	9.5	8.5
Chicago, Ill.	16.1	10.6	8.8	7.8
Milwaukee, Wis.	17.6	10.8	9.0	8.0
Des Moines, Iowa	15.9	*13.1	8.6	7.6
Kansas City, Mo.	15.0	9.7	8.1	—
Green Bay, Wis.	17.7	10.9	9.4	8.4
Peoria, Ill.	16.2	10.4	8.7	7.7
St. Louis, Mo.	15.5	10.1	8.4	8.4

* Includes 3 cent State Tax.

Examination of the foregoing tabulation demonstrates that the prices of petroleum products in Minnesota compare favorably with prices in the other cities.

c. Gas

Natural gas, having an average heat content of 1,000 B.T.U. per cubic foot, is supplied in Minnesota by the Northern Natural Gas Company of Omaha, Nebraska. Gas is transmitted from fields in the Texas Panhandle and Kansas and reaches Minnesota through two main 16-inch pipe lines. One enters the State near Albert Lea and runs almost due north to the Twin City area; the other enters the State near Petersburg and runs northeasterly to the Twin City area. There are numerous branch lines serving various towns not on the main transmission. At St. Paul straight natural gas is supplied direct to several large industrial companies and to the Northern States Power Company for power station use. In St. Paul it is not distributed through the general gas distribution system either as straight natural gas or as mixed gas.

At Minneapolis, natural gas is sold to the Minneapolis Gas Light Company which distributes 800 B.T.U. mixed gas generally throughout the city and suburban areas. One or two large industrials in Minneapolis are served directly with straight natural gas.

The Northern Natural Gas Company is a natural gas pipe line company engaged in the transmission and sale of natural gas at wholesale and direct to industries. It has a wholly owned subsidiary, The Peoples Natural Gas Company, which is engaged in the distribution of natural gas at retail.

Including Minneapolis and St. Paul, there are 42 town border supply points, including Farmington, Rochester, Austin, Albert Lea, Owatonna, Faribault,

New Ulm, Worthington, Mankato, and numerous other towns in southern Minnesota.

The following tabulation lists the total annual M.C.F. or thousands of cubic feet of gas delivered through town border stations in the State of Minnesota for the period 1935 through 1943.

NATURAL GAS DELIVERIES IN MINNESOTA

Year	Delivered M.C.F.	% Increase
1935	10,662,810	—
1936	12,128,738	14
1937	13,231,857	10
1938	14,894,667	13
1939	17,633,213	18
1940	20,268,238	15
1941	23,066,639	14
1942	29,371,445	27
1943	33,985,820	16
Average Yearly Increase		15.16%

The M.C.F. given in the foregoing table have been plotted in Exhibit III-G-6. It shows clearly both the rapid increase in the use of natural gas in the prewar period and also a continued increase during the war period when deliveries under war-time conditions have been subject to government regulations and restrictions.

The capacity of the existing lines in Minnesota is reported to be approximately 106,000 M.C.F. per day. This capacity is fully utilized during the months of October, November, December, January, February, and March, and only 5,000 M.C.F. per day is generally available after deliveries to existing customers during the months of May, June, July, August and September. Existing loads include 63,545 M.C.F. of firm deliveries on the maximum day with 42,455 M.C.F. deliveries to interruptible industrial customers.

The extent to which the existing natural gas lines may be able to supply new customers will depend to a large extent upon the load requirements of the existing customers in the post-war period. Surveys of this situation are being made, but it is unlikely that definite information will be available for some time to come.

Following is a brief summary of natural gas rate schedules covering town border gas delivery to gas utilities. These schedules are on file with the Federal Power Commission.

For general use or distribution of gas in a city or town a classification of

"Firm Gas" (non-interruptible service) is used. The rate is $0.18 per 1,000 cubic feet for the base load, which is the volume of gas purchased up to, but not exceeding the average of the three lowest monthly volumes of gas purchased during the twelve month period ending with October. For purchases in excess of the base load the rate is $0.28 per 1,000 cubic feet.

A utility purchasing Firm Gas may also purchase Interruptible Gas for resale to individual customers whose normal use of gas may be curtailed as required for the protection of delivery of Firm Gas. The rate for such Interruptible Gas may be $0.175, $0.16 or $0.145 per 1,000 cubic feet, depending on certain priority classifications of the individual customers to whom the gas is resold.

The individual rates contain many provisions not included in this summary. The filed rate schedules should be consulted by those interested.

Direct deliveries of natural gas to large industrial users are usually covered by special contracts dependent on the conditions in each case. Generally speaking, such rates are said to be slightly higher than those for the same quantities and priorities for a gas utility.

Analysis of the foregoing natural gas rates, and comparisons with prices of coal and of oil, show that the cost of natural gas on a strictly B.T.U. basis is the lowest. For industries operating under an Interruptible Customers Rate, account must also be taken of the costs of shut-downs, or of costs of stand-by equipment to give service during the time of interruption or discontinuation of the natural gas service. From the number of industrial companies using natural gas in the area served in southern Minnesota, it is evident that its advantages have been rather generally recognized.

The Minneapolis Gas Light Company supplies gas in the City of Minneapolis and in adjacent suburban areas, but does not supply gas in the City of St. Paul which is served by the Northern States Power Co. In Minneapolis the company purchases natural gas from the Northern Natural Gas Company and distributes mixed natural and manufactured gas of 800 B.T.U. per cubic foot heating value. It also supplies industrial natural gas of 1,000 B.T.U. heating value to eleven customers.

Natural gas was introduced into Minneapolis on June 1, 1935. The record of gas sales and number of customers by classes of business for the period of 1934 through 1943, as filed with the City by the Company, is shown in detail in Exhibit III-G-7. The figures of gas sales in Exhibit III-G-7 have been plotted in Exhibit III-G-8.

Examination of Exhibits III-G-7 and III-G-8 demonstrates that total gas sales decreased slightly from 1934 to 1936, but since 1936 they have increased steadily and in large amount. The gas sales for 1934 and the first half of 1935 are presented in actual M.C.F, but the heating value of the gas in that period was

550 B.T.U. per cubic foot as contrasted with a heating value of 800 B.T.U. subsequent to June 1935. If the M.C.F. in 1934 and 1935 are adjusted for the difference in heating values, an unbroken upward trend from 1934 to 1943 is indicated.

Considering the various classifications of Gas Sales it may be noted that:

1. Domestic Sales have remained practically constant.
2. House Heating Sales have increased steadily and rapidly throughout the entire period until in 1939 they were nearly 8 times, and in 1943, 17 times the volume of 1934, with a corresponding increase in the number of house heating customers from 541 in 1934 to 8,493 in 1939 and 17,629 in 1943.
3. Combined Commercial and Industrial Gas Sales increased from 856,763 M.C.F. in 1934 to 857,800 M.C.F. in 1939 and 3,644,512 M.C.F. in 1943. If the figures for 1934 are adjusted for lower heating value, a substantial increase in these uses of gas (about 46%) is indicated from 1934 to 1939 and a large increase (about 325%) from 1939 to 1943.

The average rate for each class of business for the year 1943 is given below.

MINNEAPOLIS GAS LIGHT COMPANY 1943 AVERAGE RATES

Class of Business	Average Rate per M.C.F.	B.T.U.
Domestic	$1.12	800
House Heating	0.61	800
Commercial	0.78	800
Industrial—Ordinary	0.59	800
Industrial—Off peak	0.29	800
Industrial—Natural	0.21	1,000
Suburban	0.74	800

St. Paul is supplied by the Northern States Power Co. with gas consisting of a mixture of by-product coke oven gas and manufactured gas, having a heating value of 550 B.T.U. The records of gas sales and number of customers by classes of business as supplied by the Company for the period 1934 to 1943 are shown in Exhibit III-G-9. Total gas sales have been plotted in Exhibit III-G-10. From these two Exhibits, it appears that there has been but moderate growth in sales and in number of customers, practically all of it occuring during the war period.

The average rate per M.C.F. for each class of customer for the year 1943 is given below.

NORTHERN STATES POWER COMPANY, ST. PAUL DIVISION 1943 AVERAGE RATES

Class of Business	Average Rate per M.C.F.	B.T.U.
Residential	$0.96	550
Commercial	0.77	550
Industrial Manufactured Gas	0.67	550
Industrial Natural Gas	0.21	550

Recently there has been public agitation for the more general use of natural gas in St. Paul. The great growth in use of gas for househeating and for industry in Minneapolis following the introduction of natural gas into that city is an indication of what well might occur in St. Paul if natural gas were made more generally available.

In Duluth, the third city of Minnesota, gas is supplied by the municipality, and is a mixture of by-product gas and manufactured gas. Several other municipalities are supplied with manufactured gas, including Red Wing, Winona, Stillwater, Willmar, St. Cloud, Hibbing and Eveleth. A number of other towns are supplied with butane or propane gas. It appears from the latest available information that over 80 cities and towns in Minnesota have gas supply.

The pipe lines supplying natural gas to Minnesota from Kansas and Texas now are operating at or near their capacity during most of the year. There would appear still to be a large potential market for this type of fuel in competition with other types now being consumed, and it is expected that, after the war, additional pipe line capacity will be installed as required.

In 1940, there was a project for the construction of a natural gas line from the Hugoton area in southwestern Kansas through Nebraska, South Dakota, and western and central Minnesota to the iron ranges in the northeastern part of the State, but there has been no construction on this line. There still is hope that this line may be built after the war, and if built, it should benefit the communities through which the line passes and those mining companies which expect to use the gas for beneficiating iron ores.

If the use of the three principal types of fuel—coal, oils and gas—is evaluated on the common basis of B.T.U. content it is found that the total heat consumption increased about 10% between 1935 and 1939, and about 16% between 1939 and 1943. This analysis does not take into account variations in weather conditions in the various years, nor does it give any effect to the progress in efficiency of combustion that has taken place in the past decade. On the whole, this analysis shows that Minnesota has had a moderately healthy growth in the combined use of fuels.

d. Wood

Minnesota's forests, particularly the wood lots on farms, are the principal sources of domestic fuel supply for the rural population. No accurate statistics are available regarding the actual quantities of wood used for fuel, but it is estimated that approximately 3,000,000 cords are so used normally.

e. Peat

There are large deposits of peat in the north central part of the State, but these have not been developed for fuel purposes, owing primarily to the relatively low heat content and the cost of drying and preparing the product. It is rarely used except by a few individuals as a domestic fuel.

4. Trade and Commerce

Commerce, or the exchange of industrial products, is one of the oldest of man's occupations and provides a livelihood for a large part of the population in civilized countries. It is therefore an important element in the economy of any country. According to the latest (1939) United States Census of Manufactures, Wholesale and Retail Trade in Minnesota produced more than $2,475,000,000 of Sales by over 46,900 establishments and provided employment for more than 143,000 persons, requiring an annual payroll of over $164,900,000. It is evident that trade is no small factor in the economic welfare of the State and its inhabitants.

Trade is usually divided into two classifications: (a) Wholesale Trade and (b) Retail Trade. The annual volume of Retail Trade is an excellent index of general prosperity, since it indicates the extent to which the people are satisfying those needs and desires which they are unable to gratify through their own personal efforts. Wholesale Trade refers generally to an intermediate step in the distribution of goods, namely; the distribution of goods by manufacturers to retail stores, either directly or through warehouse facilities. In general, this phase of trading is gradually assuming less importance, largely because of improved transportation facilities, mail order houses, and chain store operations which either tend toward direct distribution or enable the retail stores to operate with smaller stocks and more nearly on a "hand-to-mouth" basis.

The markets or areas in which industrial products are sold are an important factor in any study of commerce, since these indicate the extent to which an industry depends on the requirements and general prosperity of its own and other localities.

Minnesota's wholesale and retail trade, present markets for the State's products and the State's financial facilities are discussed in the following paragraphs.

a. Wholesale Trade

Exhibit III-J-1 sets forth a comparison of Wholesale Trade statistics for Minnesota and the neighboring states of Indiana, Iowa, Michigan, Missouri and Wisconsin for the census years 1929, 1935 and 1939. These figures are taken from revised and comparable figures of the United States Census Bureau. In Exhibit III-J-2 are comparable units derived from the basic census figures.

Examination of these exhibits clearly shows in all states the effect of the economic depression of the middle 1930's and the subsequent business recovery by 1939. Further examination indicates that, based on state populations, the sales per capita in Minnesota compare favorably for all three years with those of the other states, except Missouri. Also the extent of business recovery on a per capita basis in 1939 was not so marked in Minnesota as it was in Indiana and Michigan, probably due to the higher degree of industrialization in the latter states.

The sales per employee were higher in Minnesota in each of the three years than they were in any of the other states. This may reflect either heavy demand or good salesmanship.

Wages per employee in Minnesota in 1935 and 1939 compare favorably with those in the other states with respect to both average wages paid and the relative recovery from the depression indicated in 1935. In 1929 the average wages in Minnesota were lower than in any of the states listed, except Iowa, but the average wage reduction by 1935 was considerably less than in any of the states listed. The percentage recovery by 1939 increased Minnesota's average wages paid in wholesale trade so that they were then considerably above the average for the six states listed.

The average sales per establishment in all of the listed states were much lower in 1939 than in 1929. This may be due to a general lower level of business. However in each state the number of establishments increased materially during the interval and it appears probable that the size of the average establishment is smaller. This is borne out by the tabulation showing the average number of employes per establishment.

From the foregoing, it would appear that Minnesota's wholesale trade had not been losing its position as compared with neighboring states during the 1929-1939 decade. Figures subsequent to 1939 are not available, but would be of little comparative value on account of war conditions.

b. Retail Trade

Basic and derived data for Retail Trade, similar to those previously given for Wholesale Trade, are presented in Exhibits III-J-3 and III-J-4.

Examinations of these exhibits shows much the same general conditions

that existed for Wholesale Trade. Average wages are considerably lower for the Retail Trade group and the average retail sales per employee are only about one-quarter to one-third those in Wholesale Trade. However, Minnesota compares favorably with the other listed states both in retail sales per capita and in sales recovery after the business depression of the middle 1930's. It is worthy of note that in 1935 Minnesota's Retail Trade was not so adversely affected as was Retail Trade in the other states listed.

In general it would appear that in 1939 Minnesota's position with respect to Retail Trade was considerably better than the neighboring states. As in the case of Wholesale Trade, conditions subsequent to 1939 are not available, and should not be used for comparison because of unstable world conditions.

c. Markets

A detailed survey of markets for Minnesota's industries would necessarily cover not only each type of industry but also the various products manufactured by each. Such a survey would be a major study in itself and was not included in the scope of this investigation.

However, in the course of this survey the principal executives of over one hundred and fifty industrial and commercial establishments in the Twin Cities, Duluth and other points throughout the State were interviewed. Information was obtained as to the market for the products of their business, a summary of which is presented herewith. The industries are grouped so that in no case do the statements identify any individual concern.

MINNESOTA'S PRINCIPAL INDUSTRIAL MARKETS

Markets	Industry Group	
National		
	Meat Packing	Knitted Goods
	Livestock Dealers	Woolen Goods
	Heating Apparatus	Linseed Oil
	Paper & Pulp	Canning
	Electrical Equipment	Beet Sugar
	Canning & Preserving	Granite
	Malt	Pottery
National & Export		
	Commercial Printing	Dairy Products
	Flour Milling	Cereal Preparation
	Machinery N.E.C.	
Northwest		
	Bakery Products	Mattresses—Bedding
	Planing Mill Products	Furniture
	Work Garments	Cloth & Paper Bags
		Kegs & Barrels
National & Canada	Periodicals	Drugs
Northwest to Coast	Newsprint	
North & West of Chicago	Malt Liquors	
Northwest & West	Machine Shop Products	
West of Mississippi River	Furniture	
Central United States & Export	Machinery & Structural Steel	
Central, South & Western United States	Marble	
Northern United States	Confectionery	
Eastern United States	Poultry	
Western United States	Harness & Shoes	
Local	Non-Alcoholic Beverages	Ice Cream	Cement

The foregoing tabulation indicates the general markets for a large number of representative industries. It shows clearly how widely the market territories vary for different products, and the impossibility of generalization.

Exports from the State indicate the extent of its outside markets. On the other hand imports into the State give an indication as to the extent of its dependence upon outside sources for the requirements of its citizens and industries.

The major imports and exports of Minnesota are carried by steam railroads, waterways, and highways. There also is a small amount of goods in the nature of express that move by airplanes. Commodity movements are here treated under these three general headings.

(1) Steam Railroads

Tons of revenue freight originating and terminating in Minnesota by Class I Railroads for the year 1940, the last before the War, are reproduced in Exhibits III-J-5, III-J-6, III-J-7, III-J-8, and III-J-9. A third column has been added showing the tons originating minus the tons terminating. It should be borne in mind, however, that the first two columns are not indicative of the State's gross exports or imports by way of railroads, because of the inclusion of local intra-state traffic in these figures. However, where the figures in this third column are positive, they indicate an excess of out-of-state movement ,and when negative, an excess of into-state movement.

From these tabulations it appears that the principal items falling into the "Import-Export" classes were as follows.

PRINCIPAL COMMODITY MOVEMENT SHOWN BY DIFFERENCE IN TONNAGE ORIGINATING AND TERMINATING IN MINNESOTA DURING 1940

Incoming		Outgoing	
Group I — Products of Agriculture			
Wheat	Fresh Fruit	Corn	Straw
Apples	Citrus Fruits	Oats	Mill Products
Bananas	Peanuts	Barley & Rye	Potatoes
		Flour	
		Veg. Oil Cake & Meal (except cottonseed)	
Group II — Animals and Products			
Cattle & Calves	Sheep & Goats	Hogs	Poultry
		Fresh Meats	Butter
		Cured Meats	Hides (green)
		Packing House Products	
Group III — Products of Mines			
Anth. Coal	Petroleum	Iron Ore	
Bit. Coal	Asphalt	Gravel & Sand	
Stone (crushed)	Salt		
Group IV — Products of Forests			
Posts, Poles, Piling, Lath, Box, Crate, Lumber, Shingles, Cooperage Material		Pulpwood	
Group V — Manufacturing and Miscellaneous			
Sugar	Autos—Trucks	Linseed Oil	Canned Food
Rails	Newsprint		
Pipe	Tobacco		
Non-Steel	Paints		
Copper	Paper Bags		
Lead & Zinc	Wrapping Paper		
Cement	Soap		
Tractors	Glass		
Autos—Passenger			
Agricultural Implements			
Miscellaneous Mfgs.			
Petroleum Products			

(2) Waterways

(a) Lake

The principal products received and shipped at Duluth-Superior Harbor as reported by the District Engineer, Corps of Engineers, Duluth, are shown below in order of value.

PRINCIPAL COMMODITY MOVEMENTS BY LAKE CARRIERS, DULUTH-SUPERIOR PORT

Incoming		Outgoing	
Bituminous coal	Paper & Paper Products	Iron Ore	Milk, Dried & Evaporated
Automobiles & Trucks	Barley	Wheat	Buttermilk
Gasoline	Creosote	Butter	Cream
Rubber & Tires	Beverages	Flaxseed	Coke
Iron & Steel	Coke	Flour, wheat	Paper
Fuel Oil	Sulphur	Corn	Automobiles
Canned goods	Peanuts	Copper	Bunker Coal
Coal, anthracite	Soda products	Wool	
Limestone & Limestone products	Soda ash	Scrap Iron	
	Tar, coal	Zinc	
	Dolomite	Iron & Steel	
Glass & Glassware	Quartzite	Barley	
Liquors, alcoholic	Grain Screenings	Eggs	
Linoleum	Sugar	Poultry	
Kerosene	Fish, fresh	Rye	
Confectionery	Stone	Oats	
Twine & Cordage	Gravel & Sand	Mill products	
Lubricating oils & Greases		Canned food products	
Bags, bagging & burlap		Lumber & Shingles	

(b) River

The principal commodities handled by river carriers, as reported by the District Engineer, Corps of Engineers, St. Paul, and by Carriers, are:

PRINCIPAL COMMODITY MOVEMENTS BY RIVER CARRIERS

Incoming		Outgoing
Coal	Soap	Grain
Coke	Glass	Grain Products
Burner Oils	Acids	Scrap Iron
Gasoline	Liquors	Canned Goods
Barrels	Stoves	Food Products
Beer	Rice	
Coffee	Iron & Steel	
Binder Twine	Cotton Linters	
Denatured Alcohol	Oyster Shells	
Sulphate of Alumina	Sugar	
Agricultural Implements	Chemicals	

(3) Highways

Highway carriers are not required to report tonnage of various commodities, hence there is no break-down similar to those presented above. Livestock is the largest single item, constituting about 50% of the tonnage.

d. Cooperatives

The early beginnings of cooperatives in the United States were essentially farm movements. Consumer associations in the urban areas represented a later development, far exceeded by the producers and marketing cooperatives.

A recent report of the Farm Credit Administration states that there are about 10,450 cooperatives with nearly 4,000,000 members in the United States, with total transactions approximating $4,000,000,000. It has been estimated that the 1944 income will amount to $5,000,000,000. The 1943 income is said to be over a billion dollars more than for the 1941-42 season and over 11 times as much as in the 1912-1913 season. Nine-tenths of the existing cooperatives began since 1920.

The American movement has been developing regional and district wholesale cooperatives. National Cooperatives, Inc. has been more of a jobbing business, up to the present, than a national wholesaler and has been confining itself to purchases of petroleum products, tires and automobile supplies rather more than general items. The Regional and District Wholesales are expanding the scope of their activities and cover almost everything.

Minnesota, Wisconsin, Iowa and Illinois lead all the states as to number of marketing or purchasing cooperative associations (about 70 per cent in 1936). Minnesota, Illinois, Wisconsin and Missouri are the leading states as to membership in these cooperatives, having 63.6% of the total membership in 1936. Of these associations, 30% market grain, 21% manufacture and market dairy products, and 18% purchase farm supplies for their members.

The oil associations, the dairy associations, the grain elevator associations, and others principally connected with agriculture are large and important cooperatives in Minnesota. The State leads the nation in the number of dairy cooperatives. Most of these cooperative associations appear to have modern up-to-date buildings and equipment, with good management and large memberships. There have been some failures in the State in the past and there are some outstanding successes.

During the 1934-35 marketing season the total business done by the Minnesota Associations was $122,450,000 and it has increased steadily. In the 1941-42 marketing season, Minnesota's marketing and purchasing cooperatives did an estimated business of $264,000,000 and ranked a close second to those in the State of California.

For the 1942-1943 fiscal year a gross business of $336,500,000 is reported for Minnesota cooperatives with the following breakdown:

Dairy products	$136,000,000
Fruits and vegetables	2,550,000
Miscellaneous	2,400,000
Purchases (oil, gas, etc.)	42,000,000
Eggs and poultry	1,700,000
Wool	850,000
Grain	70,000,000
Livestock	81,000,000
Total	336,500,000

However, this includes business done in other states by Cooperatives having their home offices in Minnesota. The net volume of business done in Minnesota has been approximated at $300,000,000. Owing to the higher prices prevailing in the 1943-1944 fiscal year, the total volume for that period probably will be much greater.

Exhibit III-B-16 in the Agricultural Section of this Report, indicates the growth in number of dairy cooperatives. Exhibit III-J-15 shows the increase in the number of oil cooperatives.

There are about 200 cooperative oil associations in Minnesota affiliated with the Regional Wholesales. In 1939 the wholesales distributed 83,183,000

gallons of light oil, 58.4% going to affiliated asociations and 41.6% going to unaffiliated companies. In recent years this business is reported to have increased to the extent that the cooperatives of Minnesota do more oil business within the State than any of the national oil companies except one.

By compliance with certain conditions clearly specified in various Federal and State laws, cooperative associations may obtain several advantages over private concerns, partnerships and corporations. Among the most important of these are exemptions from the payment of Federal and State Income Taxes. Most associations have endeavored so to organize and operate that they may obtain the advantages permitted by these laws.

e. Banking and Finance

The following information has been developed from interviews with officers of the Federal Reserve Bank of Minneapolis, some of the larger banks in Minneapolis and Saint Paul and over 150 business organizations and concerns in the Twin Cities and various other points in Minnesota, representative of a wide range of different activities in the State.

1. Minnesota is located in the 9th Federal Reserve District.
2. There are two bank chains, each headed by a large Minnesota bank.
   (a) One chain is confined to banks in the 9th Federal Reserve District.
   (b) The membership of the other chain is comprised mostly of banks in the 9th Federal Reserve District, with some banks located beyond the boundaries of that district.

3. The financial condition indicated by the following statement, taken from "The Northwest in Two Wars," by Paul W. McCracken, Director of Research, Federal Reserve Bank of Mississippi, probably forms the basis for the general opinion that the banks of Minnesota have available funds with which to satisfy the ordinary requests made upon them for accredited loans.

ASSETS AND LIABILITIES OF ALL NINTH DISTRICT BANKS, JUNE 30, 1944
(Dollar Amounts in Millions)

	Amount	Per cent of Total
Assets		
Cash and due from banks	$ 862	24
Loans	534	15
U. S. Government obligations	2,029	56
Other investments	168	4
Other assets	34	1
Total	$3,627	100
Liabilities		
Deposits	3,402	94
Capital account	216	6
Other liabilities	9	(a)
Total	$3,627	100

Source: Call report tabulations for national banks; abstracts from state banking departments for all other banks.

(a) Less than five-tenths of one per cent."

4. In extraordinary cases many of the Minnesota banks, through their connections in Chicago or New York, can obtain larger amounts than they, themselves, are permitted to loan.

5. Many of the larger business concerns in Minnesota carry substantial balances in Chicago or New York, or both, and at times arrange directly with their banks in those cities for part or all of any large loan they may desire.

6. No substantial complaint was made as to undue difficulty in obtaining loans or of excessive interest rates on them in Minnesota.

In view of the limited time available, no attempt was made to determine to what extent capital in Minnesota is prepared to underwrite corporate financing, based upon a public offering of new securities, or whether or not such financing could be arranged within or without Minnesota on conditions and terms comparable with those which could be obtained in neighboring states,

The following tabulation taken from the published report of the United States Treasury Department indicates the total loans, investments and deposits in $1,000's as of December 31, 1942, of all banks in Minnesota, seven other selected states and the entire United States.

BANK LOANS, INVESTMENTS, AND DEPOSITS AS OF DECEMBER 31, 1942

Location	Loans	Investments	Deposits
Minnesota	$ 389,487	$ 835,498	$ 1,638,915
Indiana	306,973	799,356	1,579,740
Illinois	1,263,822	4,333,854	7,364,140
Iowa	337,574	441,451	1,137,071
Michigan	500,039	1,629,612	2,990,053
Missouri	562,137	1,188,379	2,497,590
New York	7,926,523	18,875,203	31,561,959
Wisconsin	312,739	761,376	1,450,933
United States	23,917,384	54,184,656	99,753,312

5. Communication

Modern civilization, particularly modern industry, is largely dependent on speedy and accurate communication. The effect of electrical communication systems on industrial development has been so enormous that they have become indispensable.

Application of electricity for conveying information started about the middle of the nineteenth century. The original application was to the telegraph, closely followed by the telephone. Radio, the latest application of electricity to communication, involves the propagation of electro-magnetic "waves" without the use of wires. It is used for the transmission of either "record messages" (telegraph), or "spoken messages" (telephone), or sound pictures (television).

The most popular use of Radio is the well known broadcasting of entertainment, educational and news programs, usually sponsored by advertisers. Transmission of international commercial messages by Radio is a business of no small proportions, but local transmission is now suspended in the United States on account of the war and is not discussed separately in this report.

A study of the electric communication systems of Minnesota indicates that its inhabitants have taken as full advantage of these modern communication methods as have those located in neighboring states.

a. Telegraph

During recent years until 1943, the bulk of the telegraph business in the United States was carried on by two competing companies, Western Union Telegraph Company and Postal Telegraph Company. Under competitive con-

ditions practically all areas which could be reached economically were served by either or both companies. In 1943, Western Union acquired Postal Telegraph by outright purchase and now is operating as a single organization. Under these conditions it is to be expected that over a period of time, a consolidation of offices in many localities may be effected in the interest of economy and efficiency. This might result in some reduction in employment.

Comparative data are not available, but Western Union Telegraph Company advises that as of December 31, 1943 there were 958 telegraph offices in Minnesota, connected with 41,520 miles of wire lines. This would appear to be ample to supply the requirements of those doing business or living in Minnesota.

b. Telephone

A large part of the telephone business in the United States is conducted by the so-called "Bell System," a group of operating companies owned in whole or in part by the American Telephone & Telegraph Company. These companies render a high grade of service which is so well known as to require no further comment in this report. They have been among the leaders in development of telephony.

Northwestern Bell Telephone Company is the Bell System company operating in Minnesota. In addition to this company there are numerous smaller independent companies and Farmer Co-operatives operating within the State. Most of these companies are interconnected with the Bell System and thus their subscribers are enabled to communicate with Bell System subscribers. However, good telephone communication requires careful design and proper maintenance of lines and equipment and the Bell companies do not assume responsibility for the quality of communication carried on in part over lines which they do not operate.

Exhibit III-H-1 is a map showing the location of each telephone exchange in Minnesota as of January 1, 1941. The preponderance of independent company exchanges is striking, but it will be noted that the Bell System exchanges are generally located in the larger cities such as Minneapolis, St. Paul, Duluth, and other major centers of population, including many of the County seats.

In Exhibit III-H-2 is tabulated the total number of telephones in Minnesota and selected states by years from 1927 to 1943, and for earlier years where such data are available, together with the telephones per 100 population. This exhibit indicates that there is an upward trend in the total number of telephones in Minnesota as well as in the other selected states; furthermore, that the number of telephones in Minnesota did not decrease as rapidly during the depression period as did those in the other states, and that it generally recovered more rapidly. The numbers of telephones in Minnesota and selected states for the years

1927 through 1943 have been plotted in Exhibit III-H-3, which indicates more clearly the trend in each of said states. The number of telephones per 100 of population in Minnesota compares favorably with those in the other states listed, indicating that Minnesota is not lacking in telephone facilities.

Exhibit III-H-4 tabulates the total number of originating messages and messages per capita for Minnesota and selected states for the years 1912, 1917, 1922, 1932 and 1937, as shown by United States Census data for these years. No data subsequent to 1937 are available. It would appear that the general trends of telephone messages and per capita conversations are upward in Minnesota and in the selected states, although the volumes of messages in 1937 did not equal volumes attained during the latter part of the 1920 through 1930 decade. The use of telephones in Minnesota compares favorably with the uses in the other selected states.

c. Radio

The following tabulation taken from United States Census Reports, Series H-7, 1942, indicates the extent to which dwelling units in Minnesota and selected states are equipped with radio receiving sets.

HOME RADIOS IN MINNESOTA, 1942

State	Total Dwelling	Units (1000's) With Radio	Percent With Radio
Minnesota	728	648	89
Illinois	2,193	1,975	90
Iowa	702	617	88
Michigan	1,396	1,271	91
South Dakota	166	136	82
North Dakota	152	131	86
Wisconsin	827	743	90

Evidently the people of Minnesota are equipped to take about as full advantage of radio broadcasting programs as are the people of neighboring states.

Every telegraph office in Minnesota is now an agency for the reception and delivery of messages transmitted by international cable or radio. Consequently, Minnesota appears to have ample facilities for the satisfactory handling of any such messages.

d. United States Mail

The United States Post Office Department handles a huge volume of communications by regular and air mail. Presumably, such communications do not require the same speed as is obtainable from the means of communication pre-

viously discussed. The services of the Post Office Department are too well known to require further comment in this report.

e. Employment

No United States Census figures later than 1937 are available to show comprehensive employment in the Electrical Industries, Telephones and Telegraphs. Data for 1943 supplied by Western Union and covering its nationwide operations indicate that the telegraph part of the industry for that year probably employed about 1,900 in Minnesota, with a total payroll of approximately $3,000,000 or $1,600 per employee.

Similar data published in Telephony's Directory 1944, indicate that in 1942 the telephone portion of the industry employed approximately 9,000 in Minnesota with a payroll of about $17,000,000 or $1,900 per employee. According to U. S. Census figures for 1940 there were about 500 people employed in Radio Broadcasting and Television in Minnesota. The same source indicates about 8,000 employees of the Post Office Department in Minnesota.

B. Iron Ore Industry

This section of the Report briefly relates the economic history of Minnesota's iron ore industry with some analysis of presently important developments and details which bear upon its future prospects, as this industry supports a large section of the State, either directly or indirectly, through taxation or direct employment.

1. Introduction — Importance of Industry

As this Report is written (Winter 1944-45) the allied armies, for the second time in one generation, seem to be winning a major war. This would be impossible without the developed resources of the steel industry in the United States.

The foundation of this greatly expanded war industry is the iron ore of the Lake Superior district, in which Minnesota is most important.

This region, Minnesota in particular, has been fortunate in having large deposits of fairly high grade iron ore within approximately 100 miles of Lake Superior, which are mined and transported to the furnaces cheaply.

The Lake Superior Iron Ore district includes the so-called iron ranges in the northeast portion of Minnesota, northern portions of Michigan and Wisconsin and the southern portion of Ontario, Canada. Location of the iron ranges is indicated in Exhibit III-C-1. **Quantities of ore and the percentages shipped from each of the ranges in 1943, were:

Range	Location	Gross Tons* Shipped	Percentage of Total
Mesabi	Minnesota	64,906,280	75.3
Marquette	Michigan	5,601,418	6.5
Gogebic	Michigan & Wisconsin	5,486,918	6.4
Menominee	Michigan & Wisconsin	4,902,556	5.7
Cuyuna	Minnesota	3,065,555	3.5
Vermilion	Minnesota	1,779,014	2.1
Michipicoten	Ontario	450,973	0.5
	Total	86,192,714	100.0

*Throughout this Report, weight of iron ore is expressed in gross tons of 2240 pounds unless otherwise stated.

** Reproduced by courtesy of The Lake Superior Iron Ore Association.

Annual shipments from the Lake Superior district are shown in Exhibit III-C-2 and shipments from other states are compared in Exhibit III-C-12.

The Mesabi Range still dominates as the leading ore producer of the world, and without its open pit mines the steel industry might not have been able to meet the demands of the war effort.

Of the tonnage shipped in 1943, 1,795,734 tons, or 2.1%, were shipped by rail from the mines to the blast furnaces; the remainder, or 97.9%, was shipped by rail from the mines to the "Upper Lake Ports" for transporting by ore boats to the "Lower Lake Ports."

Exhibit III-C-1 indicates the Upper Lake Ports—Duluth and Two Harbors in Minnesota, Superior and Ashland in Wisconsin, Marquette and Escanaba in Michigan, and Michipicoten in Ontario—as well as the railroads serving these ports.

The principal Lower Lake Ports, arranged approximately in the order of tonnage of ore handled, are Cleveland, Ohio; Conneaut, Ohio; Chicago, Ill.; Astabula, Ohio; Gary, Ind.; Buffalo, N. Y. (including Lackawanna and Tonawanda, N. Y.); Lorain, Ohio; Indiana Harbor, Ind.; Erie, Pa.; Toledo, Ohio; Fairport, Ohio; and Detroit, Mich.

Most of the Lake Superior ore is used in the Pittsburgh, Valleys, Steubenville, Wheeling, Buffalo and Chicago districts for reduction to pig iron and conversion to steel.

Little of Lake Superior ore is shipped to the Eastern Pennsylvania and Maryland districts.

The location of the steel districts is shown in Exhibit III-C-1 as well as the movement of Lake Superior iron ore and of Eastern and imported ores from sources to consuming districts for year 1937.

Had Minnesota been endowed with large beds of good coal, similar to those in the Pittsburgh district, a steel industry of large proportions would have been developed at the western end of Lake Superior.

2. Mine Ownership

The ownership of the high grade ore deposits in Minnesota is largely distributed among individual mining interests (many of whom are non-residents of the State), the State of Minnesota, and various steel companies located outside the State. Some of the subsidiaries of the steel companies have their home offices in the State.

Of the approximate 500 iron ore properties listed in the Mining Directory of Minnesota for the year 1944, 420 are located in the Mesabi Range, 64 in the Cuyuna Range, 11 in the Vermilion Range, and 5 in Fillmore County; 83 of them are listed as exhausted.

The State owns approximately 10% of the known ore reserves in Minnesota. Properties owned by the State may be classified as follows:

School Lands	39
Swamp Lands	12
University Lands	13
Lake-Bed Leases	2
Total	66

Three of these properties are only partly owned by the State. All of the State's iron ore properties are leased through the Division of Lands and Minerals of the Department of Conservation, and the inspection of mining operations is performed by this Division. More than half of these properties, having approximately 100,000,000 tons of reserves, were under lease in 1943. Those not under lease had a reserve of approximately 10,000,000 tons. Of these, most of the open-pit mines had either been mined and were exhausted or almost exhausted, and many of the underground mines were not operated for economic reasons.

3. Mining Operators

In 1943, 23 mining companies operated 95 properties, 74 of which were open-pit, 7 open-pit and underground, 13 underground, and 1 milling. The number of mines operated by one mining company ranges from a minimum of one (nine companies) to a maximum of 23 (Oliver Iron Mining Company). Most of the 95 properties are not owned by the mining companies but are leased from private owners, corporations, estates and the State. In some instances mining companies sub-lease from lessees. Of the 23 properties operated by the Oliver Iron Mining Company, 16 are leased properties and 7 owned in fee.

The total estimated Minnesota reserves on the Tax Department rolls as of May 1, 1943, exceeded 1,100,000,000 tons, and of these, Oliver Iron Mining Company owned or controlled over 660,000,000 tons, or approximately 60%. On the Mesabi Range, Oliver owns 106 properties in fee, and leases 28 properties while on the Vermilion Range Oliver owns two and leases two properties. Oliver does not own or lease any property on the Cuyuna Range.

In general, both State and privately owned ore properties are leased on a royalty basis on the ore as mined except for requirement of a minimum annual payment.

a. Royalties on State-Owned Land

The laws of 1889 specified that in sales of any State lands in Lake, Cook, St. Louis, and Itasca Counties, the mineral rights must be reserved for the State. In 1901, this requirement was extended to all the counties of the State. The 1889

laws specified that State ore properties be leased for fifty years, and yield a royalty to the State of $0.25 per ton on all ore mined and shipped. This has been interpreted by the courts to mean $0.25 per ton on crude ore, not beneficiated ore. A minimum annual royalty of $1,250 had to be paid when a railroad was built within one mile of the property. The law also specified that the lessee must pay property taxes. Several thousand prospecting permits were granted, good for one year, and limited to 160 acres. Approximately 800 were converted into leases. Many of these have since been dropped or cancelled for non-payment of minimum royalty. These mining laws were suspended in 1907, but again authorized in 1921.

The 1917 laws permitted the removal of iron ore from lands located under the beds of public waters. Two leases were issued at $0.50 per ton royalty, with an annual minimum royalty payment of $5,000. In 1927, the laws were amended to permit payment of royalty on a sliding scale, depending on the iron content, and specifying a minimum annual payment of $5,000. A royalty of $0.12 was specified for ore containing 25% dried iron, with a 5% cumulative increase for each additional percentage or unit of iron. This set the minimum royalty for a 50% ore at $0.4065 and for 55% ore at $0.5187 per ton.

In 1937, new laws authorized the extension of leases made under the 1889 laws, which were about to expire. They provided for new leases not to extend beyond January 1965; that the royalty be not less than $0.50 per ton, based on weight of beneficiated or concentrated ore when ore requires such treatment; that stock piles of non-merchantable ore be included in the lease; that minimum annual payments be not less than $3,000, construed as ground rental and not advance royalty when no ore is shipped from property.

In 1941, the legislature realized that a uniform royalty for all types of property was not logical, and passed a new royalty law setting up seven classifications or schedules, in order to encourage the mining of low grade or underground ore as follows:

Schedule		Minimum Royalty Per Ton 25% Dried Iron	60% Dried Iron	% Increase in Royalty for each Unit of Iron
1	Open-pit merchantable ore	$0.12	$0.66	5.0
2	Open-pit wash concentrates	0.12	0.56	4.5
3	All other open-pit concentrates	0.12	0.47	4.0
4	Underground merchantable	0.11	0.37	3.5
5	Underground wash concentrates	0.11	0.31	3.0
6	All other underground concentrates	0.11	0.22	2.0
7	Taconite concentrates	0.11 (40% Fe)	0.135	1.0

This law, like the 1937 law, specified a minimum rate for 25% iron (40% iron in the taconite schedule) with a definite cumulative per cent increase for each unit increase of iron.

This 1941 law, with the low royalties on taconite, and the Taconite Bill which specifies, in lieu of ad valorem taxes, a tax of $0.05 a ton on taconite concentrate when mined, have encouraged several mining companies to take up leases of State-owned taconite land. The State owns about 10,000,000,000 tons of iron formation or taconite, containing an estimated 30% iron. In addition, approximately 37,000,000 tons of lean ore and taconite are stored in stock piles on State-owned land. It is hoped that much of this latter material will be concentrated under the easier terms of the 1941 laws.

Many of the mining companies have applied for renewals of their leases and some have been granted. Where State and mining company cannot agree on renewal terms, the property is advertised for bids. Bids on all unleased State property are advertised twice a year. Each proposal must include base prices (25% iron) not less than the minimum price stated in the 1941 laws, and be accompanied by $250. The high bidder is granted a permit, good for one year, to carry on exploration work. If a lease is signed, $200 of the $250 is credited toward the lease. If no lease is signed the State retains all of the $250.

As an example, the Missabe Mountain Mine was one of the leases which expired in 1942. Up to that date, approximately 66,500,000 tons had been shipped from it, with about 7,000,000 tons still remaining in the ground. The property was advertised and leased at a royalty price which averaged $1.387 per ton for over 993,000 tons of ore shipped in 1943. Some of the ore from this mine has yielded as high as $1.90 per ton royalty. The mining operator's occupation tax profit based on Lake Erie prices was approximately $0.36 per ton.

It is generally conceded that the mining company which has the lease for this property will not attempt to remove all of the ore within the mine, extracting only that ore which can be removed without any additional stripping or removal of overburden. The new operator is working on the sides of the pit removing track benches left by the first operator, and, therefore, development costs of the new operation have been extremely low.

For the fiscal year ending June 30, 1942, the State received approximately $4,300,000 in royalties from State mineral leases. This is an average of about $0.25 per ton for the 16,860,000 tons of ore shipped from State-owned land for the year 1941. The moneys received from ore royalties become a part of The Permanent School Fund or The State University Fund.

b. Royalties on Privately Owned Land

Except for ore properties which are owned by the Oliver Iron Mining Company, most of the mining companies lease their property on a royalty basis. Most of the leases provide for a minimum royalty whether ore is mined or not. However, this minimum royalty is applicable against royalty due when ore is shipped. On State-owned property this provision does not apply as the $5,000 minimum annual payment on new leases with the State can only be applied against royalties on ore mined during the year when payment is due. Royalties for 1943 on privately owned mines as reported in the occupation tax reports, varied considerably for the different mining properties. Lowest royalty approximated $0.02 per ton and highest approximately $0.85 per ton. For the two largest mines, the Hull-Rust and the Mahoning, the 1943 royalties approximated $0.24 and $0.13 per ton, respectively. The above values do not necessarily reflect the actual royalty costs, because fee owned ore may be included in computing the average unit cost for a property based on total output.

The average royalty cost, spread over the total tonnage mined each year including fee-owned ore, has not fluctuated materially for the period from 1921 through 1941. Maximum average royalty was $0.547 per ton in 1932, the year of lowest production; minimum royalty was $0.379 per ton in 1937, a year of high production. The average approximates $0.43 per ton.

4. Ore Reserves in Minnesota

a. Exploration

The three great ore producing ranges of Minnesota have been drilled so that the outlines of the ranges are well defined. It is probable that every forty acre tract within the limits of the ore formations has at least one drill hole, and most of them at least five. During the days of the "Hill Lease", one stipulation of the lease was that lessee must drill every section with at least five holes, one in the center and one near each boundary line or corner of a "forty".

It is generally agreed that no new large deposits are likely to be found, though it is possible that small deposits may be located between the drill holes.

This is most likely to be true in the Vermilion Range, owing to the complicated folding and faulting of the iron-bearing formations, and because the formations stand on edge with ore bodies much deeper than on the Mesabi or Cuyuna Ranges.

The mining companies on the Vermilion Range do not drill any deeper than is necessary in order to develop a mine in the immediate future. This is partially due to the fact that the present ad valorem tax law discourages any unnecessary exploration work, because as soon as an ore body is located, it is

placed on the tax rolls, and tax has to be paid on the ore until it is shipped out of the state. This is also due to the fact that drilling is expensive and not entirely satisfactory. The tax department, in estimating quantity of ore in these mines for tax purposes, arbitrarily assumes that ore extends 100 feet deeper than the bottom of the shaft.

b. Known Iron Ore Reserves

A state law requires that records of every exploration drill hole be filed with the State with an analysis of the iron bearing rock in the hole. Every year, members of the staff of the Minnesota School of Mines and Metallurgy obtain all the drill records from the mining companies or the owners, and in the case of active mines, cross sections of about 35 mine properties. At this rate each property is examined about once every six years.

From the drill records and cross-sections the School of Mines computes the total volumes of different classes of ores, using its judgment in interpreting the quality and quantity of ore between and beyond drill holes. From the computed volume, an estimate of the gross tonnage is made by applying a factor of 14 cu. ft. per gross ton.

In making these estimates, the School of Mines attempts to be conservative. This conservatism is partly indicated in the fact that for the biennial period August 31, 1942, during which the school reported on 74 properties, five showed decreases totaling 2,417,803 tons while fifty-six showed increases totaling 79,768,571 tons or a net increase of 77,350,768 tons. A large part of this increase is probably due to reclassification of material, which formerly was not considered ore.

These estimates and reports on each mine are made for the Tax Commission to obtain the ad valorem tax on the ores of each mine property. The estimates are published in the Mining Directory of Minnesota prepared annually by the Mines Experiment Station of the University of Minnesota.

As of May 1, 1943, the reported reserves of iron ore in the ground and in stock piles, including 16,400,000 tons of ore in the ground on State lands not under lease, totalled approximately 1,150,900,000 tons. Deduction of last year's and this year's estimated shipments, reduces the known reserves in Minnesota to approximately 1,000,000,000 tons at the end of the year of 1944.

At the rate of 60,000,000 tons annual shipment, which is the approximate average rate for years 1940 through 1944, these reserves would be completely exhausted in about 16 years. However, the annual shipments are more likely to average 30,000,000 tons or less per year so that the ore reserves will probably not be exhausted for at least 33 years.

This ore on the Tax Commission's tax rolls is not all high grade "direct

shipping" ore. Probably only half of it is "direct shipping" and the remainder grades down to ore of doubtful value. On the other hand, there are huge quantities of iron bearing formations which may become "ores" to supply future demands, depending upon many presently unpredictable factors. Among these factors are:

(1) Demand for steel in the United States and the world after the War.

In the United States there may not be the great demand for steel which existed during the recent period of rapid expansion of industrial, utility and transportation facilities of all kinds. Perhaps the greater part of the steel demanded for replacements such as losses through wear and rust may be supplied from scrap without substantial drawing down of the ore.

On the other hand, if we aid in the upbuilding of countries which are far behind in industrial development, demand for our steel may be quite large.

(2) Development of new uses for steel.

Steel may be used more widely than previously, such as in airplanes, airports, and homes, and in apparatus, such as oil burners, air conditioning plants, refrigerators.

Use of steel as a substitute for other materials will depend somewhat upon relative costs. The lower the price of steel, the better its chance of being used. The price of steel depends to a considerable extent upon price of ore.

(3) Competition of substitutes for steel such as aluminum, magnesium, and plastics.

The use of these materials as competitive substitutes for steel is not likely to affect steel's position seriously because if their total war production were to displace steel the amount of steel so displaced is estimated as not to exceed 3,000,000 tons. For the present, at least, such materials will probably find expanding uses as supplements rather than as substitutes.

(4) Development of steel alloys.

Alloys may decrease the use of steel by decreasing the weight of material in structures such as bridges and buildings, but alloys may increase the use of steel products such as in airplanes where greater strength would permit lighter sections in competition with aluminum and other light metal alloys.

(5) Competition with reserves in other states of the United States and in foreign countries.

Certain other countries have large reserves of high grade ore, notably Brazil, Sweden and Russia.

Russia will probably want to conserve its ore for its own use.

Sweden will probably control the export of its ore.

England and Germany will probably seek the Brazilian ore. Unless competitive methods of concentrating United States ores are developed and taxation

and labor costs entering into their production are reduced, the United States steel industry may also be forced to develop and import Brazilian ores. Docking facilities to accommodate the importation of foreign ores have been built recently on the eastern seaboard of the United States.

(6) The United States Government's attitude toward stock piling of iron ore reserves from foreign countries in payment for lend-lease material and to prevent exhaustion of our reserves.

(7) Attitude of the United States Government in bringing back scrap from war areas; disposal of such scrap and of future domestic scrap.

Approximately 17,000,000 tons of scrap were exported from the United States from 1936 to 1940. This is equivalent to approximately 34,000,000 tons of ore.

(8) Reluctance of steel companies to abandon their large investments of railroads, ore docks, ore vessels, and ore unloading equipment, and to move the steel mills to other locations in order to be more favorably situated in relation to ores other than from the Lake Superior district.

This is evidenced by the laboratories and experimental plants now being built or planned for utilization of low grade ores. However, steel companies will in the end use ores from the cheapest source.

(9) Preference of steel companies to obtain ore in the United States. Thus they are less subject to the vagaries of foreign governments and the vicissitudes of war.

(10) Date of next world war. War increases the use and the waste of natural resources.

c. Potential Ore Reserves

There are enormous reserves of iron bearing formations in Minnesota and the Lake Superior district which may become the ores of the future. Among these are "taconite", a term applied locally to the cherty rock in which the iron minerals are disseminated.

The following table is reproduced from page 492 of United States Geological Survey, Monograph LII, "The Geology of the Lake Superior Region" by Charles Richard Van Hise and Charles Kenneth Leith, dated 1911.

ESTIMATED TONNAGE OF IRON BEARING FORMATION
(35 per cent or more in iron.)

DISTRICT	Area Sq. Mi.	Depth Ft.	Volume Cu. Mi.	Quantity of iron formations Tons	Quantity containing 35% or more iron Tons
Michigan:					
Crystal Falls	7.8	1,250	1.85	24,100,000,000	1,500,000,000
Marquette	28.5	1,250	6.75	87,800,000,000	16,000,000,000
Menominee	5.6	1,250	1.30	16,900,000,000	3,500,000,000
Gogebic	5.8	1,250	1.40	18,200,000,000	1,250,000,000
Swanzy	1.0	1,000	.20	2,600,000,000	260,000,000
Minnesota:					
Mesabi	127.0	400	9.60	125,000,000,000	30,000,000,000
Vermilion	15.6	1,200	3.70	48,100,000,000	1,025,000,000
Wisconsin:					
Florence	.7	1,250	.16	2,150,000,000	215,000,000
Penokee	5.8	1,250	1.40	18,200,000,000	1,250,000,000
Baraboo	11.0	350	.70	9,100,000,000	910,000,000
Ontario:					
Animikie	10.0	100	.19	2,500,000,000	250,000,000
Michipicoten	6.6	1,250	1.57	20,400,000,000	2,040,000,000
North Shore Lake Superior	30.0	1,250	7.10	92,400,000,000	9,240,000,000
Other Ores					200,000,000

It is to be noted from the above table that for the Mesabi Range alone, estimated quantity of iron-bearing formations containing 35% or more iron was 30,000,000,000 tons based on 127 square miles and 400 feet depth below the surface of the ground. The quantity of iron-bearing formations in the Mesabi Range, including the above, was estimated at 125,000,000,000 tons.

In the above table, the authors did not include an amount of available ores which they then estimated for the Mesabi Range at 1,600,000,000 tons. Approximately this amount of ore has been shipped from the Mesabi Range since 1911, and there is still about 1,000,000,000 tons of "ore" in the ground.

Of ore and iron-bearing formations which can become the ores of the future, Minnesota has enough reserves to retain its position as the leading producer of iron ore in the United States for many generations to come. However, this position can only be retained under certain conditions.

5. Mining Methods and Beneficiation

There are three methods in use in mining the Lake Superior ores:

1. Open-Pit
2. Underground
3. Milling

a. Open-Pit Mining

In the Lake Superior District, the first iron ore mined came from outcrops or from ore bodies having a thin covering of glacial drift. Operations from open pits were started on a commercial scale in 1854.

The ore was mined by hand labor, using hand drills, picks, shovels, and sledge hammers; hauled by two-wheeled horse-drawn carts, dumped into small wooden ore cars; and moved out of the pit on narrow gauge tracks.

This method gradually changed with the coming of steam shovels, mounted on rails, then electric and internal combustion engine shovels. Rail mounting of shovels gave way to full revolving crawler type mountings. The size of shovels gradually increased until now 8 cu. yd. dippers are in use.

Narrow gauge tracks gave way to standard gauge tracks and wooden ore cars were replaced with steel cars which increased to the present maximum carrying capacity of 150,000 pounds. Shovels load directly into these cars, which are hauled out of the pits in six to ten car trainloads by steam or Diesel locomotives. The grades on the track are steep and deep pits require switchbacks.

The trend in the last ten years has been toward the use of trucks in preference to railroad cars and locomotives. This is particularly true of the small, deep deposits. Trucks have gradually increased in capacity until they now haul 30 tons per load. Owing to the fact that trucks can turn in a comparatively short radius and can climb an 8% grade with full load, the length of roads required is much less than would be required with a rail track system. The cost of building the roads per lineal foot also is cheaper as with standard road equipment they can be built and maintained with a minimum of labor, quickly and easily. The ore under the roads can be recovered more cheaply than under railroad beds. In the small deposits, the trend is to use smaller shovels because of the necessity of moving more often.

b. Underground Mining

As the ore near the surface of the ground was exhausted, the open-pit

mines on the old ranges soon gave way to underground mines, which is the practical way of mining these deep ore bodies.

Methods of mining are adapted to the shape and position of the ore body and the physical characteristics of the ore. They have improved, so that mines are safer and less timber is required.

In the Soudan mine on the Vermilion Range, which started as an open-pit mine, ore is now removed from a depth of approximately 2,000 feet. Even with advanced methods in the hard ore encountered at the Soudan mine, one lineal foot of round timber is required for posts and caps for each ton of ore mined.

The Menominee Range has six mines with shafts from 1,700 to over 2,000 feet deep.

The Marquette Range has one mine over 2,400 feet deep.

The Gogebic Range has at least three mines over 3,000 feet deep.

More, better and faster machinery is in use so that labor costs are reduced, but nevertheless, underground mining has difficulty in competing with the open-pit mines of the Mesabi Range. Only the highest grade ores under the most favorable mining conditions permit an underground mine to be operated at a profit. The majority of the less favored mines have ceased to operate.

In the early days on the Mesabi Range, a number of mines were operated as underground mines, when the depth of glacial deposits was considered excessive. Many years ago the approximate rule was that one cubic yard of overburden could be removed for each cubic yard of ore available. Now, owing to the use of larger and better equipment, and consequent lower costs of excavating and moving overburden, this ratio has become, roughly, three to one. Many of the underground mines on the Mesabi Range have been converted to open-pit mines.

c. Milling Method

The milling method is a combination of open-pit and underground mining. The overburden over the ore bed is removed as in the open pit mine. A shaft is sunk near the edge of the bed to a level below the lowest level of ore deposit, and one or more horizontal drifts or tunnels are excavated under the ore deposit. "Raises" or openings are excavated from the drifts to the top of the ore beds where the overburden has been removed. The ore is then excavated and hauled to these raises by any of several methods, such as shovels and trucks, bulldozers, or drag scrapers, and it drops down to the drifts into hoppers with control gates for controlling rate of flow into small ore cars or belt conveyors. The latter convey the ore to the shaft where it is hauled to the surface of the pit.

The use of belt conveyors for hauling ore out of the pit in both open-pit and milling operations has been increasing. They may be used either horizontally or inclined, or in a combination of both.

d. Beneficiation and Concentration of Minnesota Iron Ores

(1) General

Beneficiation or concentration of ore is a process or combination of processes whereby either or both the grade and structure of the ore are improved.

Approximately 60% of the iron ore taken out is loaded directly into railroad ore cars at the mine and hauled to the Lake Superior ore docks; approximately another 20% of the ore is screened and crushed before shipment. Some rock is removed from the rest of the ore in the process. The operation of crushing breaks down the large pieces of ore which are not desirable in the blast furnace. While the process of screening and crushing is in a sense beneficiating the ore, it is not so considered in this discussion or in the statistics. Therefore, approximately 80% of ore is classed as direct shipping ore, although about 20% of this is rehandled through the screening and crushing operations. The rest of the ore is beneficiated and shipped as "concentrates."

Iron content is not necessarily the determining factor as to whether an iron formation is an ore. If low grade ore bodies are near the other two raw materials necessary to produce pig iron, namely, coal and limestone, and are relatively near markets for pig iron and steel, then the low grade iron formations will indeed be ores and will be used. This accounts for the iron and steel industries in the Birmingham district of Alabama and in the provinces of Alsace-Lorraine in France. Both of these districts use ore with iron content below 40%.

However, when ores have to be transported long distances as is the case with Lake Superior ores for which freight charges constitute about 50% or more of the cost of the ore at the blast furnace, it is necessary to consider the advantages to be gained by beneficiating or concentrating the ores and compare the costs of such beneficiation with the added costs per unit of iron for freight and smelting the unconcentrated ores. Other things being equal, blast furnaces will use the ore which is delivered at the minimum cost per unit of iron content and which can be converted at the least cost per ton of finished pig iron.

Ore shipments in the early 1900's were chiefly of the direct shipping type requiring nothing more than a limited amount of screening and crushing. As shipments increased and more properties were opened, the grade of shipped ore began to diminish, as indicated in Exhibits III-C-7 and III-C-8. A study of these charts shows that in the ore of all grades shipped from the Mesabi Range, there was a decline of the average iron content from 56% in 1902 to a low of 50.65% in 1916. At the same time the silica content rose from a low of 4.3% to approxi-

mately 8%. Phosphorus also increased from a low of .045% to .065%. The various grades of ore from the other Lake Superior ranges all show the same trend. Non-Bessemer ore from the Mesabi Range for the year 1916 averaged 49.2% iron. The chart shows a rapid increase in shipments of non-Bessemer ore, from 20% of all Mesabi shipments in 1902 to an average of 75% in recent years with a corresponding decline in shipments of Bessemer ores. The small amount of Bessemer ore available compared with the quantity of non-Bessemer probably contributed materially to the rapid decline in the use of Bessemer converters in steel mills and to the change to open hearth furnaces.

Since 1910 the average iron, silica and phosphorous contents of Minnesota iron ore shipments has been reasonably constant, despite the variations in the grade of the mined ore. Beneficiation has contributed to this fact.

Beneficiation of ores was started about 1910. The quantity of concentrates shipped each year was irregular, fluctuating with the total shipments. The percentage of concentrates to total ore shipped rose uniformly from zero to 12.5% during the period from 1909 through 1919, averaged about 15% from 1920 through 1929 and averaged over 20% from 1930 through 1943. (See Exhibits III-C-9 and III-C-10.) In 1920 5,000,000 tons were shipped and nearly 18,000,000 tons in 1942. In the early days, "wash" ore was the only type that was beneficiated but since 1930, 80% of the concentrates shipped have been of this type.

There are many methods and combinations of methods for beneficiating ore. Each mining company uses the type of equipment and method which it finds most suitable for the ore it is handling. Ore from different mines, and even in the same mine may be variable, and this condition adds to the problem of obtaining efficient and complete concentration. The mining companies are continually striving to lower the cost of beneficiation, to beneficiate lower grades of ore, and to increase the percentage of recovery. Most Minnesota ores do not permit recovery of high iron content, on an economical basis and tailings or waste material still contain as much as 20% iron. This compares unfavorably with the 3% to 6% iron in the tailings of the New York and New Jersey magnetites.

The 1944 issue of the Mining Directory lists 52 beneficiation plants, although the output from the first three groups totaling 15 plants is not listed as concentrates:

Crushing plants	6
Screening plants	2
Crushing and screening	7
Crushing and washing	1
Crushing, screening and washing	1
Washing	21
Washing and jigging	8
Washing and Hi-Density	2
Washing and drying plant	1
Washing, screening and sintering	1
Crushing and drying	1
Magnetic concentration	1
Total	52

Forty-five plants are located on the Mesabi Range, 6 on the Cuyuna Range and 1 in Fillmore County. These plants are not in all cases located at the mines they serve, and some may process the output of more than one mine. A few of the plants listed were not operating in 1944.

(2) Washing

As already noted, this process is used at the present time more extensively than all the other methods of beneficiation. The purpose of washing the ore is to remove as much as possible of the free quartz or silica grains from the crude or lean ore with the least possible loss of iron in the tailings, and to produce a concentrate of definite minimum requirements.

The first large washing beneficiation plant was placed in operation at the Trout Lake plant of the Oliver Iron Mining Company in 1910 after five years of experimental work. Changes in the quality of the crude ore and necessity for maintaining minimum specifications of concentrate have required frequent revisions and improvements in methods of beneficiation. A brief description of this plant, as it is now functioning, indicates the general method in use in many of the other washing plants, although most of them are not as elaborate as the Trout Lake Plant.

The ore is brought into the top of the plant by the railroad from three mines in the vicinity (Morrison, Walker and Arcturus) with an average haul of less than ten miles. Some ore from the Hibbing District, 25 miles away, is being hauled to the plant to determine whether it can be washed economically. The ore is dumped into bins from which it is fed by a pan conveyor on to roller

screens which remove lumps over 6″ to 8″ in size. These are discarded as being rock. The material which falls and is washed through the rollers, passes over a screen with approximately 1″ openings.

Large material which passes over the screen is crushed in a Symons cone crusher and then raised by a bucket elevator to the top of the screen. Material passing through the screen is fed into a Dorr or Akins classifier, with proper amount of water added. The purpose of the classifiers is to separate the larger and heavier particles containing iron ore from the lighter particles containing quartz. The lighter and smaller particles flow over the overflow. Larger and heavier particles sink to the bottom of the troughs and are gradually pushed up the incline and discharged at the top by means of rakes (Dorr) or a helical screw conveyor (Akins). The degree of separation depends upon the extent to which the iron oxides are liberated from the quartz. This separation is never perfect and there is every gradation in the ore fragments from 100% pure quartz to 100% iron oxide. Therefore, much iron oxide is carried over into the tailings and considerable quartz or silica remains in the concentrates. Wash ore concentrates are always high in silica compared with the average direct shipping ores.

In some of the other wash ore plants, no crushing is required. The ore is screened into three sizes. The large size passes onto a picking belt from which the pieces of rock are removed by hand. The smallest size is washed in a log washer or classifier, and then all three sizes are combined for shipment as concentrate.

The Trout Lake Plant has an output capacity of over 2,500 tons per hour. About 7 tons of crude ore are required to make 4 tons of concentrate. Costs of concentrating approximate $0.16 per ton of concentrate which includes milling operations, running repairs (not major winter repairs), labor, material and supplies, but no depreciation of plant or general overhead. Railroad freight from mine to plant is $0.08 per ton of crude ore, and switching costs at plant are approximately $0.07 per ton of crude.

(3) Jigging

Jigging of iron ore is a process of concentration carried out in water and depends for its effectiveness on differences in specific gravity between the iron oxides, and silica and other impurities. The methods and machinery vary considerably in detail, but all depend upon imparting frequent up and down and forward motions to the water and the crude ore, (100 to 300 strokes per minute) which produce a stratification of the material with the heaviest on the bottom. Much of the success of jigging depends upon the method used in the continuous removal of the material in the various strata or layers.

Early attempts to use jigging for iron ore concentration were not successful

and it was not until 1924 that a jigging operation was put to advantageous use at one mine on the Mesabi Range.

The jigging process is used on ores or portions of ores that are not readily concentrated by washing. In one installation, after the crude ore is crushed to pass through a screen with 1/2" openings, it is fed to a log washer. The tailings are wasted while the log product is fed to the jigging machines, which produce concentrates, middlings (part ore), and tailings. The middlings are crushed finer and again passed through the circuit. In another installation the ore is crushed to —1 1/4" and passed over a screen with 1/4" openings. The material retained on the screen is classified into four sizes (—1 1/4" to +3/4", —3/4" to +1/2", —1/2" to +1/4", and —1/4"), each size being treated on separate jigs.

Jigging is not entirely satisfactory because as in washing, complete separation of iron oxide from the rock is not possible. The concentrates recovered weigh about 50% as much as the input and the process costs approximately $0.35 per ton of concentrate. With certain types of ores another process called heavy media separation is now supplanting the jigging process, giving more satisfactory results at less cost.

(4) Heavy Media Separation

In this process differences of specific gravity are used to separate ore from impurities. In the heavy media method of concentration water is mechanically given a high specific gravity by keeping in suspension in the water a controlled amount of a heavier mineral or alloy. Various minerals, such as galena, have been tried without success. Ferrosilicon containing 15% silicon and crushed to pass a 24 mesh sieve is being used successfully. Enough ferrosilicon is added to give a specific gravity of approximately 2.8. Hematite has a specific gravity of about 5, while quartz has a specific gravity of about 2.5. Therefore, hematite will sink, and quartz will float in this mechanical liquid.

Tailings from wash ores, as well as crude ore are being treated. Only material from 1/4" to 1 1/4" size is treated by this method. Such material, with proper amount of water, is introduced into the top of a 7 1/2 ft. diameter cone containing the heavy media liquid. The light material (impurities), runs over the overflow, and is discarded as tailings, while the heavy material (the concentrate), sinks to the bottom of the cone where it is removed continuously by an air lift through a pipe passing out of the top. Some ferrosilicon passes into both tailings and concentrate, and both are washed and screened to separate the finer particles of ferrosilicon from the larger particles of tailings and concentrate. The ferrosilicon is then separated magnetically from the other fine material contained in the dirty water and pumped back into the cones. Approximately 1 1/4 pounds of ferrosilicon are lost per ton of concentrate at a cost of approximately $0.05. Approximate cost of this type of concentration is $0.25 per ton of crude.

(5) Drying

Many ores contain as much as 20% water in the form of water of crystallization and free water. These ores are low in iron content, and because of the consequent penalty in price are not merchantable as mined.

By applying moderate heat, some of the free water can be driven off, and the ore becomes merchantable. This is being done at one of the mines on the Cuyuna Range, by the use of rotary kilns. Bituminous coal is burned in mechanically stokered furnaces, and the hot gases of combustion flow the full length of kiln with the ore. The process is very dusty. Extreme care must be used not to dry the ore too much as then all of the lumps in the ore would be converted to dust, which is undesirable both in shipment and at the blast furnace. Ordinarily the moisture content is reduced to between 12% and 13%.

(6) Sintering

Some ores contain so much fine material that they are not desired at the blast furnaces. Too much fine ore in the blast furnace requires greater air pressure to blow the air through, and this higher pressure carries much of the fine material out of the furnace as flue dust. Certain steel companies are now sintering some of the fine ore at the blast furnaces, and consideration is being given to sintering the ores at or near the mines. This will depend upon where it can be done most cheaply.

One sintering plant is in operation at Crosby near Ironton on the Cuyuna Range. The ore before being sintered is screened to remove the lumps.

The sintering plant consists of a continuous traveling type of grate, upon which is placed at one end, a layer of about twelve inches of a mixture including ore to be sintered, flue dust from the Duluth blast and steel furnaces, and either coke breeze (ground to 10 mesh or finer) or coal dust. The coal or coke is ignited by coal or oil flames from the top and combustion is maintained by drawing air down through the bed. By the time the grates travel the full length, the mixture is burned through its entire depth and the fine material is converted into a semi-fused porous mass which breaks into lumps as it is discharged directly into the railroad cars.

The total cost of producing sintered ore including crushing, screening, mixing, sintering, supplies, labor, repairs and depreciation, approximates $1.90 per ton.

(7) Sponge Iron

Sponge iron is not being produced commercially in the United States, but the United States Bureau of Mines is planning to use the facilities of the Universities of North Dakota and Minnesota in experimental work in the production of hydrogen from the North Dakota lignites, and the employment of this hydrogen in the production of sponge iron from taconite. Sponge iron will be

produced from the ore by removing the oxygen from the iron oxides through the combination of hydrogen with that oxygen to form water vapor. This is done at a comparatively low temperature (1000°F), without melting the iron.

Sponge iron is produced in Sweden to a limited extent by using carbon monoxide (CO), which combines with the oxygen in the iron oxides to form carbon dioxide (CO_2). Part of the CO_2 passing up through the furnace is drawn off and passed over charcoal or coke which is heated electrically. This reconverts the CO_2 to CO which again passes up through the furnace to remove additional oxygen. In Sweden, the ore used is either extremely high grade, or concentrated ore. The sponge iron produced contains about 85% iron, the remaining 15% being unaltered iron oxides and impurities such as silica. This sponge iron is charged into an electric furnace with a limited amount of scrap iron and charcoal to produce steel. The reported costs of producing sponge iron do not compare favorably with the United States costs of producing pig iron.

It is doubtful that sponge iron will be produced in the United States on any extensive scale, particularly from Minnesota ores. It has been reported that a plant will be erected by the Republic Steel Corporation to convert New York State magnetite concentrates into sponge iron.

(8) Magnetic Separation

Magnetic separation is one of the oldest and easiest methods of separating highly magnetic iron ore from the gangue or rock. This method has been developed to a high degree on the magnetite ores of New York and New Jersey. Unfortunately, most of the iron ores in Minnesota consist of hematite which is only slightly magnetic, (1.32 against 40.2 for magnetite and 100 for iron) and therefore cannot be separated by this process. On the east end of the Mesabi Range, the iron oxide in the taconite formations is mainly magnetite and in 1918 a commercial plant was erected at Babbitt to produce magnetic sinter. A high grade concentrate containing approximately 64% iron was produced and shipped. To separate the magnetite grains from the hard rock requires fine crushing (100 mesh or finer). The costs of drilling, quarrying, crushing and sintering were too high so that price obtained for product was less than total costs, and the plant was shut down in 1924.

In order to expand the field of application of magnetic separation, experiments have been conducted for converting hematite to magnetite through the application of heat in the presence of carbon monoxide. The experiments have been successful chemically but the process is not now commercially successful.

(9) Experiments

Inasmuch as the necessity for beneficiating lean ores will continue to increase, much thought and effort is being devoted to experiments with ores which today are not commercial, but which may become commercial ores as a

result of processes developed through the experimental work. Most of the mining companies in Minnesota have laboratories where these experiments are carried on, and some of the larger companies have built or are building large pilot plants. The Mines Experiment Station of the University of Minnesota, is doing considerable experimental work, both independently, and in cooperation with the mining companies. The United States Bureau of Mines, the Division of Lands & Minerals of the State Conservation Commission, of Minnesota, and the Battelle Institute at Columbus, Ohio (privately financed) are also devoting time and effort to these problems.

Considerable experimental work has been done in the flotation of fine particles of ore, but no commercial plant has been built. Should this process prove successful, much of the iron may be recovered that is now washed out with the fine tailings of ores concentrated by washing or by heavy media method.

The Mines Experiment Station has developed a method of producing iron powder from the slate iron carbonates which are part of the waste over-burden resulting from stripping the ore deposits for open-pit operation. Briefly, the process consists of crushing the slate, dissolving the iron in the slate in sulphuric acid, filtering off the waste material, driving off the acid and water and converting the iron sulphate with heat, leaving iron oxide which is then converted to iron by use of hydrogen or similar gas. The final product, having an iron content of 99.5% or better, is ground to required fineness. The cost of producing this powder iron in a 5-ton per day plant, is expected to be about $0.13 a pound.

This is high compared with the cost of steel, but its special uses offset this high cost. The iron powder is compresed under extremely high pressure in molds to form such finished products as gears, cams, and washers. The compressed iron is then heated in a furnace free of oxygen to a temperature short of melting and distorting the product, which is then ready for use without machining. It is stronger than cast iron, but not as strong as steel.

The saving in machining and the uniformity of the product offset the high costs of the iron powder. Several large automobile companies have signified their intentions of utilizing the output from the 5-ton plant for use in the manufacture of brake drums and other articles.

6. Markets and Competition

a. Competition from other states.

Minnesota does not have a monopoly on iron ore. It has always had competition and will always have competition. Capital expenditures for blast furnaces and steel mills run into huge sums. A blast furnace costs at least $6,000,000, while a steel mill costs at least $60,000,000. Because a plant could not be moved except at tremendous cost, many items of cost are carefully considered before

plant locations are finally chosen. These include market for final products, availability of good labor, cost of the raw materials delivered at the blast furnaces, and cost of power. No one of these factors, in itself, decides location. They are all important. The cost of raw materials and certainty of supply are so important that most steel companies own or control their own sources of coal, limestone and iron ore. Certain steel companies own the railroads and steamship companies which transport these materials because the cost of transportation is a major factor in the cost of the material delivered at the blast furnace.

Every steel company desires to own or control at least 20 years' supply of iron ore. It is almost impossible for a steel company to obtain financial backing without having such a reserve. During the early 1900's, the United States Steel Corporation bought or leased as much as it could of the ore properties on the Mesabi and Vermilion Ranges. That this policy was wise, is indicated by the fact that United States Steel has not had to worry about its ore reserves, and still has over 20 years' reserves on the two ranges.

Previous to 1940, the Oliver Iron Mining Company, which is a subsidiary of United States Steel, sold no ore to any company except United States Steel and its subsidiaries. However, in 1940, Oliver offered ore for sale through advertisements appearing in the steel trade journals. It has sold ore since that date, and its present policy is to continue to do so.

Roughly, the Allegheny Mountains outline the eastern boundary, and the southern part of Ohio outlines the southern boundary of the market for Lake Superior ores. The northern boundary is the Great Lakes area and no ore is shipped west. While Lake Superior ore is shipped outside of this outlined area, the quantity is relatively small and is offset by shipment into the area from sources to the east. Minnesota has, and will have, competition from the iron mines in the States of Wisconsin, Michigan, New York, Pennsylvania, New Jersey and Alabama, either directly as iron ore, or as the products of pig iron and steel.

Exhibit III-C-12 shows the total ore shipped from mines in the United States for the years 1933 through 1943, and indicates the relative position of Minnesota compared with other states. Minnesota shipped 55% of the ore in 1938, and almost 70% in 1942 and 1943. Percentage of ore shipped by Minnesota is highest during years of high production and lowest during periods of low production. Alabama's percentage increases during periods of low production. While the tonnage shipped by Michigan and Wisconsin shows an increase, the percentage shipped has declined from 27.5% in 1931 to 15% in 1943.

(1) Michigan and Wisconsin

As of January 1, 1944, Michigan lists 136,000,000 tons and Wisconsin 6,000,000 tons of iron ore reserves, exclusive of low grade siliceous ore. Almost

all of this ore is mined underground, and therefore is at a disadvantage compared with the open-pit direct shipping ores of Minnesota. On the other hand, it has the advantage of being closer to consumers and therefore has lower freight rates. It averages slightly higher in iron content than Mesabi and Cuyuna Ranges, and definitely has a better structure compared with the ore from either of these two ranges. It is needed and used for mixing with the soft earthy ores of the Mesabi Range. That it does compete with Minnesota ore is indicated by the fact that an average of 12,000,000 tons per year have been shipped from Michigan and Wisconsin for the period 1911 to 1943.

Although only 142,000,000 tons of high grade ore are listed as reserves for these two states, the past trend has indicated that additional reserves may be disclosed. On January 1, 1916, reserves were listed at 211,000,000 tons, but shipments since that date have approximated this amount, and there are still 142,000,000 tons listed. At the average rate of 12,000,000 tons per year, the range would be exhausted in 12 years, but lower production and new reserves would probably double this life.

(2) New York, New Jersey and Pennsylvania

Iron ore reserves of the region from New York Adirondacks through New Jersey, Pennsylvania, and Ohio, have been estimated at 3,000,000,000 tons, with another 1,500,000,000 tons in Virginia, Tennessee, Kentucky, and North Carolina. It is estimated that 2,500,000,000 tons of this ore are in the Adirondack Mountain area of New York in the form of magnetite, and 800,000,000 tons in New Jersey also as magnetite. By making use of its magnetic properties, magnetite lends itself to easy separation from the gangue or native rock. There are no large concentrated deposits. The ore occurs as veins or lenses, usually on edge, varying in width up to 50 feet and in height up to 200 or more feet. Some of the veins of New Jersey which originally outcropped, have been mined since pre-revolutionary days, and now are being mined 2500 feet below the surface of the ground. Usually there is no sharp line of demarcation but a gradual change between the ore and the native rock. Some of the mines yield a high percentage of lump ore (over 50%) containing about 62% iron.

To varying degrees, all of the mines produce lump ore which is used for charging directly into the open hearth furnaces in the production of steel. The remainder of the ore is crushed to required fineness to separate the ore from the rock. The degree of grinding varies in different mines, depending upon the size of the ore grains. Some make initial separation of ore from the rock after screening through 20 mesh sieve, others have to grind much finer before initial separation. In some instances, the concentrate can be used in the blast furnaces without agglomeration, but where ore has had to be ground to pass a 100 mesh sieve, it requires sintering.

The ores vary considerably in phosphorous, sulphur and titanium content. Some of the ores are so high in titanium as to make them undesirable for use in a blast furnace, although progress has been made in blast furnace practice in overcoming the difficulties that this undesirable element introduces in the handling of slag.

One large open-pit deposit of titaniferous ore is now being mined at Lake Sanford, near Tahawus, N. Y. Ilmenite, the titanium mineral, is separated from the native rock after the ore has been finely ground and the magnetite removed and separated. At the present time, the magnetite, though containing as much as 9% titanium dioxide, is being sent to the blast furnaces.

The disadvantages of all of these magnetite ores are that they are comparatively small scattered deposits, occurring in comparatively narrow veins requiring costly underground mining, varying degrees of concentration, and in some instances, sintering of the concentrates. The advantages are that they can be readily concentrated; they all produce most desirable high iron content lump ore, which commands a premium price, and high iron content concentrate. The sintered concentrate can be smelted in a blast furnace at lower costs than the Mesabi Range ores.

The freight costs on iron ore from the Minnesota Ranges to Pittsburgh and Youngstown are $0.55 and $0.25 per ton higher, respectively, than the freight costs from northern New York to the same cities, so that this advantage offsets to a considerable extent the higher cost of underground mining. There is the further advantage that all year transportation by rail is available from the New York and New Jersey mines to the steel centers of the east.

Although shipments of iron ore from the magnetite mines of New York, New Jersey, and Pennsylvania, compared to Lake Superior region, are comparatively small — over 3,000,000 tons per year for the period 1940 to 1943 — it is expected that shipments will continue to increase, during and after the war. New funds totaling $40,000,000 were invested in New York State in milling plants, mining machinery and ore processing equipment during 1943, and proportionate sums were spent on plants in New Jersey. The recent acquisition of mining properties in northern New York by the Republic Steel Corporation, National Lead Company, Jones & Laughlin Steel Corporation, and the M. A. Hanna Company — all leading firms in the industry — is an indication that the recent expansions are all of substantial and permanent nature.

(3) Alabama

Although Alabama iron ore cannot be transported on a competitive basis to the furnaces using Minnesota ores, it is converted to pig iron in the Birmingham district at low costs and has been quoted at prices 15% to 25% lower, at Birmingham furnaces, than prices at furnaces in other districts. Exhibit III-C-13

shows the average price of No. 2 Foundry Pig Iron in four other districts in addition to the Birmingham district for the years 1929 through 1944. While most furnaces now list No. 2 Foundry Pig Iron at $24.00 per ton at the blast furnace, the Birmingham list price is $20.38 per ton. Birmingham pig iron has been sold in Chicago, Illinois, and Gary, Indiana in competition with the local pig iron.

The Interstate Commerce Commission in a decision in 1914 stated: "Nature has unusually favored Birmingham by placing at its doors all the raw materials necessary to the manufacture of pig iron."

The Birmingham district ore occurs in veins or beds extending for 20 miles under Red Mountain which overlooks Birmingham Valley. Although this ore contains only 44% to 34% iron, it is practically self-fluxing, containing almost the right amount of lime, so that little limestone has to be added to the furnace charge. Across the valley from Red Mountain to the west of Birmingham, are large deposits of good coking coal. If limestone is needed, it is found in Birmingham and vicinity. Under these conditions freight costs from the iron and coal mines to the blast furnace are low, varying from about $0.10 to $.50 a ton.

There are four ore beds, occurring in beds of sandstone and shale which range from 200 to 300 feet total thickness. The largest ore bed called the "Big Seam," from which most of the ore is obtained, is 15 to 22 feet thick. The Irondale bed is mined to a limited extent and averages only 4 feet in thickness. The other two beds are between 2 and 3 feet thick, and one of these beds has been worked in previous years. These beds dip approximately 22°, and the mining now is all underground, with shafts up to 2,500 feet deep. It is estimated that the cost of delivering ore to the blast furnaces is between $2.00 and $3.00 per ton.

The reserves of ore approximate 1,000,000,000 tons. The Tennessee Coal and Iron Company, a subsidiary of the United States Steel Corporation, owns about one-half of these ore reserves, as well as reserves of 2,000,000,000 tons of coal. Other steel companies, such as the Republic Steel Company, own the remainder of the reserves. With the steel companies owning their reserves, they have no royalties and no royalty tax to pay. The taxes on iron ore are much less than in Minnesota, and include an ad valorem tax, severance tax, and a corporation income tax. The severance tax amounted to $0.03 a ton, and the corporation income tax was 3% of the "taxable net value" in 1941.

b. Competition from Foreign Ores

Steel mills at or near the eastern seaboard have been using and will again use iron ores from foreign countries, particularly, Chile and Cuba, as soon as war and shipping conditions will permit. Steel produced from these ores is in competition with steel produced from Minnesota ores. Canada, Newfoundland,

Labrador, Venezuela, Sweden and Brazil are among some of the other foreign localities from which ore can be shipped for use in the eastern mills. Each of these sources is discussed briefly:

(1) Canada, Newfoundland and Labrador

Reserves of ore in Canada are estimated at 400,000,000 tons, in Newfoundland at 3,500,000,000, and in Labrador at 1,000,000,000 tons. Newfoundland ores are high in phosphorus, and are controlled abroad. Ores are being shipped from all three places, but in limited quantities. All have the disadvantage of severe winters. If the St. Lawrence waterway should be constructed, these deposits could be exploited by using the same ore vessels, as are used for Minnesota ores, and the existing lower lake unloading docks, blast furnaces, and mills.

(2) Cuba

Ore reserves on the north shore of Cuba are estimated at 3,000,000,000 tons and on the south shore at a few million tons. These latter deposits which are nearing depletion have been actively mined by the Bethlehem Steel Company and smelted in their eastern United States mills. The north shore deposits have impurities which are hard to remove, and some are fairly high in the rarer metals, such as nickel and vanadium, which may make them valuable.

(3) Chile

Chilian reserves are estimated at 250,000,000 tons, very high in iron content, and are being extensively mined by the Bethlehem Steel Company. The ore now being mined is located within a few miles of the seaport.

(4) Venezuela

The Bethlehem Steel Company has developed an open-pit deposit containing 60,000,000 tons of ore containing better than 65% iron. In connection with the deposits which it has developed in foreign countries, Bethlehem Steel Company is handling shipments to the United States from the area, and it is conceivable that efforts will be made to find a bulk commodity to ship on the vessels which have been returning to these countries in ballast.

(5) Mexico, Nicaragua, Honduras, Panama, Puerto Rico

These countries have a total ore reserve of 2,400,000,000 tons. There are no large deposits and they are not extensively mined now.

(6) Brazil

Brazil has 13,000,000,000 tons of high grade ore ranging in iron content from 50% to 65%. Many of these reserves can be mined by open-pit methods. Many are located about 300 to 400 miles from the seaboard, and some of the deposits are now being mined. The United States Government, through the Export-Import Bank, has made large loans for the improvement of the railroads connecting the deposits with the seaports, and some of the output for a number of years is to be divided between Great Britain and the United States.

The United States has also financed the erection of a steel mill in Brazil. Brazil does not have any large deposits of good coking coal, and will probably have to import coal in exchange for its high grade ore.

(7) France

The iron ore reserves of France total between 8,000,000,000 and 12,000,000,000 tons, located mainly in the Lorraine district. They average about 35% iron, and are high in phosphorus, 1.6% to 1.8%. Germany has used these ores extensively, mixing them with the Swedish ores, having developed blast furnace and steel furnace technique for the removal of the phosphorus.

(8) Sweden

The Swedish ore deposits, estimated at 2,200,000,000 tons, mainly magnetite, are rich in iron content, ranging from 60% to 69%. Many of the deposits are being mined as open-pit mines. The Swedish Government controls the export of the ore.

(9) Russia

Total Russian reserves are not definitely known, but the Krivoi Rog deposits in the Ukraine are estimated at 1,000,000,000 tons of 57% iron. Russia will probably conserve all iron ore for its own use.

(10) French North Africa

Deposits in Algeria, Tunisia and Morocco, are estimated at 100,000,000, 88,000,000 and 30,000,000 tons respectively. They are small and scattered, but high in iron content ranging from 51.6% to 62%, and are low in phosphorus and sulphur.

(11) Summary

No attempt has been made to include all of the known iron ore reserves in the above brief discussions. Only those ores have been mentioned which either are now, or may in the future be competitive with Minnesota ores, either in the form of iron ore or as contributing to finished products of steel.

From time to time attempts are made to estimate and list the known iron ore reserves of the world. Each such estimate tends to increase the previously published estimates, owing to new discoveries, better information on old discoveries and change in classification from potential reserves to actual reserves.

Prior to 1926, the actual iron ore reserve of the world was estimated at between 30,000,000,000 and 35,000,000,000 tons. In 1926, Olin R. Kuhn estimated the world's iron ore resources at 57,800,000,000 tons, with an additional 167,700,000,000 tons of potential or possible ore reserves.

The latter included iron bearing formations about which information is meager or which are not merchantable now.

In an article entitled "Known Iron Ore Reserves of the World and Their Significance," published in the May 1939 issue of Iron and Steel Engineer,

Charles Hart estimated the known iron ore resources at 62,900,000,000 tons and the potential reserves at 143,700,000,000 tons, divided among the continents as follows:

	Actual (Tons)	Potential (Tons)
Europe	32,608,100,000	13,993,050,000
America	22,357,000,000	100,443,960,000
Oceania	1,950,325,000	1,300,000,000
Asia	4,600,000,000	19,000,000,000
Africa	1,410,000,000	9,000,000,000
Total	62,925,425,000	143,737,010,000

The known iron ore reserves of the United States are estimated at about 10,000,000,000 tons, and the potential or possible ore reserves are estimated at about 84,000,000,000 tons.

Therefore, Minnesota, with its 1,000,000,000 tons of known ore reserves, has 10% of the United States' known ore reserves, and only 1.6% of the world's known ore reserves, some of which are of much higher grade than Minnesota ores.

Though the imports of iron ore in the past have not been excessive, the fact that from 500,000 to over 3,000,000 tons of ore have been imported each year is a definite indication that foreign ore is competitive with Minnesota ore. Imports from 1909 through 1940 are shown in Exhibit III-C-14.

In addition, an average of 112,000 tons of pig iron, equivalent to approximately 200,000 tons of iron ore, were imported annually from 1931 through 1939. Imports of steel mill products have been as high as approximately 300,000 tons of steel per year.

c. Competition from Scrap Iron and Steel

In addition to competition from domestic and foreign ores, Minnesota iron ore, as well as all iron ore, has had and will have to compete with scrap iron and steel. Exhibit III-C-15 indicates the steady increase in use of scrap iron and steel by showing the amount of iron ore used in the United States in relation to the steel produced for each year from 1905 through 1941. From 1905 through 1913, the amount of ore averaged well over 2.0 tons of ore per ton of steel produced, while for the years 1932 through 1941, the average was a little over 1 ton of ore per ton of steel.

The increased use of open hearth furnaces in preference to Bessemer converters has increased the use of scrap. In 1905 open hearth furnaces produced only about 45% of the steel, whereas in 1938, they produced approximately 92% of all steel in the United States. Steel can be produced in an open hearth

furnace from scrap without the use of pig iron. Before the war, the Pacific Coast steel mills depended preponderantly upon local supplies of scrap in the production of steel. The location of steel mills in the Detroit area has helped these mills to show good profits for several reasons, one of the principal ones being the nearness to the source of large quantities of scrap available from the automobile industry with no freight charges to be added to their cost.

The increased consumption of purchased scrap in relation to steel and pig iron production for the years 1905 through 1941, is shown in Exhibit III-C-16. Purchased scrap is the scrap the steel mills buy from sources outside of their own mills as distinguished from the "home scrap" which includes all the cut off ends of ingots, slabs, bars and finished steel rolled products plus discarded used parts of machinery such as rolls. All of these are charged into the open hearth furnaces for remelting. Exhibit III-C-16 indicates the steady increase of purchased scrap from 5,000,000 tons per year to over 25,000,000 tons per year. Exhibit III-C-17 shows, for each year from 1905 through 1941, the tons of pig iron produced and tons of purchased scrap consumed per ton of steel produced. The amount of pig iron has steadily declined while the amount of scrap has steadily increased per ton of steel produced. The last few years have shown a temporary reversal of this trend, partly because of the shortage of scrap, (over 17,000,000 tons having been exported during the period 1936 through 1940), and partly because of the large increase in steel production.

d. Competition from Substitutes for Steel

Steel, and therefore iron ore, will have competition from materials such as alloys of aluminum and magnesium, the plastics and new methods of treating and using woods. To a great extent the amount of competition will depend upon the relative costs of the various materials.

7. Ore Transportation Methods and Costs and Lake Erie Prices

a. Railroads

The three iron ranges in Minnesota are served by railroad as follows:

(1) Vermilion Range

The Duluth, Missabe & Iron Range Railroad, a subsidiary of the United States Steel Corporation, runs the length of the range between Tower on the west and Ely on the east, and connects with Two Harbors, Minnesota, on Lake Superior.

(2) Mesabi Range

The Duluth, Missabe & Iron Range Railroad runs almost the full length of the range from Coleraine on the west to Babbitt on the east with two connections to Lake Superior, one to Two Harbors, the other to Duluth.

The Great Northern Railroad serves the range from Grand Rapids on the west to Virginia on the east, having ore docks at Superior, Wis.

(3) Cuyuna Range

The Northern Pacific Railroad runs the full length of the range from Brainerd on the west to Aitken on the east, and thence on to Duluth and Superior.

The Minneapolis, St. Paul and Sault Ste. Marie Railroad (Soo Line) at one time had independent spur lines to most of the mines. The two railroads, by joint agreement, have eliminated some of their parallel and competing trackage and each railroad operates trains serving the mines in alternate months.

The minimum length of haul from mine to ore dock is approximately 60 miles, maximum approximately 124 miles, with a weighted average haul, based on the business handled in 1944, of about 92 miles. The ore is hauled in steel cars, with lower portion of sides and ends sloping to two gate controlled hoppers. Net carrying capacity of cars varies from 50 to 75 tons. After the cars are loaded and delivered near the mouth of the mine, they are assembled by the railroad serving the territory into trainloads of up to 180 cars and hauled toward Lake Superior.

b. Ore Docks

There are only three harbors, all on Lake Superior, which serve the three Minnesota Iron Ranges—Superior, Wisconsin; Duluth, Minnesota; and Two Harbors, Minnesota. Except for the relatively small amount of ore used in the blast furnaces at Duluth, the ore is dumped into storage bins at the ore loading docks at these harbors. The number of pockets and the storage capacity of these docks for each railroad are as follows:

RAILROAD	HARBOR	No. of Docks	No. of Pockets	Total Storage Capacity (Tons)
Duluth, Missabe & Iron Range	Two Harbors, Minn.	3	600	168,800
Duluth, Missabe & Iron Range	Duluth, Minnesota	2	768	268,800
Great Northern	Superior, Wis.	4	1,352	441,800
Northern Pacific	Superior, Wis.	1	310	108,500
Total		10	3,030	987,900

The Soo Line uses the ore docks of the Northern Pacific.

c. Lake Transportation

The ships which carry the ore from the upper lake ports to the lower lake ports are specially designed vessels to allow both rapid loading and unloading. They are limited in draft by the depth of water in the Sault Sainte Marie Canal

and Locks and in the Detroit River. Maximum depth of water varies from 22 to 24 feet, depending upon season of year. Some of the new vessels are built for a draft of 24 feet, but most are built for a draft of between 20 and 22 feet.

Thirty-two companies operate 312 of the ore freighters for the entire Lake Superior iron ore district, with a combined capacity of 2,940,000 tons for one trip based on a 20 foot draft. Two companies own only one ship each, while one company owns 68. Forty-one of the 312 freighters belong to the United States War Shipping Administration, but are operated by 10 of the 32 companies. The vessels vary in carrying capacity from a minimum of 4,700 tons to a maximum of 20,000 tons.

The vessels make a round trip in about six to seven days. Loading facilities are such that under good conditions a vessel can be loaded in about four hours. However, certain types of fine ore which contain large amounts of alumina and moisture tend to "hang up" in freight cars and the loading pockets, and the time and labor required to prod this material loose lengthens the loading time to as much as 16 to 24 hours. Long steel chutes from each loading pocket on the dock are raised and lowered by power so that ore is guided across the width of the vessel. Power operated gates control the rate of flow. The whole length of ship is loaded at one time. At the same time that the ship is being loaded, water ballast from space between the two bottoms of the vessel is being pumped out.

The ore boats are unloaded at the lower lake ports quickly and efficiently with large mechanical equipment built especially for this purpose. There is no lost time in the operation of these freighters. As soon as they are loaded or unloaded, they start moving, regardless of the time of day or night.

Some of the vessels return to upper lake ports without cargo; some return with cargo, principally with coal. Some limestone is brought into the Duluth harbor for the blast furnaces and cement mill at Duluth.

Most of the ship companies are owned or controlled by the steel companies. A few independent ship companies carry ore on a tonnage basis or under contract. These independents can move wheat, and do so, whenever possible, because of larger income per trip.

Some of the ore delivered to lower lake ports is used at blast furnaces in these ports or vicinity. The remainder is hauled inland to the iron and steel centers. Distribution of the ore and the location of the iron and steel furnaces is indicated in Exhibit III-C-1.

d. Railroad Freight Costs—Mine to Upper Lake Ports

In the following discussion, the 3% Federal Transportation Tax imposed on rail and lake freight charges and dock charges is not included in the figures given.

The freight rate from the mouth of any mine, on any of the three Minnesota ranges to the Lake Superior ports serving that range, is $0.81 per ton. There is a dock charge of $0.11 per ton for unloading ore from car to ore pockets and loading into ore boats, making a total charge of $0.92 from mine to boat.

All of the ranges in Wisconsin and Michigan have lower freight rates to the ports than the Minnesota ranges, because the distances are longer from the Minnesota ranges. The situation is shown in the following table. The distances used in this table are taken from the decision of the Interstate Commerce Commission in Adriatic Mining Company vs. C. & N. W. Railway Company, 78 ICC 611.

Range	Port	Frt. Rate (Per Gross	Dock Chg.	Total Cost Ton)	Distance Miles	Rate-Mills Per Net Ton Mile
Vermilion	Two Harbors, Minn.	$0.81	$0.11	$0.92	70-90	9.0 mills
Mesabi	Superior, Wis.	0.81	0.11	0.92	106-124	6.29 "
Mesabi	Duluth, Minn.	0.81	0.11	0.92	75	9.6 "
Cuyuna	Superior, Wis.	0.81	0.11	0.92	100	7.3 "
Eastern Marquette	Marquette, Mich.	0.54	0.11	0.65	12-42	18.5 "
Western Marquette	Marquette, Mich.	0.60	0.11	0.71		20.6 "
Menominee	Escanaba, Mich.	0.78	0.11	0.89	43-90	10.4 "
Marquette	Escanaba, Mich.	0.78	0.11	0.89	60	11.6 "
Gogebic	Ashland, Wis.	0.78	0.11	0.89	40-52	15.1 "

The net ton mile rate on movement of iron ore from the Minnesota ranges, based on the weighted average haul of business handled in 1944, is approximately 7.85 mills, materially lower than the net ton mile rate from the Michigan and Wisconsin ranges.

At least as early as 1916, the Interstate Commerce Commission has fixed the rates from Mesabi and Vermilion Ranges to Duluth and Two Harbors. The Commission has since reviewed or fixed the rates from all the ranges in the Lake Superior district to ports of trans-shipment. The last decision was in 1923, I.C.C. Docket 12071, reported 78 ICC 611.

In the last named case, the Commission, while approving the present rates from Minnesota ranges, required some reductions in the then rates from Wisconsin-Michigan ranges to Ashland, Escanaba and Marquette—present rates from latter being those ordered by the Commission.

When, on November 15, 1937, the Interstate Commerce Commission granted an increase in freight rates on so-called heavy basic commodities, iron ore from Minnesota to the Lake Superior ports was one of the few commodities which was excluded from any increase. An increase, if granted, would have raised the rates approximately $0.08 per ton. In 1942, the railroads in the U.S.A.

asked for a 10% increase in freight rates, except those on coal, coke and iron ore, to cover increased labor and material costs. Most of the products of mine, except coal and iron ore, were allowed increases of 3% or more.

Range of railroad freight rates from the mines to Lake Superior for the three Minnesota Ranges from 1893 through 1944, is shown in Exhibit III-C-6. The minimum freight rate was $0.55, and the maximum $1.00 per ton.

e. Lake Freight Costs—Upper Lake Ports to Lower Lake Ports

Bulk commodities, such as iron ore, coal and wheat, shipped separately by boats on the Great Lakes, are not subject to Interstate Commerce Commission regulations. Rates are published by the various steamship companies and during normal times are probably adhered to. Inasmuch as the great bulk of the ore is carried by steel company owned vessels, the freight rates are merely a matter of bookkeeping between the steel company and the subsidiary. During periods of low ore production, there is price cutting below the published rates by the independent steamship companies.

For the war duration, the lake freight rates have been frozen by the Office of Price Administration. The rates now in existence are:

From	To	Lake Frt. Rt. Per Ton	Unloading Chg.	Total Chg.	Difference in Rates Between Minn. Pts. & Others
Duluth, Superior, Two Harbors, or Ashland	Lower Lake Ports	$0.80	$0.14	$0.94	—
Marquette, Mich.	Lower Lake Ports	0.72	0.14	0.86	$0.08 less
Escanaba, Mich.	Lake Erie Ports	0.60	0.14	0.74	0.20 less
Escanaba, Mich.	Lower Lake Michigan Ports	0.48	0.14	0.62	0.32 less

A study of the combined freight rates from all of the Lake Superior ranges to various lake ports reveals the following facts: The rate from any of the three Minnesota ranges to any port on Lake Michigan or Lake Erie is uniform and equal to $1.86 which includes unloading charges. This is the highest rate and compares with the costs from the Michigan and Wisconsin ranges as follows:

From Range	To Ports	Combined Frt. Rates, Incl. Unloading Ch.	Dif. Between Minn. Range Frt. Costs & Other Ranges
Minnesota Ranges	Lower Lake	$1.86	—
Eastern Marquette	Lower Lake	1.51	$0.35 less
Western Marquette	Lower Lake	1.57	0.29 less
Menominee and Marquette	Lower Lake Mich. via Escanaba	1.51	0.35 less
Menominee and Marquette	Lake Erie via Escanaba	1.63	0.23 less
Gogebic	Lower Lake	1.83	0.03 less

Thus, freight costs from Minnesota ranges to lower lake ports are $0.03 to $0.35 higher than similar costs from the other three main producing Lake Superior ranges. These freight costs are higher because of the greater distances from Minnesota ranges to Lake Superior ports, plus the greater distance from Lake Superior ports serving Minnesota to the lower lake ports.

f. Total Freight Costs—Minnesota to Blast Furnaces

Additional freight and handling charges from the lower lake ports to the blast furnaces inland from the lakes are as follows:

From	To	Frt. Rate	Total Frt. Cost From Mouth of Minn. Mine to Consuming District, incl. all handling charges
Lake Erie Ports	Mahoning and Shenango Valleys, Canton and Massillon	$0.97	$2.83
Toledo	Jackson, Hamilton	1.05	2.91
Lake Erie Ports	Midland, Steubenville, Weirton and Neville Island	1.14	3.00
Cleveland	Jackson	1.27	3.13
Lake Erie Ports	Pittsburgh and Wheeling Districts	1.30	3.16
Chicago	Granite City	1.35	3.21
Lake Erie Ports	Monessen	1.37	3.23
Toledo	Ashland and Portsmouth	1.40	3.26
Cleveland	Ashland, Portsmouth and Hamilton	1.40	3.26
Lake Erie Ports	Johnstown	1.45	3.31
Buffalo	Troy	1.46	3.32
Ashtabula, Conneaut & Erie	Riddlesburg	1.88	3.74
Buffalo and Erie	Lehigh and Schuylkill Valleys and Riddlesburg	2.09	3.95
Buffalo and Erie	Sparrows Point	2.09	3.95
Lake Erie Ports	Virginia District	2.22	4.08

The freight rates in the above tabulation include a handling charge of $0.09 per ton from rail of vessel to freight car. If ore is placed on a stock pile first, then charges, in place of the $0.09 are:

From rail of vessel to stock pile	$0.22 per ton
From stock pile to car	0.14 per ton
Storage per month	0.01 per ton

These rates are in addition to the $0.14 per ton for unloading the vessel.

The all-rail freight rate from Cuyuna, Gogebic, Menominee and Marquette Range to Granite City, Ill., is $2.50 per ton.

All-rail freight rate from Northern New York mines to Pittsburgh and Youngstown is $2.58 per ton. Rail-lake-rail freight rates from Minnesota ranges to these localities are $3.13 and $2.83 respectively.

It is to be noted that cost of handling ore at both the upper and lower lake ports amounts to not less than $0.34 per ton. Adding the $0.11 per ton charge at the upper lake ports to the two charges of $0.14 and $0.09 for unloading from vessel and loading into railroad cars at the lower lake ports makes a total of $0.34. If the material has to be stock-piled first, the total handling charges are $0.50 per ton plus $0.01 per ton per month for storage. Owing to the fact that no ore is hauled on the lakes during the winter months, the amount of ore stored on the docks on December 1st of each year at Lake Erie ports has averaged over 7,500,000 tons since 1900. The ground storage capacity of these docks is approximately 19,000,000 tons.

On the basis of Lake Erie base price of Mesabi Non-Bessemer ore, the value of ore at the mouth of the mine is $2.54 per ton, allowing $0.05 per ton to cover interest, marine insurance and incidentals. The transportation charges from the mouth of mine to inland steel district vary from $2.83 to $4.08. Thus the transportation costs exceed the value of the ore at the mouth of the mine.

g. The Lake Erie Prices

The Lake Erie price is a price per gross ton of the ore delivered at the Lake Erie ports. It therefore includes the cost of freight from mouth of mine to the upper lake ports, the cost of unloading from freight cars to ore boats, the cost of freight through the lakes, and the cost of unloading from boats at the lower lake ports.

There are five general grades of ore, based principally on the phosphorous content, and whether ore comes from the Mesabi range:

Grade	Range	Phosphorous Content
Bessemer	Old Range	0.045% or lower
Bessemer	Mesabi	0.045% or lower
Non-Bessemer	Old Range	between 0.045% and 0.180%
Non-Bessemer	Mesabi	between 0.045% and 0.180%
High Phosphorous		over 0.180%

The Mesabi Range ores have always carried a lower price than the ores from the older ranges (Vermilion, Marquette, Gogebic and Menominee) because of the poorer structure, most of the Mesabi ore being very fine. Lake Erie prices for years 1855 through 1944 are shown in Exhibit III-C-11.

The Lake Erie price was formerly supposed to represent the sale price of the first sale of ore in any given year. However, owing to the fact that most users

of iron ore own or control the mines and the mining companies, the Lake Erie price has lost much of its significance and it is now regarded more as a catalog price than a selling price. What little ore is sold in the open market usually is sold below the Lake Erie price, in many instances as much as 15% or more. However, the Lake Erie price is important in two other ways. It is used as a basis of adjustment for variations in iron content in the ore, and is used by the State Department of Taxation as the selling price of the ore in determining the assessed valuation of unmined ores in some mines for ad valorem tax and to obtain the taxable value of mined ore for occupation tax.

At the present time all Lake Erie prices are based on an iron content of 51.5%. If the iron content is more or less than this amount, the price is adjusted according to the "unit iron value."

The "unit iron value" is the Lake Erie price divided by 51.5 (if the iron content is above 50%). If the iron content is between 49 and 50%, penalty deduction for the iron ore of this iron content is 1½ times the unit iron value. For iron content below 49%, penalty deduction is two times the unit iron value for each 1% below 49%.

The ore on the Cuyuna Range, because of its high manganese content, is treated differently. If the manganese is less than 2%, it is disregarded and only the iron content is paid for. If the manganese is between 2% and 5%, then manganese content is added to iron content and paid for at iron unit value. If manganese content is higher than 5%, it is classed as a manganiferous ore and the manganese unit brings a higher price than the iron unit.

8. Employment, Wages and Other Costs

a. Employment

The 1940 census shows that the mining industry utilizes only 0.8% of the employment of the State. Due to lack of fuel in the State ,iron ore is not converted into pig iron or steel locally except in three blast furnaces in Duluth, whereas there are about 220 furnaces outside of the state using Lake Superior District ore.

Therefore it is apparent that at present, from the standpoint of employment, the iron ore industry relatively does not employ many persons. However, allied industries such as the railroads, blast furnaces, steel mills, ore docks, steamship companies, all contribute substantially to employment, income and taxes. These industries would be non-existent or much reduced in scope, were it not for the Minnesota iron ore industry.

Owing to the easy accessibility of high grade open-pit ore, there is little labor needed in the mining of this ore.

The extraction and shipping of iron ore from the open pit mines in Minnesota is a seasonal operation depending upon the navigation season on the

Great Lakes, the approximate opening and closing dates being April 15 and December 15 respectively. Therefore, it would be expected that during four of the winter months most of the mining men would be unemployed. While this may have been true in the past, and is to some extent still true of the small independent mining companies who operate on a small margin of profit, the large companies make every effort to keep the men employed throughout the year. The payroll records of one of the large mining companies indicate not over 10% variation in employment between summer and winter months of the same season.

Tonnage of ore shipped each year has varied from a minimum of 2,200,000 tons in 1932 to a maximum of 75,500,000 tons in 1942, and employment has to some extent followed the variations in shipments. Exhibit III-C-24 shows the relation between men employed and the tonnage of overburden stripped and ore shipped. There has been a decided trend downward in the number of men employed. The exhibit, which covers the years 1906 through 1943 shows that in 1910 when total combined tonnage handled approximated 65,000,000 tons, 23,000 men were employed, whereas in 1943, when 135,000,000 tons of overburden and ore were moved, approximately 15,000 men were employed. The lowest employment, or 4,000 men, occurred in 1932 during the year of lowest shipment of ore.

That exhibit also shows the tons of overburden stripped and the tons of ore shipped per man for each year. This has varied with the tonnage shipped each year, increasing with heavy shipments and decreasing in years of light shipments. The trend, however, is definitely toward increased production per man employed, and can be accounted for mainly by the expansion of open-pit operations. This is indicated also in Exhibit III-C-25, which shows the output for all Minnesota mines in tons per manhour, as well as output from underground and open-pit mines, for the years 1915 through 1940. The latter exhibit does not show an exact picture, because of the variation in amount of stripping performed each year in proportion to the ore mined, but it does indicate the trends. These same trends are indicated in Exhibit B-4 of the "Brief of Iron Mining Industry before Minnesota Interim Commission on Iron Ore Taxation." These charts show that the output per manhour from underground mines since 1920 has increased only about 50%, while the output for open-pit mines has increased over 100%. The output per manhour from open-pit mines is at present, at least five times the output per man from underground mines.

This increase in output per manhour has been due to increase in size of equipment, better equipment and change in type of equipment. Although the underground mines have been able to increase output per manhour, some of the increase has been due to the fact that many of the uneconomical underground

mines have ceased operations and some have been converted to open-pit mines.

Underground mines are operated twelve months in the year, the output from the mines being stored at the mouth of the mine during the winter months. During the winter months, operators of the open-pit mines do most of their stripping, some "scramming" operations which consist of removal of ore from ravines or crevices in the bottom or sides of the pits, and generally prepare for the next season's work.

b. Wages and Salaries

Wages and salaries of personnel employed in the mining industry have been estimated from the information published in the State Tax Commission Reports, by multiplying the unit costs by the tonnage mined and applying an estimated percentage for labor cost. This information is derived from the occupation tax reports submitted by the mining companies. Exhibit III-C-26 gives the approximate labor costs or wages.

Column 4, which represents the wages paid for direct mining costs, shows the average for 19 years as approximately $9,630,000 per year, with a minimum of $2,360,000 and a maximum of $16,250,000.

Column 6 represents the estimated wages paid for development, obtained by assuming that wages represent 50% of the total development costs. The approximate average annual wages paid were $3,640,000, with a minimum of $710,000 and a maximum of $6,670,000.

Column 8 represents the estimated wages of miscellaneous clerical and administrative forces, obtained by assuming that these wages are 30% of the total miscellaneous items of cost. The average annual wages for this group by this approximation is $1,820,000 with a minimum of $730,000 and a maximum of $3,090,000.

Column 9 is the sum of all of the wages paid by the mining industry, with approximate average annual wages of $15,090,000, with a minimum of $3,290,000 and a maximum of $23,730,000. The total wages noted in this column for years 1938 to 1941 compare closely with the wages reported to the Minnesota Unemployment Compensation Division. The Unemployment Compensation Law did not become effective until 1938.

Column 10 gives the total costs of development, royalty, mining and other miscellaneous costs except taxes, while Column 11 gives the total costs of ad valorem, occupation and royalty taxes. The average annual taxes of $21,300,000, exceeded average annual wages of $15,090,000. Average annual taxes represented 49% of the average total cost excluding taxes, $43,500,000, noted in Column 10.

Exhibit III-C-27 which shows the wages paid for common labor in the mines

in St. Louis County for a period of years, indicates the continuous trend toward higher wages.

c. Social Aspects

The communities on the range during the boom times built schools, city and town halls, civic centers, stadiums, and public golf courses, probably with the expectation that the communities would continue to expand. The communities are almost entirely dependent upon the iron ore industry for their existence. The last large sawmill on the ranges which helped to sustain some of the range inhabitants ceased operations in Virginia, Minnesota about 1930. The largest part of the costs of all improvements and costs of operating the communities has been paid through the medium of taxation by the mining companies because of high taxable valuations on the large reserves of iron ore.

The Iron Range Resources and Rehabilitation Commission was created in 1941, with an appropriation from the general fund of 5% (now 10%) of the occupation tax paid into the fund. Its purpose was the development of the resources in any county, and the vocational training and rehabilitation of residents when distress and unemployment exist within the county by reason of the removal of the natural resources.

Two projects are under way in this direction. The first is the proposed construction of the 5-ton iron powder plant, and the second is the erection of a peat moss cleaning and dehydrating plant at Floodwood. Both these projects are discussed elsewhere.

d. Costs

It must be realized that costs of producing iron ore vary considerably in one mine as compared with others, owing to the differences in the shape, size, and nature of ore deposit, depth of overburden, type of mine (underground, open-pit, or mixed), quantity of water to be pumped, and sundry miscellaneous items.

Exhibit III-C-3 indicates the average costs of producing iron ore for each year from 1921 through 1941, from all the mines in Minnesota including underground operations. This information is obtained from tables in the Tax Commission's Biennial Reports which are derived from information furnished by the mining companies in filing their reports for the occupation tax.

This Exhibit shows that the total average cost of mining and beneficiation, including labor, supplies, and miscellaneous items, ranged from a minimum of $0.509 per ton in 1941 (a year of high productivity with 63,700,000 tons of ore mined) to a maximum of $1.07 in 1938, (a year of low productivity with only 14,700,000 tons mined). The average costs per ton for labor, supplies and miscellaneous respectively were $0.207, $0.14, and $0.162 in 1941, and $0.409, $0.254, $0.407 in 1938.

The miscellaneous items mentioned above do not include items which mining companies usually consider as costs deductible under the Federal Income Tax, such as depletion of capital, interest on capital investments, and interest on loans or other costs of a more or less indirect nature, but do include costs in the nature of administrative and overhead expenses, depreciation and miscellaneous costs directly attributable to mining operations.

The average cost of development per ton of ore mined was $0.206 and $0.186 for the same two years, 1941 and 1938, respectively. Adding average costs of royalties which were $0.415 and $0.387 for the two years respectively, brought total costs for all items noted above to $1.13 and $1.643 for years 1941 and 1938, respectively.

Per ton of ore mined the average total cost of ad valorem, occupation, and royalty taxes was $0.389 and $1.255 for 1941 and 1938, respectively. These tax costs were, respectively, 25.6% and 43.3% of the above total costs, including taxes, and 34.5% and 76.3%, respectively, of total costs, excluding taxes.

Tables in Exhibit III-C-4 show similar information, but operations have been separated into open-pit operations and underground or mixed operations. A comparison of the costs for different items indicates the following approximate ratio of costs per ton of ore mined between open-pit and underground or mixed operations:

	Open-Pit		Underground
Development	4	to	1
Labor	1	to	7
Supplies	1	to	4
Other Items	1	to	1½
Royalties	1	to	1
Weighted total of above costs	1	to	2

e. 1943 Operations

In 1943, twenty-five mining companies mined 95 properties which were divided as follows:

	Open Pit Mines		Open and Underground and Milling		Underground	
Operated at Profit	40		6		6	
Operated at Loss	34		2		7	
Direct Shipping Ores		32		5		11
Beneficiated Ores		42		3		2
	74	74	8	8	13	13

Exhibit III-C-5 indicates the wide range in the costs, taxes, value of ore, and profits as reported by the mining operators in their 1943 Occupation Tax Reports on direct shipping ores. There is considerable range between the minimum and maximum values reported. Some of the extreme variations probably are due to different methods of cost accounting and distribution used by the various companies. Total mining costs range from $0.33 to $4.88 per ton, royalties up to $1.39 per ton, real and personal tax from $0.01 to $2.70 per ton. Profit and loss statements based on "market value" range from a "loss" of $15.76 per ton to a "profit" of $1.89 per ton.

In all of the above mentioned tables, the "profits" indicated are based on certain assumptions:

1. That "market value" is the Lake Erie price with adjustments for iron, silica and phosphorous content. This may or may not be the true value. In some cases selling price varies from market value, and in many sales is lower than "market value."
2. Full amount of real estate taxes of each mine is used in determining tax per ton, instead of only ratio of ore mined to ore in ground.
3. Shrinkage of 1% is used instead of ½%, in cost item.
4. Occupation tax is included in cost item.
5. Royalty tax is included in cost item.

The costs do not include depletion, Federal income taxes, administrative expenses of the home office, carrying charges, real estate taxes or royalties on idle mines.

9. Iron Ore Taxation

a. General

In the following discussion of taxes, there are not included United States Government income, Corporation, Federal Old Age Benefit and Unemployment taxes.

The taxes which will be discussed are those peculiar to the mining industry:

(1) Ad valorem
(2) Occupation
(3) Royalty

b. Importance of Taxes as a Cost of Mining

Taxes levied on the mining industry are a large part of the cost of mining. In 1920, the total taxes exceeded $20,000,000. For the period 1920 through 1943 they aggregated $513,800,000, or an average of $21,400,000 per annum, while other costs have averaged about $44,000,000 per annum. Variation in taxes for each year is shown in Exhibit III-C-18.

c. Average Tax Cost Per Ton of Ore Shipped

The total tax burden, for this same period, including taxes levied on reserves, was equivalent to $.595 per gross ton of ore shipped. This tax per ton of ore shipped has varied considerably because of the large variations in annual shipments. The total annual tax has been more nearly constant. Variations in total annual taxes are indicated in Exhibit III-C-19.

In 1932, when only 2,250,000 tons of ore were shipped, the total taxes levied were equivalent to $7.35 per gross ton shipped. During the last two years (1942 and 1943), because of large shipments, the tax burden was equivalent to only $.31 per ton.

With an approximate average Lake Erie price of $4.60 per ton and average delivery cost of approximately $1.80 per ton, the average value at the mouth of the mine for the period 1920 through 1943 was $2.80 per ton. The average tax of $0.595 per ton for the period is approximately 21% of this amount. However, ores have sold as low as 85% of the Lake Erie price, or approximately $3.90 per ton. Again deducting the $1.80 per ton for freight charges, leaves a net average value per ton of $2.10. The average tax is approximately 28% of this amount.

d. Apportionment and Relationship of Taxes

The amount paid in each of the three types of mining taxes and the percentage of each to the total are indicated in Exhibit III-C-20.

The ad valorem tax amounted to $20,840,000 in 1920, when it constituted 100% of the total taxes paid by the mining industry. Since then it has gradually declined to approximately $13,000,000 in 1942 and 1943, or approximately 60% of the total taxes.

The occupation tax was first levied in 1921. It is computed as a percentage of the "profits" from the operation, as defined by law and discussed hereinafter in detail. Exhibit III-C-20 shows that the total amount of occupation and royalty taxes has varied from year to year. This is due partly to changes in the tax rate, but largely to variations in the tonnages mined resulting in variations in "profits" on which the tax is based.

The maximum occupation tax levied amounted to slightly over $9,000,000 in 1937, while the minimum was $260,000 in 1932.

The total occupation tax for the period 1921 through 1943 approximated $84,000,000 or an average of $3,650,000 per annum. The average occupation tax per ton of ore shipped was $0.102. Since 1940, the occupation tax has averaged 30% of the total taxes.

The royalty tax (which applies only to royalties paid on privately owned ores) was first levied in 1923. The total royalty taxes levied for the period 1923

through 1943 approximated $20,000,000, or an average of $950,000 per year. The minimum royalty tax was $335,600 in 1933 and the maximum $2,163,000 in 1942. The royalty tax amounted to a little less than 10% of the total mining taxes for 1942 and 1943.

e. Ad Valorem Property Tax

From 1885 to 1896, the State assessed the iron ore properties on the basis of $0.01 per ton of ore mined. This tax was in lieu of all taxes or assessments upon capital stock, personal property, income, and real estate used in mining. In 1897, this tonnage tax law was declared unconstitutional.

The Ad Valorem Property Tax is a levy against all real and personl property, including ore in the ground or in stock piles. It is computed by the application of mill rates (mills per dollar) to assessed valuations.

The Minnesota State Constitution provides that all property taxes must be based on a "full and true value," unless otherwise specified as in the case of railroads, telephone and power companies. This "full and true value" ordinarily is based on what the property would bring in an ordinary sale, not a forced sale.

In 1913, the Legislature set up four main property classifications and specified the percentage to be applied to the "full and true value" for each class in order to obtain the assessed value. Iron ore, mined or unmined, was placed in Class 1, with an assessed valuation of 50% of the "full and true value." No other class was valued at such a high percentage. Justification for this higher rate on iron ore is claimed on the basis that iron ore is a natural resource which is being depleted and cannot be replaced. The next highest class is Class 4, which includes all property not included in other classifications and is assessed at 40% of "full and true value." Real estate, except iron ore and unplatted property and manufactured articles are assessed at 33⅓%. The lowest assessment rate is 10% which applies to Class 3A. The law also specifies that the value must be applied to property on hand as of May 1st of each year.

Many of the Tax Commissioners in their Biennial Reports, and the Majority Report of the Minnesota Interim Commission on Iron Ore Taxation (1941), and other authorities on taxation have stated that ad valorem taxes on the mining industry are too high. Some of the Tax Commissioners have advocated the reduction of assessed valuation from 50% to 33⅓% of "full and true value."

(1) Valuation of Ore Properties

Comparatively few mining properties have been sold since the turn of the century, most of them being owned in fee by the mining companies or leased by them on a royalty basis. Therefore a method of valuation which is based on actual current sales prices on similar properties cannot be used.

At present the State Tax Commission is using two methods to determine the value of ore:

1. The Classification System
2. The Hoskold Formula

The Classification System is explained in some detail in the Chapters on Mining Taxation in the Biennial Reports of the State Department of Taxation for various years. The Report of the Minnesota Interim Commission on Iron Ore Taxation, 1941, also explains the Classification System, as well as the Hoskold formula.

There has been considerable controversy regarding the use of these two methods. Among other items, the Hoskold Formula recognizes anticipated profits as a factor contributing to the tax base so that the resulting tax varies inversely with the operating costs. The Classification System distributes the mines into nine classes and puts generally similar mines into the same class.

Under the Hoskold Formula, other factors being equal, the more efficiently a mine is operated the higher will be its anticipated profit and valuation, and therefore the higher the ad valorem tax. Application of the Hoskold Formula has indicated that, in all cases so far checked, the values would be less than under the Classification System. Nevertheless, in those localities where the levy is equal to the maximum allowed by the per capita limitation ,the value of any individual mine alone is not as important as its value relative to other mines and properties in the same taxing district. Assuming only two mines in a taxing district and that the maximum tax permitted by the per capita limitation of the taxing district is $1,000, then under equal valuation, using either system, each mine would pay the same tax, $500, regardless of whether the assessed valuation of each mine was $5,000 or $10,000. If, however, one mine were valued at $4,000 and the other at $6,000, then the tax would be $400 and $600 respectively.

The application of this principle to two mines in the same class (under the Classification System) in the same taxing district, would result in the same valuation per ton of ore. By application of the Hoskold Formula method each might be assessed at different values per ton of ore, due to relative differences in efficiency and resultant operating costs. Thus the Hoskold Formula shifts a larger portion of the tax burden to the mine with the relatively higher efficiency of operation, which mine would pay a higher tax than if valuations had remained under the Classification System.

(2) Mill Rates

The mill rate applied to the valuations thus derived is an aggregate of mill rates imposed by the following political divisions: the State, the County, the School District, the Township or Village or City.

(3) Limitations

Due to the large valuations concentrated in small areas, a relatively low mill rate produced large revenues. The State found it advisable to place limitations on the amount of revenue that could be collected by the small mining communities. Legislation was passed which placed a "per capita" limitation on the amount of tax money that could be levied by school districts, towns, villages and cities. The only mill rate limitations on charter-rule cities are those specified in certain of the Home Rule charters.

In active mines the valuation of these properties decreased from year to year because of the shipments of ore and because the best ore was mined first. To raise the same revenue, the local taxing authorities increased the mill rate, if this could be done without conflicting with the per capita tax limitation. When the mill rate was raised, it placed a larger share of the tax on the undeveloped or reserve properties. Under this procedure the last developed property paid the most taxes, because it paid for a longer number of years and at a higher rate with each succeeding year.

(4) Discussion

Ad valorem property taxes present numerous problems to all concerned.

The first is presented when taxes on all reserve properties as well as operating properties are considered as operating expense and not as capital charge. This is, perhaps, the only way a mining company can absorb these taxes, but it leads to varying taxes per ton mined or shipped, paid by different companies, because, all other factors being equal, a company having large reserves and a small production in any year will have a larger unit tax cost than a company having small reserves and mining the same tonnage.

Under this system of charging off all taxes as an operating expense, the tax per ton of ore mined is uniform when the ad valorem tax is the same for each year and the property is mined at a uniform rate. However, if taxes on the mine decrease proportionately as the mine is depleted, then, assuming uniform rates of mining and taxes, the tax cost per ton of ore mined would decrease with each succeeding year.

In Exhibit III-C-20 there is shown the downward trend of ad valorem taxes from the peak year of 1920, when ad valorem taxes amounted to $20,840,-227, to the low years of 1942 and 1943, when the tax was slightly over $13,000,000.

This reduction in taxes is due to several causes:

(a) Depletion of all ores
(b) Depletion of the higher grade ores faster than low grade ores
(c) Limitation imposed on local taxing communities and school districts by per capita tax and mill rate limitations.

Exhibit III-C-21 indicates the trend in valuations on the Mesabi and Vermilion Ranges. The known taxable ore reserves decreased from 1,284,-081,000 gross tons in 1924 to 1,146,144,000 gross tons in 1939, with assessed valuations $278,857,000 and $185,505,000 respectively, equivalent to $0.217 and $0.162 per gross ton respectively. It should be borne in mind that the reserve has not decreased at a rate corresponding to the shipments. This result may be attributed partly to new discoveries of ore, and partly to reclassifiication of low grade materials as "ore"because of improved methods of beneficiation.

While the tonnage reserve has decreased only 10.7% from 1925 to 1939, the assessed valuation has decreased 33.5% because of a 25% decrease in valuation per ton of ore during the same period of time.

Distribution of total ad valorem taxes between local units, county, and state is shown in Exhibit III-C-22. The state levy averages over 10%, the county levy has increased from 15% in 1920 to approximately 28% in 1941, while the local levies have decreased from 77% in 1920 to 62% in 1941.

This Exhibit also shows the percentage of total taxes (ad valorem, occupation, and royalty taxes) as levied by local governments, county and state. The trend is also indicated, namely, that the State receives an increasing share of the mining taxes through the application of the occupation and royalty taxes.

Though there have been some reductions in the last few years, they have been due, in large measure, to acts of the State Legislature which have imposed per capita limitations at various times. A 1940 act imposed a further limitation with a decreasing rate each year, so that in 1950 the per capita limitations will be $50 and $40 for municipalities and school districts respectively.

Those cities, school districts and villages levying under the "per capita" limitation can, and in most cases do, levy to the full amount of the legal limitation without regard to the valuation until the mill rate limit, if applicable, is reached.

A striking illustration of this fact is shown by the City of Eveleth (School District No. 39) — See Exhibit III-C-23. The following tabulation compares the years 1934 and 1943:

CITY OF EVELETH

Item	1934	1943	Years Percentage Variation from 1934 value Increase	Decrease
Assessed Valuation	$12,440,000	$6,200,000		50%
City Taxes	538,000	484,000		10%
Mill Rate — City	43.3	77.65	*93%	
School Taxes	464,000	331,000		29%
Mill Rate — School	37.4	53.1	*42%	
County Taxes	213,000	135,000		36%
Mill Rate — County	17.15	21.65	*26%	
State Ad Valorem Taxes	149,000	33,000		78%
Mill Rate — State	11.95	5.46		54%

* County, City and School mill rates increased as valuation decreased so that the decrease in the amount of taxes was not great.

Though the valuation decreased 50%, City taxes decreased only 10%, School taxes 29% and County taxes 36%. Only the State taxes decreased at a greater rate than 50% — namely 78%.

It is claimed that properties on the ranges, other than iron ore lands, have low assessed values and therefore low taxes, compared with similar properties in other parts of the State.

From Page 147 of the Report of the Minnesota Interim Commission on Iron Ore Taxation, the following is quoted,

> "In any community in which the revenues for municipal or school government are paid or furnished largely by a single industry and in which the average citizen contributes only an insignificant part of the whole, as is true on the Iron Range, the very natural tendency on the part of the local governing bodies to become reckless and extravagant in refusing to stay within anticipated revenues for current operating purposes, becomes obvious. In this situation there is, too, a lack of vigilance or incentive on the part of the average citizen to scrutinize municipal expenditures because of the very small part thereof which he contributes individually to the cost of municipal or school government."

(5) Effect of Existing Method of Ad Valorem Taxation

The present system of ad valorem taxation makes it advantageous for the mining companies to mine and ship the higher grade ores carrying the higher assessed values as rapidly as possible, in order to rid themselves in the shortest

time of as much of the tax burden as possible. This often results in leaving in the mines the leaner ores, some of which consequently may never be recovered. This is particularly true of underground mines.

Under this system of taxation, when practically the same amount of taxes are assessed each year, larger tax burdens are placed upon ore remaining in the ground. This would make practically imperative its immediate mining or relinquishment to the State as being no longer profitable. It should be considered that the steel industry can absorb only a definite amount of iron ore each year, depending upon the demand for steel and the use of scrap iron and steel.

The use of two rates for valuation, one for active properties and one for reserve properties, makes a mining company hesitate to open up a reserve mine until it is ready to rapidly exhaust the mine. This is true even though a mining company may wish to develop a property for sound reasons, such as to keep men employed during periods of low production, or during the winter seasons, or to have a property ready for sudden, unexpected peak demands.

This form of taxation not only does not encourage exploration for unknown reserves, but actually discourages exploration, because all test drillings must be reported to the State. If ore is discovered, it is immediately placed on the tax rolls even though it may not be mined for many years, and unless such property has been leased to a mining company, it becomes an added tax burden of the company or person upon whose property it is located.

f. Occupation Tax

The Occupation Tax, which became law in 1921, is levied by the State against the operating mining companies, based on their reports, for the privilege of carrying on a mining business in the State of Minnesota. The original rate was 6% of the taxable value of the ore mined each year. There have been several increases in the rate, which is now 10½%.

The taxable value is the difference between the selling price of the ore and certain costs of ore production. Inasmuch as the percentage of ore actually sold is small, the tax commission uses the Lake Erie base prices in arriving at a selling price, making the necessary adjustments for variations in iron content.

Production costs which are deductible include:

Transportation from mouth of mine to Lake Erie ports.
Marine Insurance.
Shrinkage in Transit.
Marketing Expense.
Cargo Analysis.
Beneficiation.
Loading from Stock Piles.

Development work applied to tonnage mined during year.
Mining, including labor, supplies, repairs, pumping and mine supervision.
Royalties.
Administration within the State of Minnesota, including supervision, clerical, engineering, laboratory, and experimental.
Miscellaneous, such as fire, compensation, and public liability insurance and related items.
Ad valorem taxes on mining equipment, buildings, etc., and on ore in stock piles.
Portion of ad valorem taxes on iron ore.
Social Security Taxes.
Depreciation of Plant and Equipment.

The above deductions do not include all costs. Deductions not allowed include such items as legal expense, contributions, welfare work among employees, interest on working capital, federal income tax, depletion, and expenses incidental to inactive or reserve mines. Only a portion of the ad valorem tax paid that year on the iron ore of a given property is allowed, namely the ratio that the ore mined bears to the ore presently in the mine.

Neither the total ad valorem taxes for reserves nor the ad valorem tax paid in the past years on the tonnage mined are allowed. Each mine must be figured separately, hence no allowance for mines operated at a loss may be claimed against profitable mines operated by the same mining company.

Due to the fact that the Lake Erie price is used as a basis of arriving at a selling price, and that all costs are not deductible, mined properties have paid an occupation tax when actually operating at a loss.

From the standpoint of the mining companies, and excluding any discussion of rates and allowable deductions, the occupation tax appears to be a more equitable method of taxing than the ad valorem tax. Since the occupation tax is imposed upon the profits, as defined by law, the total occupation tax for each year is directly related to the amount of ore produced that year. Hence, the tax yield fluctuates considerably from year to year, depending upon the relative production of steel.

The fact that invested capital, development and other costs are considered in determining the occupation tax appears to be fair to the mining companies.

On the other hand, the local taxing bodies would consider the revenue from this type of tax to be too uncertain and too irregular to permit them to carry on their governmental functions. In depression periods when their responsibilities, as well as their expenditures may increase, their revenue from the occupation tax would decrease.

With the existing ad valorem tax, the tax revenue to local governments is predictable. During depression periods, the mining companies need lower costs to stimulate demand for iron ore and steel, but under their present accounting systems the tax cost of ore mined or shipped increases, because the annual ad valorem tax, which changes but slowly from year to year, must be absorbed by the smaller tonnage of ore produced. In addition, production costs increase because of the lower rate or part time production of various properties.

In 1940, in order to encourage the mining of ores requiring beneficiation, and high cost ores, the "Labor Credit Amendment" was enacted by the Legislature whereby deductions may be applied against the occupation taxes when labor costs, not including administrative labor costs, exceed $0.20 per ton of ore mined. A 1943 amendment provided a sliding scale of deductions as follows:

10% of labor costs in excess of $0.20 per ton, but not exceeding $0.30 per ton.

15% of labor costs in excess of $0.30 per ton, but not exceeding $0.45 per ton.

20% of labor costs in excess of $0.45 per ton.

The total credit could not exceed two-thirds of the total occupation tax.

For the year 1942, the total occupation tax of the 69 operating mines that paid an occupation tax, if computed on the basis of 10½%, would have totaled $9,100,000. The labor credit amounted to $872,000, making the net average rate 9½%. Sixteen properties received the maximum permissible credit and paid tax at rate of 3½% while only five properties received no labor credit and paid the full 10½% rate.

The 1943 Legislature increased the limit of labor credit to a maximum of 90% of the total occupation tax, and some mining companies, in 1943, were able to deduct the maximum permitted, paying occupation tax at the rate of 1.05% instead of 10½%.

The "Labor Credit Amendment" to the occupation tax law indicates that the Legislature recognizes the inability of the low grade and high production cost ores to pay the same tax burden as the high grade direct shipping open-pit ores.

In order to encourage local industries, this same law permits an alternative deduction of ⅔ of 1% of the occupation tax for each 1% of output of any mine which is converted into pig iron, sponge iron, or powdered iron within the limits of the State of Minnesota.

When the tax on income became law, the mining companies were not required to pay income tax, apparently because they were already paying an occupation tax.

It is claimed that, owing to the facts mentioned above, the mining com-

panies are paying occupation taxes equivalent to a rate of 23% on a net income, which in other industries would be taxed at a much lower rate, as provided in the income tax.

This discrimination appears to be unfair, but the two methods of taxation, income and occupation, are not comparable because the occupation tax is classified as a severance tax (in which the costs of production are considered) by such authorities as "The Tax Research Foundation"; "The Division of State and Local Government, E. R. Gray, Chief Statistician, U. S. Bureau of the Census"; and "The Council of State Governments".

The funds derived from the occupation tax now are allocated as follows:

45% to the State general fund
40% to permanent school fund
10% to permanent University fund
5% to the Iron Range Resources and Rehabilitation Commission

g. Royalty Tax

The royalty tax is levied on all royalties paid for iron ore which is privately owned. There is no royalty tax on State-owned or local government-owned ore properties.

The Legislature intended that those receiving royalties pay the royalty tax and the courts ruled that this was a property tax. Since the leases provide that all taxes against the property shall be paid by the lessee, this tax is also paid by the operating companies.

This tax is computed as a percentage of the royalties paid. The royalty tax law when passed in 1923, specified a rate of 6%, and this has been increased to the present rate of 10½%. The royalty tax report is filed by the recipient of the royalty, and also by the payer of the royalty. Funds collected are credited to the General Revenue Fund.

The royalty tax as originally intended, that is, a tax levied against the interest held in mining properties by the lessors, was perhaps a fair principle of taxation, but interpreted as a property tax, the royalty tax becomes an unfair tax because royalty is not "a fair value" upon which to levy a property tax. The higher royalties are not necessarily paid on the higher valued ores.

Since no royalty tax is applicable to State owned properties, or properties that are owned in "fee" by the operating companies, this tax is not applied on a true and fair value basis. This added tax is borne only by those companies leasing their properties from private owners.

h. Taconite Bill

In order to encourage the mining and concentration of taconite, the Legislature passed the "Taconite Bill", which specifies that a tax of $0.05 per ton of concentrate when mined, be levied for 55% dried iron, plus $0.001 per ton for each 1% of iron in excess thereof.

This tax is in addition to the occupation and royalty taxes, but is in lieu of all other taxes, except that "iron ore" on the same property shall not be exempt from the normal ad valorem tax.

When less than 1,000 tons of concentrate are produced in any one year per forty acre section, then a tax not exceeding $1.00 per acre may be levied on the taconite land.

Any tax collected under this bill is to be allocated equally between community, school district, county and state.

As a result of the passage of this bill, several companies have taken over State leases on taconite land, and experimental work is being conducted in pilot plants to develop most economical methods of concentrating taconite.

The feeling among operators, however, is that before they will make large investments in plant, and mining and concentration equipment, some definite assurance is necessary that the Legislature will not raise the tax after operations have been started.

C. Miscellaneous Mining and Quarrying

In addition to the iron ore which has been discussed previously, Minnesota has many other mineral resources, but their possibilities for future development at present appear to be limited. Some of them are now being developed for local consumption.

1. Iron-bearing Formations

In addition to the iron ore deposits now being mined in the three Ranges there are indications of other iron-bearing formations stretching across the State of Minnesota having the same general trend as the Ranges. In 1943 the Legislature passed the "Wildcat" or iron ore prospecting bill to encourage the drilling and explorations of these formations outside the counties in which the three Ranges exist.

2. Manganese Ore

Minnesota does not have any deposits of high grade manganese ore (48% or more Mn.). Only this high grade ore is used at the present time in the manufacture of standard "ferro" grades of manganese, essential in the production of steel. Twelve and one-half pounds of manganese ore are required for each short ton of steel produced, to desulfurize and deoxidize the steel in the furnaces.

Minnesota does have large deposits of ferruginous manganese (10 to 35% Mn.) and manganiferous iron ores (5 to 10% Mn.) in the Cuyuna range which have been estimated at over 40 million tons of ore containing 15% or more manganese, with large reserves of still lower grade.

Approximately 95% of the high grade manganese ore used in the United States is imported. When sources of supply are cut off or threatened, the ferruginous and manganiferous ores of the Cuyuna range are in demand but this demand drops off as soon as the emergency is over.

Exhibit III-D-1 indicates for years 1931 through 1941, the annual shipments of manganiferous iron ore containing 5 to 10% manganese, and ferruginous manganese ores containing 10 to 35% manganese. In addition, large tonnages are shipped containing less than 5% manganese. The Lake Superior Iron Ore Association reported shipment for 1941 of 2,066,000 gross tons of manganiferous ore averaging 7.58%, which is almost double the sum of the two grades of

ore reported by U. S. Bureau of Mines. This amount includes all ore containing more than 2% manganese.

According to the Minerals Year Book for 1941, 366,000 tons of ferruginous manganese ore, containing 46,000 tons of manganese and valued at $1,100,000, and 819,000 tons of manganiferous iron ore containing 56,500 tons manganese and valued at $1,950,000, were shipped in that year.

To free American steel and alloy production from dependence on foreign sources, which required vital ocean shipping and naval convoy, the U. S. Bureau of Mines outlined a program for beneficiation of low grade manganese deposits in the United States. Two processes had been developed in the laboratory and pilot plant, one using a blast furnace and the other leaching (Bradley) process. This program was to include the installation of a beneficiation plant on the Cuyuna range which would have cost approximately $8,000,000 with an estimated annual output of approximately 100,000 tons of manganese.

To make the beneficiation of Cuyuna ore commercially successful would necessitate a selling price of beneficiated ore of approximately double the existing price. When considerable reserves of high grade ore accumulated in the United States, the project was dropped.

3. Titanium

Titanium in the form of the mineral ilmenite ($FeTiO_3$) is found associated with magnetite in the rock known as the Duluth gabbro which outcrops in and around Duluth and extends northeastward into Lake and Cook counties. Some of the deposits have been explored by diamond drilling, but apparently deposits are neither extensive nor high enough in either iron or titanium content. Titanium in iron ore is an undesirable element for the blast furnace. However, when there is considerable titanium present and it is in such form that it can be separated from the magnetite, it can be mined for the titanium. Some of the samples of ore from test pits and outcrops carry more than 20% titanium dioxide (TiO_2).

There now is in operation at Lake Sanford, N. Y., in the Adirondack Mountains, a plant for the concentration of ilmenite from the magnetite and native rock. The Sanford Hill deposit is estimated to contain 15 million tons of crude ore containing 16% titanium oxide. The ilmenite concentrates contain about 48% titanium dioxide. At an annual rate of production of 4,000 tons of crude ore, 800 tons of ilmenite concentrate, and 1,600 tons of magnetite, the supply will last ten years.

Large deposits allowing open-pit operations similar to the above have not been found in Minnesota. Some of the Minnesota titaniferous magnetite sampled, assayed up to 0.45% vanadium, which is a comparatively rare metal used

principally in the manufacture of high speed and low alloy tool steels, and high strength cast iron and steel forgings. The presence of this vanadium may be a deciding factor in any possible use of the titanium deposits at some future date.

Titanium is used primarily in pigments, but its use is being expanded into many other fields.

4. Gold

Minnesota had its gold rush in 1865, when gold and silver were discovered at Vermilion Lake. Many claims were staked out, shafts sunk, and stamp mills built, but the deposits were too lean and were soon abandoned. One gold mine on an island in Rainy Lake produced $4,635 worth of gold in 1894. Total production from Minnesota since that date has been less than this 1894 production. Gold prospecting has been carried on intermittently. The State issued several permits to prospect for gold during the last few years and a gold lease has been in effect, but gold in commercial quantities has not been found.

5. Aluminum

In several places in Minnesota, impure forms of bauxite and rocks and clays high in aluminum content are known to exist. Processes have been developed for extracting aluminum from these materials, and during the threatened shortage of aluminum in other states some aluminum plants were built to utilize low grade bauxite ores, clays, alunite, and other similar minerals. However, costs of extracting aluminum from these materials are much higher than from the high grade bauxite ores. When huge stock piles of bauxite began to accumulate these plants were the first to close.

6. Magnesium

Several methods are in use for the production of magnesium from dolomite, which is a magnesium-calcium-carbonate rock similar to limestone. Minnesota has many deposits of dolomite which contain relatively small amounts of impurities and could be used in the production of magnesium. However, magnesium plants constructed during the last few years probably will have a capacity beyond the normal requirements of the country. This fact, and other unfavorable factors, indicate little possibility of utilization of Minnesota dolomites for the production of magnesium.

7. Miscellaneous Metals

Copper, nickel, cobalt, silver, lead and zinc have been found in limited quantities in Minnesota, but never in quantities of commercial importance.

8. Building Stones and Other Extractive Materials

a. Granite

Granite for building and monumental purposes of commercial value exist in the following districts within the State:

(1) The area around St. Cloud.
(2) The Upper Minnesota River Valley.
(3) The Arrowhead District north of Duluth.
(4) The Isle-Warman District southeast of Mille Lacs Lake.

The granite that is produced ranges through all shades of gray, pink and red to variegated. Minnesota granite has been used in many prominent buildings, widely located.

In 1915, the value of granite products produced in Minnesota exceeded $841,000. Of this amount $504,000, $177,000 and $124,000 were for dressed monumental stone, dressed building stone and paving blocks respectively. The remainder of the amount was divided between rough monumental granite, crushed stone for roads, rubble, miscellaneous rip rap and rough building stone, listed in the order of their importance. In that year, Minnesota ranked ninth in granite production. Vermont was first with a value of $2,778,730; and the total value of granite produced in the United States was $17,854,000.

During the present war, use of granite for building purposes has dropped to an almost negligible amount, but sales for monumental purposes have increased. In 1941, Minnesota ranked seventh in the production of dimension stone with a value of $635,000. Vermont again was the largest producer with a value of $2,472,000. The total for the United States was $10,831,000. Dressed and rough monumental stone accounted for $282,000 and $253,000 of Minnesota's value respectively, while the remaining $100,000 value was represented in rough and finished building stone. In 1941 no paving block or crushing stone was produced. Minnesota produced only $56,000 value of rip rap and crushed granite for concrete, road work or railroad ballast as against a total value of $14,137,000 for the United States.

Only flawless granite is sold and there are therefore huge piles of "grout" or waste material around each quarry. Some of the smaller waste material and the waste from the granite cutting and finishing plants is crushed for road material, concrete aggregate and railroad ballast. Some effort is being made to interest the rock wool industry to utilize the waste material in the manufacture of rock wool.

The quarries in the St. Cloud district are small, averaging about 100 ft. x 200 ft. x 40 ft. deep and are located where the rock outcrops or is near the surface of the ground. Joints in the rock are widely spaced, thereby permitting the

quarrying of large blocks, giving Minnesota an advantage over some of the other states. On the other hand, severe winters and higher labor rates are disadvantages for Minnesota quarries when compared with Georgia quarries.

Owing to cheap foreign labor and the fact that both rough and finished granite is shipped as ballast, the whole United States industry has competition from abroad.

Much of the monumental work is sold east of Chicago. To aid in reducing freight costs, the industries around St. Cloud pool their shipments to make up carloads to Chicago. A good portion of smaller shipments goes by truck out of Minnesota.

b. Limestone and Dolomite

Minnesota limestone and dolomite outcrops have been utilized for building construction from the days of the early settlers. The most important commercial quarries are located in the Mankato-Kasota and Winona Districts. From these come the well known Mankato dolomitic limestone ranging in color from cream to yellow, gray, pink and red, "Kasota marble," yellow and pink in color, and the "Winona travertine," a porous dolomite, cream, buff or gray in color, all of which have been used in important buildings throughout the United States. The Philadelphia Museum of Art used 855 carloads of Mankato-Kasota stone, valued at $1,500,000. During the years 1921, 1931 and 1941, the tonnages and values of this stone sold were 56,590; 90,420; 30,200 short tons; and $518,857; $535,343; and $196,456 respectively. The stones are hard, being fairly high in silica content, and take a polish. These advantages, along with the range of color, make the Minnesota stones desirable. However, this hardness and the thinner beds as compared with the Indiana limestones, make costs of quarrying and finishing high. Indiana in 1940 produced 248,420 tons of limestone building stone valued at $2,132,000, while Texas and Missouri produced 394,210 and 106,800 tons respectively, valued at $677,320 and $114,157 respectively.

c. Sandstone and Quartzite

A sandstone building stone has been quarried in the Kettle River District in Pine County, but the use of sandstone is small compared with the other more durable building stones. The sales of the various stones in the United States are shown in Exhibit III-D-2.

Quartzite has had a limited use as a building stone. It occurs in rather thin beds ranging in color from pale pink to deep purplish red. One company with plant located at Sioux City, Iowa, is producing "flint" liners and "flint" pebbles from this material, which it quarries at Jasper, Minnesota, for use in tube grinding mills. The pebbles compare favorably with flint pebbles formerly imported from France, Denmark and Belgium in amounts of from 15,000 to 20,000 tons per year.

d. Slates

Various slaty rocks outcrop in Carlton County along the St. Louis River, and in Cook County near the Canadian border. Several quarries were opened about sixty-five years ago, but the slate has not proved suitable for commercial roofing.

e. Keewatin Basalt

This rock, of ancient lava origin, outcrops at Ely, Minnesota, and is sometimes called Ely greenstone. It has been used for foundations, retaining walls and crushed rock. In 1920 use of this material was started for coating composition roofing shingles by crushing and screening to a definite size. The granules are colored, when other than natural green is desired.

f. Coal, Oil and Gas

Coal occurs in beds up to six inches thick in western Minnesota and a thin seam is known at Two Rivers, south of Little Falls, Minnesota. Neither of these deposits are of commercial value.

Considerable drilling has been done for oil and gas without success. A few wells in glacial drift yielded a small amount of natural gas for a few years.

g. Peat

Minnesota has large deposits of peat, the major portion being located in the north central part of the State. (See Exhibit III-D-3). It is estimated that there are in Minnesota more than 5,200,000 acres of high grade peat deposits whose depth exceeds 5 feet. The quantity of air dried peat available for fuel use in these deposits exceeds 6,835,000,000 tons. The total reserves for the United States, exclusive of Alaska, were estimated in 1922 as 13,827,000,000 short tons calculated as air dried peat.

The following table based upon Bulletin 30 of the Minnesota Geological Survey, page 117-18, compares the heating values of various common fuels with peat:

TYPICAL FUEL HEATING VALUES

Fuel	Locality	B.T.U. per lb.
Mixed coke		12,366
Anthracite	St. Nicholas, Pennsylvania	12,523
Bituminous	Average of six districts	13,174
Lignite	Wilton, N. D.	7,069
Peat (water free)	Michigan (range of 18 samples)	7,500-10,000
Peat (water free)	Indiana (range of 29 samples)	7,500-10,000
Peat (water free)	Wisconsin (average)	8,070
Peat (water free)	Minnesota (range of 12 counties)	7,000-11,000

Raw peat contains from 80 to 90% water by weight. Many attempts have been made in the past to prepare and sell peat for fuel on a commercial scale. These attempts have not been successful, principally because of the difficulty and cost of removing the water. During critical periods of coal shortage and high prices, peat plants may be operated. Many processes have been patented, wherein the peat is mixed with other ingredients including some binder, pressed into briquets and air dried. At present in this country, peat does not compete with coal as a fuel except where it may be dug and dried by individuals for domestic use.

In the United States, the principal uses of peat have been as a soil conditioner, and a filler for commercial fertilizer. Moisture-free samples of Minnesota peat contain 1.5% to 3.5% nitrogen, an essential plant food. Another principal use is as peat moss for stock and poultry litter and as packing material for plants, shrubs, eggs, fruit and fragile items.

The production of peat in the United States for the period 1908 through 1925 and 1934 through 1942, is shown in Exhibit III-D-4. This indicates a maximum production of over 100,000 short tons with a value of $1,000,000. Minnesota ranks 14th in order of production out of 17 states reporting. Imports (tonnage and value) of peat moss for the period 1919 through 1940, are represented in Exhibit III-D-5. Imports reached their maximum in 1937 with 86,871 short tons and value of $1,219,127.

The Iron Range Resources and Rehabilitation Commission is encouraging the development of the peat moss industry in Minnesota by erecting a cleaning and dehydrating plant at Floodwood, about 40 miles west of Duluth. The process to be used is similar to one which has been successfully operated in the State of Washington. The moss when ready for shipment will contain

about one-half the moisture of air dried moss, and the sale price is expected to be considerably under the price of imported moss. The plant will be privately operated, repaying the State on a "tonnage produced" basis.

Other uses to which peat might be applied include paper stock, woven fabrics, artificial wood, nitrates, tanning materials, surgical dressings (so used during World War I), ammonium sulphate, dye stuffs ,tars, producer gas, and coke.

h. Limestone and Marl

Most of Minnesota limestones are dolomitic, ranging from a small percent of magnesium carbonate to almost pure dolomite ($CaCo_3$, $MgCo_3$). These limestones and dolomites are scattered throughout the southeast of Minnesota being exposed along the Mississippi River from Minneapolis to the southern boundary, and along the Minnesota River from Fort Snelling to Mankato.

Use of limestone and dolomite for dimension stones has already been discussed. As a crushed or pulverized stone it is used in the State for road and concrete construction, railroad ballast and as a soil conditioner or sweetener. At least 10 plants were in operation in 1939, producing 1,263,000 tons valued at over $1,407,000.

By burning, limestone is converted into lime and used for mortar and plaster and as a soil sweetener. The magnesium carbonate is not detrimental for use as a soil conditioner, but is not so desirable in plaster or mortar work. A plant at LeRoy in Mower County, with a plant capacity of 200 bbl. per day, produces a pure, white, high calcium lime which is used for chemical, building and pharmaceutical purposes.

Natural cement has been produced from limestone containing clay at two plants, located at Austin and Mankato; over 1,000,000 barrels were shipped in 1935. Recently, the Austin plant was dismantled and the Mankato plant is closed for the duration.

Because of the high magnesium carbonate content of most of the Minnesota limestones, they have not been used in the manufacture of Portland cement. Magnesia is an undesirable element. The only Portland cement plant in Minnesota is located at Duluth. It uses limestone brought from Michigan by boat and whenever suitable, slag from the adjacent blast and steel furnaces. Though plant capacity is 2,250,000 barrels annually and at times consumption within Minnesota has exceeded 3,000,000 barrels, the plant never has operated to capacity because of competition from cement mills in adjoining states. The largest competitor manufactures cement in Michigan, ships it in bulk by boat and packages it in Duluth. Consideration is being given to dismantling the

cement mill and building elsewhere, rather than replacing the equipment which is old and obsolete.

A new use for Minnesota limestones and dolomites was found with the starting of rock wool manufacture at Mankato and Red Wing. A clayey or shaley limestone or dolomite is required, or a mixture of several rocks which will melt readily.

Marl deposits occur throughout most of Minnesota, but are located principally in the central part of the State (see Exhibit III-D-6.) Marl is chiefly used to neutralize or sweeten acid soils. The fact that Marl is unconsolidated and can be spread on a field without any preparation will stimulate its increasing use for this purpose. In other states which lack limestone, but have sufficiently large deposits of marl, it has been used for the manufacture of lime and Portland cement to supply local demand.

i. Clay and Shale

Minnesota has large deposits of clay and shale which are being manufactured into face brick, common brick, structural tile, drain tile, sewer pipe and stoneware. The yearly value of these products produced in Minnesota has ranged from $400,000 to over $2,000,000. Minnesota ranked 16th in 1915, and 25th in recent years. Several companies produce a fine grade of face brick which has been used in buildings throughout the northwest and as far east as New York City.

One firm at Red Wing ranked among the best in the production of stoneware. As demand for stoneware has diminished, this concern now is successfully manufacturing better grade ornamental and fancy dinnerware, giftware and pottery. For these latter products, all of the raw materials, ball clay, kaolin, feldspar and fuel, are shipped in from other states, and most of the finished products are shipped out of the state. In spite of the handicaps of higher freight rates on raw and finished products, this company compares favorably with its chief competitors located in eastern Ohio. Unless it can obtain its raw materials in Minnesota instead of importing them, it would be advantageous for this firm to relocate its plant in eastern Ohio.

The large deposits of clay in Minnesota need further study for possible development for use in refractories, paper, rubber, paint and china industry.

j. Miscellaneous Non-Metallic Minerals

Feldspar occurs in the pegmatites in the northern part of the State and one outcrop was mined for a short time. Mica also occurs as a constituent of these pegmatites, but their commercial value, except as scrap mica and a by-product of feldspar production, is doubtful. Some of the sandstone formations along the St. Croix and Mississippi Rivers contain concentrations of glauconite, which

could be used as a fertilizer filler or spread on fields for the limited amount of potassium which is available as a plant food.

k. Sand and Gravel

Sand and gravel deposits are scattered throughout the State. Many pits of various sizes, are in operation, the State Highway Department alone owning 383 pits in 64 counties. The output of these pits is used mainly for road and concrete construction, including bituminous mixes for highways and concrete products, such as building blocks, brick, cast stone, pipe, and vaults.

As reported for the year 1941, the tonnage and value of sand and gravel which was sold or used amounted to 13,517,000 tons and $2,705,000 respectively for Minnesota, and 288,715,000 tons and $147,207,000 respectively for the United States. Minnesota ranked 16th in production of sand and gravel. The abundance of sand and gravel deposits throughout the State accounts for the limited use of crushed stone within the State.

Included in the above Minnesota figures are 21,035 tons of molding foundry sands valued at $27,163; 1,296,000 tons of gravel for railroad ballast, valued at $433,000; and small amounts of sand used in glass manufacture, grinding and polishing, fire or furnace sand, and engine sand.

9. Employment in Utilization of Mineral Resources

It is difficult to obtain reliable statistics on the number of men employed, man-hours worked, and wages paid, in the industries listed above. Many of them are few men part-time operated plants, which do not report statistics.

There has been no central collecting agency for all of this information. Some idea of the size of the industry has been indicated by giving the value of the products, where such information is available.

The Division of Employment and Security of the State is now gathering much of this information through the administration of the Minnesota Employment and Security Act. From their reports, the following employment and payrolls were reported for two groups of industries:

EMPLOYMENT AND PAYROLLS

Average for Period	No. of Firms	Employees	Payrolls
NON-METALLIC MINING & QUARRYING			
Year 1938	66	960	$1,162,000
Year 1943	37	428	667,000
1938 through 1943	54	871	1,070,000
MANUFACTURING STONE, CLAY & GLASS PRODUCTS			
Year 1938	195	4630	$6,581,000
Year 1943	159	7430	14,661,520
1938 through 1943	181	6001	9,660,000

D. Forestry

The forests of Minnesota have been characterized as "the State's greatest renewable natural resource." They contributed materially to its economic preeminence when the State reached its apex in manufacturing. In this section, facts have been compiled for the purpose of discovering possibilities of indefinitely continuing this natural resource as a contributor to the State's economic success.

1. Original Forest Areas and Subsequent Changes

Prior to about a century ago the economic development of the State of Minnesota had not progressed beyond the location of occasional trading settlements and the development of scattered farms. At that time, the forests of the State were as they had been "discovered" many years earlier. Prior to 1870, about 70% of the total area was wooded. Thereafter the progressive invasion of the forest began for two reasons, clearing for farm use and lumbering for commercial purposes.

The present and original forest areas are indicated on a map, Exhibit III-A-1.

ORIGINAL FOREST AREA

Pine (mostly white and Norway)	5,800,000	acres	19%
Spruce, fir, cedar, etc.	12,400,000	"	40%
Oak, elm, maple, bass wood, etc.	10,400,000	"	33%
Scrub types	2,900,000	"	8%
Total	31,500,000	"	100%

PRESENT CONDITION OF FOREST AREAS

4%	Virgin timber	18%	Scrub forest, brush or grass
22%	In the original forest type but culled	36%	Cleared
20%	Aspen type	100%	Total

The estimate of the United States Forest Service (1940) gives a total of over 90,000,000 merchantable cords divided about equally between sawtimber, pulpwood and firewood.

Changes in the forest area of Minnesota between 1700 and 1940 and the growth of the population during the same period are as follows:

1700	70% of total land area	500 population
1800	70	1,000
1850	70	6,000
1860	70	172,000
1870	65	440,000
1880	62	780,000
1890	52	1,310,000
1900	37	1,751,000
1910	34	2,075,000
1920	30	2,387,000
1930	30	2,563,000
1940	40	2,792,000

Up to 1920 the forest area decreased as the population increased. After that the forest area increased in spite of a growing population. (See Exhibit III-A-2.)

2. Development of Forest Industry

a. Agricultural Land Clearance

Deforestation in Minnesota was initially brought about by the pressure of agricultural development as well as the commercial demand for lumber products outside the State. In the early days lumbering was primarily for export purposes since there was not sufficient population to furnish a local market. However, the land which had been cleared was almost immediately taken up by incoming settlers for hay fields and pastures and cleared of the logging debris. This led to the occupation of 30,000 farms aggregating five million acres, from some of which white pine and red pine had been cut for export purposes.

The clearing took place slowly up to 1880 but cutting and burning were pushed so actively that the percentage of forest land had decreased to 30% by 1920. However, by 1940 the abandoning of marginal farms, construction of wind breaks and other planting had restored the forest area to about 40%.

b. Commercial Logging

(1) Lumber (Sawtimber)

Prior to 1920, the principal lumber cut had been white pine and red pine, and when these species were relatively exhausted the importance of Minnesota disappeared as a source of lumber for the general market. At the present time,

in addition to small amounts of white pine and red pine, the sawmills are cutting spruce, jack pine and aspen, and there is only one large mill left such as those which were running full blast when Minnesota was a large factor in the general lumber market. In other words, the present lumber cut is almost entirely for local purposes, and a large percentage of it goes into such minor uses as box material and railroad ties.

The graph in Exhibit III-A-3 shows the lumber cut of Minnesota from 1869 to 1940. An additional graph indicating the lumber cut in the United States for the same period, shows that for the country as a whole the timber cut of Minnesota was only of importance between 1880 and 1920.

In logging, lumber usually takes precedence over other uses. Only the best logs will produce the higher grades of lumber. The following species are now figuring in the annual lumber cut in Minnesota: (Source: Forest Statistics for the Lake States, U. S. Forest Service, Jan. 1940, Section III Table 10.)

SOFT WOODS		HARDWOODS	
White Pine	25% by Volume	Elm	4% by Volume
Red Pine	10%	Red Oak	4%
Jack Pine	11%	Sugar Maple	1%
Balsam	6%	Paper Birch	1%
Spruce	4%	Misc.	1%
Tamarack	1%		11%
Aspen	26%		
Basswood	6%		
	89%		

For years Minnesota's production of lumber has fallen far short of the State's apparent consumption. The following data are taken from "Forest Statistics for the Lake States" for January 1940, Section III, Table 11:

Year	Production (million ft. b.m.)	Apparent Consumption (million ft. b.m.)
1922	555.3	985.5
1924	572.0	889.7
1926	505.5	832.0
1928	442.3	736.5
1930	222.4	517.2
1932	58.1	218.4
1934	95.4	293.9
1936	123.0	549.6

Minnesota is not now growing more than one half of its own lumber but it can produce enough for its own needs in about twenty years. Two strong arguments for taking necessary measures to make this possible are the high cost of shipping from the Northwest and the possibility of the Pacific Coast having little to spare within a few years.

As an interesting commentary on trends in the amount of pine available for lumber, the above mentioned "Forest Statistics" for January 1940 also indicates that 2,686,000 acres of original pine cover are now classified under "aspen type"— 2,135,000 acres — and "deforested"— 551,000 acres — (Section I, Table 6 and 7).

Although present indications of future trends in lumber might be amplified by lengthy discussion, there is no promise of material restoration of a large annual cut of white pine sawtimber in the immediate future.

(2) Pulpwood

About the turn of the century the cutting of pulpwood began from species which had not been big enough for sawtimber. At first this material went eastward into Wisconsin and Michigan as there were no pulp mills in Minnesota. However, mills were soon built because the State had a large amount of accessible spruce, balsam and jack pine which were excellent for making paper and insulating material.

During the present war period, pulpwood has become the most important single use of wood in Minnesota.

MINNESOTA PULPWOOD CONSUMPTION (AGRICULTURAL STATISTICS, 1933-1941)

CORDS	CORDS
1929 — 266,000	1935 — 335,000
1930 — 230,000	1936 — 323,000
1931 — 198,000	1937 — 335,000
1932 — 211,000	1938 — 255,000
1933 — 235,000	1939 — 245,000
1934 — 213,000	1940 — 349,000

These figures include only the prewar years. However, the rate of increase during the twelve years prior to 1941 was sufficient to place pulpwood in a distinctly important position among forest products, considering its future possibilities and the abnormalities of the war years.

Fifty-four per cent of the State's production goes to local mills and the remainder to Wisconsin (32%), Canada and other states (14%). The following species were cut for pulpwood in 1940 (Forest Statistics, Section III, Table 16):

Spruce	60%
Balsam	20
Jack Pine	10
Aspen	10
	100% By Volume

(3) Firewood

From the beginning of Minnesota's history an important use of wood has been for cooking and heating because wood was the most easily accessible fuel in a climate in which heat was required for at least five months of the year. However, it nearly always was cut from material not suitable for lumber or pulpwood and was handled in small units. Hardwood is, of course, much to be preferred to soft wood for both heating and cooking. Soft wood which is mainly used for kindling represents only 30% of the total cut of fuel wood. The remainder, or 70% comes from hardwood trees which are usually too small or too defective to make lumber.

There are no complete data covering the annual cut of firewood over a long period, since it has always been regarded as a minor wood product, and the information concerning it is rather scant, but its economic importance as a major source of fuel supply for a large percentage of the population is apparent when it is estimated that 3,000,000 cords a year are cut. It is the largest single use of wood in the State and is over half of the total amount of wood cut in the State.

(4) Minor Wood Products

The minor products come principally from cedar and tamarack and include posts, poles, mine timbers and fence material. In all, they constitute but a small percent of the total timber cut in Minnesota. Fence posts, piling, poles, mining timber and other small products normally are cut annually in the following proportions:

MINOR WOOD PRODUCTS (FOREST STATISTICS SECTION III, TABLE 24)

Posts (except cedar) 9,734,000 posts	5,559,000 cu. ft.
Cedar Products	5,207,000 " "
Mining Timber	3,523,000 " "
Total	14,289,000 " "

(5) Annual Cut

Based on Forest Survey figures of January 1940 and from estimates, the normal annual wood cut in Minnesota is divided as follows:

Lumber	600,000 cords	15%
Pulpwood	400,000 cords	10%
Firewood	3,000,000 cords	75%
Total	4,000,000 cords	100%

c. Value of Forest Products

APPROXIMATE VALUE OF FOREST PRODUCTS AT THE ROADSIDE
(STUMPAGE PRICE PLUS LOGGING COSTS)

Lumber 300,000 M b. f. at $15 =	$4,500,000	12%
Pulpwood 400,000 cords at $8 =	3,200,000	8%
Firewood 3,000,000 cords at $10 =	30,000,000	80%
Minor products (negligible)	———	
Total	$37,700,000	100%

(1) Lumber

In general, the course of lumber prices in both the United States as a whole and in Minnesota has been from $11 per M board feet at the mills in 1899 to a prewar (1940) value of $23 per M with a high point after the last war (1920) of $38 per M. For white pine the mill values have ranged in the United States as a whole as follows (Agricultural Statistics 1942, P. 800):

1899 — $12.69	1929 — 29.87
1909 — 18.16	1939 — 25.90
1919 — 32.83	1940 — 27.87

(2) Pulpwood

The course of prices for pulpwood from 1910 to 1940 reached a low point after the depression of the early thirties. In 1899 the value of pulpwood delivered at the mill for the United States as a whole was $4.95 a cord, and it was $7.99 in 1940, but it had risen to $20.10 per cord in 1921. (Statistical Abstract of the United States, 1943, P. 708). In Minnesota, the prices were lower (prior to the abnormal conditions of the current war) owing to the State's geographical relationship to the industrial use areas of the country.

(3) Firewood

Fuel wood prices have not fluctuated to any degree during the period of Minnesota's active lumbering for the reason that there is practically always a

large supply of wood for that purpose. Consequently, the change in prices is almost wholly due to the fluctuations in the value of money. Expressed numerically, the value of hardwood fuel in Minnesota for roadside delivery varied from nominal figures to $15 per cord, with an average price of about $12, but as of 1940 the average for all species—soft wood included—was nearer $10.

(4) Minor Products

In general, prices of minor products have followed the trends in lumber because they were cut from material which had a relatively high value on account of the durability of the wood used. The supply of these minor products seldom has been in excess of the demand, and consequently, they have not been depressed for long periods.

(5) Stumpage

Stumpage values or the values of standing timber summarize the general trend of wood values with the limitation that they tend to lag behind any rise in prices of finished wood products. There is no fixed market for standing timber and stumpage is not so negotiable as finished products. In general, stumpage values in Minnesota have risen for white pine and red pine timber from fifty cents per M in 1860 to $10 or more per M in 1940.

This rise is not the full measure of the increase in value because there has been a decrease in both the quality of the product and its accessibility. In other words, the early lumbering was done in virgin timber within easy reach, and present lumbering is picking up the timber which was passed over in the early operations.

Changes in stumpage values have been the main reason for an important change in forest values. In brief, the forest area and the quality of the timber have decreased but the value has steadily increased. This is shown clearly in the following:

ESTIMATED STAND VALUES

	1850	1910	1939
Lumber	$10,000,000	$54,000,000	$72,000,000
Pulpwood	—	—	92,000,000
Firewood	—	30,000,000	27,000,000
Totals	$10,000,000	$84,000,000	$191,000,000

ESTIMATED GROSS INCOME VALUE OF ANNUAL CUT (ROADSIDE VALUES)

	1850	1910	1939
Lumber	$500,000	$15,000,000	$4,500,000
Pulpwood	—	—	3,200,000
Firewood	50,000	24,000,000	30,000,000
Total	$550,000	$39,000,000	$37,700,000

While part of this rise in value might be more directly ascribed to the invention of new processes and products and the use of species earlier thought to be worthless, these are after all merely parts of the great movement of which stumpage prices are the simplest measure. They are all the result of the simple fact that the forests were at one time thought to be inexhaustible and were, therefore, cut recklessly; but as they became less abundant they were more carefully utilized and had a higher value.

The graph in Exhibit III-A-4 indicates the rise of stumpage values in Minnesota on white pine timber cut from the State lands between 1860 and 1940.

(6) Trends in Prices

The brief references to trends scattered through the previous discussion of values does not properly represent what has happened in the handling of Minnesota's forest products. This can probably be understood best by considering the changes in products, species, sale values, and stumpage values between 1850 and 1939.

As to products, in 1850, there was a demand in the general market for only one form of wood—lumber, as boards, or dimension material. Furthermore, only two species were accepted except in special cases where hardwood was needed. White pine and red pine met most of the demand for lumber for over three generations. Of course firewood and fencing material were needed even previous to the Civil War, but this demand was met locally up to a comparatively recent date. The normal way to get these materials was for the farmer who needed them to go out in his own woodlot and cut them. So abundant were they that neither firewood nor fencing have had any appreciable stumpage value until the last ten or fifteen years.

Pulpwood is the best example of an entirely new wood product which has opened a large field unheard of sixty years ago. In that time large mills have been built and many men are now employed in them and on the special woods operations which have had to be opened up to furnish the mills the raw material they need. As contrasted with the finished product of a sawmill, lumber, which is only doubled in value by the process of manufacture, pulpwood increases about six times in value by being processed. Naturally it has become an important use of wood, and other chemical processes similar to paper making seem to hold equal promise in creating new values.

Summarizing, the following list shows the principal uses of wood in Minnesota arranged in ascending order of their present value through the mill or place of use:

Softwood —	Firewood	— $10	per cord
	Fencing	— 12	per cord
	Lumber	— 12	per cord or $25 M b.f.
	Pulpwood	— 60	per cord
Hardwood —	Firewood	— $12	per cord
	Lumber	— 15	per cord or $30 M b.f.
	Pulpwood	— 60	per cord

The second way in which changes have taken place is in the manner in which the species have been regarded. As explained above, up to about 1900, 90% of the lumber sawn was either white pine or red pine, but since then jack pine, spruce, balsam, tamarack and aspen have become merchantable for soft wood sawtimber, and the amount of hardwood has increased with a greater variety of species being accepted than was thought practicable in the past. The same process has also taken place with firewood and pulpwood until almost any species can be sold for firewood and pulp is made from spruce, balsam, jack pine and aspen. Cedar is so preeminent as a fencing material that it has been preferred to all other species from the first.

This wider use and the decrease in the supply have naturally led to increased stumpage prices. The changes may be summarized about as follows:

CHANGES IN STUMPAGE VALUES

White pine and red pine	$0.50	(1850)	to	$10/M b.f.	(1939)
Jack pine	0.50	(1910)	to	5/M b.f.	(1939)
Spruce	0.50	(1900)	to	6/M b.f.	(1939)
Balsam	0.50	(1910)	to	4/M b.f.	(1939)
Tamarack	0.50	(1890)	to	6/M b.f.	(1939)
Cedar	0.50	(1900)	to	4/M b.f.	(1939)
Aspen	0.50	(1920)	to	5/M b.f.	(1939)
Other hardwoods	0.50	(1850)	to	3/M b.f.	(1939)

Naturally, data like these can only be approximate because there have been no fixed markets for stumpage and there are little published data.

d. Other Forest Values

(1) Hydrological

While it is difficult to appraise in dollars the benefits of the forest in increasing the State's supply of sub-surface water, the forests are beneficial for three principal reasons. They prevent the rapid run off of rainfall; they decrease the

erosion from water running off an incline; and have a cooling and moistening effect on the air which passes over them.

(2) Recreation

Recreation, which is closely related to the forests frequently has been characterized as the third greatest industry in the State of Minnesota, but there has been some difficulty in securing reliable data which would support this characterization. The Travel Bureau of the United States Department of the Interior has published the following figures for Tourists in the State of Minnesota. As the Bureau was discontinued some time ago there has been no means of determining their statistical background.

EXPENDITURES OF TOURISTS IN MINNESOTA

1935	$107,205,000	1938	$131,612,000
1936	118,308,000	1939	138,066,000
1937	128,008,000		

A report issued by the Continental Oil Company indicated an estimate of 3,578,138 as the number of visitors to the State of Minnesota in 1939, with the opinion that they had spent $165,368,106. Other data informally supplied indicated that 854 hotels and resorts in regular twelve-month operation plus 2,550 seasonal resorts and tourist camps served tourist needs; yet these figures are supported only by the record of the Hotel and Inspection Division of the Minnesota State Board of Health that there are 15,687 beds in these facilities. Allowing two beds per seasonal resort, this would indicate an average of only twelve beds per hotel. As these hotels include all metropolitan hotels, the figures fail to be impressive.

Among other estimates of an informal nature lacking documentation, are the following:

Gasoline taxes on out-of-state cars	$1,000,000
Seasonal resort and camp employment	$5,000,000

Unquestionably such figures do indicate the existence of an income from tourist trade, involving interest both outside and inside the forest, running into amounts of considerable size. But the lack of responsible documentation has given no encouragement to study or estimate, particularly under present war conditions, lest such estimates without known costs create a wholly erroneous impression of possibilities which are presumed to exist but for which no positive background has been developed.

(3) Fur

To illustrate the importance of fur production in Minnesota, the following data are summarized from recent reports of the Minnesota Division of Game & Fish (Department of Conservation) on the returns from trappers who were licensed.

	ESTIMATED NUMBER OF PELTS	ESTIMATED VALUE
1940	1,200,917	$1,549,518.61
1941	1,258,643	1,993,707.62

PERCENTAGES OF TOTAL VALUE OF CATCH

Muskrat	50%
Mink	22
Skunk	12
Weasel	4
Fox	3
Miscellaneous	9
	100%

If all trappers, unlicensed as well as licensed, had been included, the value of the catch in 1941 would have been 27% greater.

3. Carrying Charges

a. Protection

(1) Fire

The most important cost which has to be met annually in order to maintain forest areas in good growing condition is fire protection. At the present time the State is only spending on the average of one cent per acre per annum for this purpose. As a result, (1) from 1937 to 1941 there was a high percentage (35%) of fires which burnt 100 acres or more, (2) no attempt is made to estimate the money value of the timber burnt, and (3) most of the fires are due to the lack of proper policing. Apparently there have not been enough funds to hire the number of men needed to stop the fires in their early stages, to gather complete fire statistics, or to educate the general public to the necessity of extraordinary precautions during dry spells.

There follows the record of expenditures by three states for fire protection in 1943. These figures are typical.

FIRE PROTECTION EXPENDITURE

	Michigan	Wisconsin	Minnesota
Expended per acre	$ 0.040	$ 0.037	$ 0.022
Size of average fire (acres)	25.7	13.3	63.4
Forest fires over 10 acres (% of all fires)	16.5	12.0	42.3
Area burned (% of total forest area)	0.11	0.10	0.27

Although this comparison is limited, it is evident that Minnesota's forests have not been receiving even reasonably adequate protection. In the case of Minnesota, the Division of Forestry Report does not segregate "fire losses" from "other losses" but in Michigan and Wisconsin the "fire losses" are about 28% and 38% of the total losses respectively.

However, Minnesota is no exception to the general rule that American forest protection is in its infancy. The annual losses from forest fires are hard to estimate accurately because so many of them are indirect, but it is fair to say that every forest fire kills some small trees, damages older trees, decreases the soil fertility, and lessens taxable values and payrolls. The records for 1940 show 64,173 acres burnt over in Minnesota with a cost of $70,549.80 for fire fighting. Although this is a loss of less than 1% of the total forest area, it still is a poor record because all but a few fires due to lightning were preventable.

The simple fact is that the country as a whole has not yet really come to grips with the forest fire situation. We Americans still stick to the old idea that our forest resources are so vast that we do not need to bother ourselves about losses from fires. On this account it has been difficult to get people to use extra care during the dry periods of spring, summer and fall, but the task is not impossible. The National Forests in the Rocky Mountains have achieved better forest fire protection than has Minnesota, even though 60% of their fires are set by lightning. Europe's record is another standard for us to aim at. With many times our population and nearly as bad dry spells, they have reduced their fire losses to negligible proportions. They do not have fires because they do not want them. We have them because so many of us still think it not worthwhile to prevent them.

(2) Insects and Fungi

Like forest fires, annual losses from insects and fungi are difficult to estimate accurately because so many of them are indirect. Insect and fungus

damage is less spectacular than that of fires but the harm to the forest is considerable. Together, fires, insects and fungi account for 10% of the annual drain on our forest resources.

Protection against forest insects involves an important carrying charge. Unless conditions in the forest are carefully watched, such infestations as the spruce bud worm and the pine bark beetle kill the trees in large areas. For example, the Division of Forestry report for 1940-42 records serious infestations of bark beetles (Ips pini), the spruce bud worm on jack pine, and birch sawfly. These attacks not only destroy valuable timber, but also annoy visitors both from within and without the State with resulting unfavorable reactions to the forest recreation industry.

(3) Trespass

Trespass on forest land is quite different from offenses committed on other kinds of real estate. This is principally because other forms of land are open and the general public sees what goes on there day by day. Furthermore, city properties or farm lands are usually well marked by fences or monuments so that the limits of ownership are not only matters of common knowledge but the land is so valuable and so well described that not only are the court records easy to keep up but it is distinctly to the pecuniary interest of the owner to keep them up to date. On the other hand, forest land is not only covered with woods so that the boundaries are not matters of common knowledge, but the tracts frequently yield no return for long periods so that the owner has less reason to check his boundaries. Woodland is seldom fenced and the corner posts and blazed lines become obscured after a few years.

Another complication follows from the American practice of taking away from the owner the title to the fish and game on his land. That rests in the State. Hence unless the owner carefully posts his land, his property is open to hunters and fishermen, and even where notices have been posted, the public is prone to ignore them. This anomalous condition came about because, like the forests themselves, the supply of fish and game was thought to be so abundant that it was inexhaustible.

However, all the states have already found it necessary to regulate the hunting and fishing to prevent extermination of the fish and game, and expensive programs of artificial propagation have been set up. The net result of all this is that the fishing and hunting are in most cases poor, and the State is spending large sums to raise game when it could be increased better and more cheaply by proper land management. The owner of the land not only has no incentive to practice such efficient management but is constantly irritated by the hunters and fishermen who feel that they have full right to use his land and even make it unsafe for

the owner to be in his own woods during the hunting season. Neither the owner nor the sportsman is satisfied, and the fish and game are being depleted.

b. Taxation

Forest taxes have been the most discussed problem in the campaign to grow timber as a crop and replace the "cut-out-and-get-out" policy of handling forest lands. The reasons for the controversy have been that on occasion taxes have been so high as to be confiscatory, and the methods of calculating them erratic.

Taxation of the forest lands of Minnesota seemed much simpler to the assessors in the early days than the facts warranted. They applied the same reasoning that served in the case of other forms of real estate because forest taxation appeared to be like the taxing of farm lands. But farm crops were harvested annually and usually fed out before tax time in the spring so that they were not taxed per se. With woodland the crop kept increasing in value for fifty to one hundred years. If then the value of the wood lot was increased as the timber grew bigger, the taxes could eat up all the value. The usual practice has been for a woodland owner to cut his timber just as soon as he could after it reached the lowest form of merchantability, and sell the bare land or let the ownership revert to the State for non-payment of taxes. This did not lead to the growing of timber. It lead to deforestation.

As a consequence the Auxiliary Forest Law was passed in Minnesota in 1927 allowing the owner of cut-over land the option of registering his holdings with the County board and applying for a waiver of the ad valorem tax and substitution of an annual tax on the bare land and growing stock, plus a yield tax when the timber is large enough to cut. As a comparison of these two methods of taxing woodland, the following data indicate how the average condition would work out, merely as illustrating the general situation.

(1) Using the State average of one-seventh of a cord per acre per annum, and $2.10 as the average value per cord of all merchantable wood ($191,000,000 divided by 90,000,000 cords), the gross return would be 30 cents (1/7 x $2.10). The present annual ad valorem tax ranges from 17 to 68 cents per acre and averages about 28 cents. Subtracting from the gross return of 30 cents, the average ad valorem tax of 28 cents per acre leaves but 2 cents to cover protection and growing costs, including interest on investment and profit!

(2) On the other hand, the Auxiliary Forest Law would give the following results, using the same figures on gross returns (30 cents per acre per annum):

For forest land exclusive of woodlots:

8 cents (annual tax on land and growing stock) plus a yield tax of

10% of 30 cents, or 8 cents + 3 cents = 11 cents. The net return would therefore be 19 cents per acre to cover protection costs, the interest on the investment, and a profit.

For farm woodlots where the farmer is assumed to spend an average of 3 cents per acre per annum directly or indirectly for fire protection:

5 cents (annual tax on land and growing stock) plus a yield tax of 10% of 30 cents or 5 + 3 cents = 8 cents per acre. The difference between 30 cents and 8 cents is 22 cents, which is the amount to cover protection costs, interest and a profit.

c. Regeneration

All tracts which are managed on the principal of a sustained yield must incur expenses to cover the cost of getting a new stand started on the areas which have been cut over. Of the three methods open, natural regeneration is the cheapest. It seldom involves a cost of more than $5 per acre and usually can be done for much less if plenty of seed trees of the desirable species are available. If they are not abundant enough, one of the other two methods must be used — direct seeding or transplanting 2 or 3 year old seedlings. But since the average costs per acre for these latter methods are $20 and $10 respectively, it is usually much cheaper to make sure that at least 4 seed trees of the right kind are left uncut. Consequently, the National Forests and better managed private holdings use natural regeneration whenever at all possible.

d. Administration

The management of a large tract of timber land naturally involves the keeping of records of costs and returns and many data that are most easily recorded on maps. The average cost per acre per annum of these records is hard to segregate because the common practice is to lump all protection and administration costs. Considered separately, administration costs have not as yet exceeded 5 cents per acre per annum on tracts of over 1,000 acres in the United States.

The need of more effective administration of Minnesota's woodlands is shown by the low average yield of merchantable timber, about one-seventh of a cord per acre per annum. It is believed that good management can easily bring this up to one quarter of a cord.

4. EMPLOYMENT

Three methods are available for calculating the present rate of woods employment. The first is to trace through the United States Census records the number of persons employed in the woods and sawmills.

EMPLOYMENT
(From U.S. Bureau of Census and Forest Statistics)

Date	No. of Sawmills	No. of Workers
1870	207	2,952
1880	234	2,854
1890	392	16,170
1900	438	15,140
1933	1,166	5,222

According to these data the peak was reached in 1890. Since then the size of the mills has been decreasing, but not their number. The number of employees has diminished after reaching a high point between 1890-1900.

A more complete statement as to woods employment comes from the Forest Survey dated 1933 and is as follows:

Kind of Industry	Number of Establishments	Employees	Days Millwork	Days Woodwork
Sawmills	1,166	5,222	178,506	232,884
Pulpmills	8	855	226,564	349,836
Fuelwood	—	—	—	4,406,508
Other Industries	67	922	191,941	24,605

These figures show that the total annual woods work, including sawmill work, in 1933 was 5,192,339 man days. On the assumption that the average woodsworker spends 150 days annually in the forest, 35,000 men were needed in 1933. A period of one hundred and fifty days was used in making this last computation because little work is done in the woods during April, May, June, July, August and September; owing to mud and floods in April, May and June; mosquitoes and flies in June, July and August; and the pressure of farm work from May through September. Of course, special tasks like peeling pulpwood have to be taken care of when it is possible — May through June for peeling.

The following data are included because one of the first questions that arises in attempting to grow timber is how many men will be needed on a given tract. As many different kinds of tracts as possible are indicated in order to meet the great variety of conditions that may be found.

FORESTS, EMPLOYMENT
NUMBER OF ACRES PER WOODS WORKER
From "General Forestry" by J. S. Illick

	Location	Area Included (Acres)	Kind of Work	Area per Worker (Acres)
1.	Northern Sweden	40,000,000	Woods Work	1,400
2.	U.S. National Forests	162,000,000	Woods Work	1,000
3.	U.S. Commercial Forests	494,000,000	Woods Work	500
4.	Southern Sweden	25,000,000	Woods Work	400
5.	Prussian State Forests	4,900,000	Woods & Mill	156
6.	Conn. State Forests	63,000	Woods & Mill	126
7.	Denmark	750,000	Woods & Mill	125
8.	Thetford Forest, Eng.	28,000	Mostly Planning	100
9.	Switzerland	1,700,000	Woods Work	100
10.	Forest of Dean, Eng.	20,000	Woods & Mill	50
11.	Northern New England	8,000	Woods & Mill	40
12.	Germany	31,000,000	Woods & Mill	31
13.	Sihlwald, Switzerland	2,848	Woods & Mill	14

Generalizing from these figures it may be said that one man per 1,000 acres can only give superficial policing; 1 man to 500 acres would be representative of the ordinary commercial logging tract; but proper protection from fire and trespass, and cutting so as to insure proper natural regeneration combined with simple sawmill operation would require at least one man to every 100 acres.

5. OWNERSHIP

The present ownership of the forest area in Minnesota is as follows:

16%	Federal		3,200,000 acres
	Superior National Forest	1,900,000 acres	
	Chippewa National Forest	550,000 "	
	Indian lands	600,000 "	
	Miscellaneous projects	150,000 "	
35%	State and County		7,000,000 acres
	State	4,000,000 acres	
	County	3,000,000 "	
49%	Private		9,500,000 acres
	Farm woodlots	4,800,000 acres	
	Small scattered tracts	4,200,000 "	
	Commercial timber tracts	500,000 "	
100%			19,700,000 acres

Naturally this distribution is the result of the history through which the forest land has gone. The intention was to convert to private ownership as much of the State's area as possible and make farms of it. The early logging was done with this purpose in view but the demand for tillage land had commenced to slow down by 1900 and the trend was reversed by 1925. In other words since that date the forest area has been increasing.

This decrease in demand for farm land was furthermore accompanied by another factor which seriously affected the trend toward private ownership. This was the form ad valorem taxing which made it unprofitable to hold timberland after it was cut over. Consequently large areas — about 2,000,000 acres — of forest land are now tax delinquent and another larger block — 5,000,000 acres — has already been abandoned to the State. With the demand for farm land apparently satisfied and a tax law which makes it impossible for the private owner to hold his timber for future growth, the State is burdened with a tremendous area for which there is no sale and yet the State has not sufficient funds to reforest it.

A suggestion for tax reform has already been made which ought to stop the reverting of woodlands to the State for non-payment of taxes and even encourage the purchase of cut over land. More generous appropriations for the care of the State's forests will also help.

E. Manufacturing

Through nearly a century of history as an industry in Minnesota, manufacturing grew rapidly to occupy an important position in the State's economy, but in more recent years has failed to maintain its relative position. This section endeavors to determine the probable causes of this change and to show the interdependence of manufacturing and other industries.

1. Introduction — Origins

In the early years of the State, manufacturing gradually assumed importance as a factor in economic progress, concurrently with the settlement and early development described elsewhere in this report. Lumber and timber products, with saw mills, as reported under Forestry, were naturally identified with early deforestation.

Wheat as a pioneer crop invited the establishment of flour mills some eighty years ago. The Falls of St. Anthony, around which later grew the City of Minneapolis, was the site of saw mills, flour mills, woolen mills, and even cotton mills, although cotton had to be imported from the South. Manufacture of agricultural machinery developed shortly after the end of the Civil War. The growing population needed goods, and mills were established to supply such articles as clothes, blankets, lumbermen's socks, harnesses and boots. Some of these early businesses still survive, particularly the flour milling industry. Certain industries grew to national importance in the period of expansion following the Civil War, but others have not grown in size to take the place of those that have since declined.

In 1880, Minneapolis ranked 20th among the manufacturing cities of the United States and the gross value of its products totaled $30,000,000 or about 40% of the entire manufacturing for the State of Minnesota. Ranking of the chief industries in Minneapolis was then as follows:

1. Flour (also 1st in the United States)
2. Lumber, sawed (also 3rd in the United States)
3. Foundry
4. Sash, doors, etc.
5. Cooperage
6. Men's clothing

The magnitude of manufacturing in Minnesota is illustrated in Exhibit III-I-1, which shows Value of Product, Invested Capital, Value Added by Manufacture and Wages Paid over the period from 1850 to 1939. The basic data are indicated in the following table:

MINNESOTA MANUFACTURING
(In $1,000's)

Year	Capital Invested	Wages Paid	Value Added by Mfg.	Value of Product
1850	94	18		58
1860	2,388	712		3,373
1870	11,994	4,053		23,111
1880	31,005	8,613		76,065
1889	127,687	30,371		192,033
1899	165,832	29,029	73,394	223,692
1904	184,903	35,843	97,304	307,858
1909	275,416	47,471	127,798	409,420
1914	354,434	58,507	156,505	493,354
1919	679,386	127,107	335,040	1,218,130
1921		107,250	264,973	850,447
1923		125,531	315,452	962,775
1925		123,767	331,132	1,101,856
1927		123,619	340,336	1,066,727
1929	702,954	132,418	404,995	1,173,214
1931		92,929	261,747	719,064
1933		64,024	201,540	529,733
1935	469,980	77,974	245,507	746,351
1937		107,393	312,898	937,463
1939	531,641	96,887	310,628	845,772

Manufacturing and agriculture are compared in Exhibit III-I-2. Invested capital in manufacturing has shown little increase since 1919, while the value of farms has also declined. What effect the present World War has had on these values is not known and would perhaps give a misleading trend to the chart.

Farm income has been on a downward trend since its high in 1919, while "value added by manufacture" was still increasing up to 1929, when the two were almost equal. The decline in manufacturing during the depression years was only slightly greater than the reduction in farm income. The value of manufacturing to the State of Minnesota has been almost equal to the farm income during the ten year period 1929 through 1939. The 1920 peak "Value of Farms" as shown in Exhibit III-I-2 should be discounted. (See discussion

under Agriculture 2-e. "Assumptions in Estimating Investment in Farm Land").

In 1939, the relative position of manufacturing in Minnesota compared to agriculture in measure of wealth was:

Agriculture $1,865,500,000 or 36% Manufacturing 531,641,000 or 10%

The relation of major groups as measured by employment in 1939 is as follows:

Agriculture	30.30%	Personal Services	16.85%
Trade	23.72%	Manufacturing	12.45%

These comparisons do not indicate the real value of manufacturing to Minnesota, however, as well as the following condensed statement:

(1) Industry needs cash customers

(2) Customers appear when there is spendable income

(3) There is spendable income when agriculture has high net income.

Thus agriculture must have the income to spend that starts the factories producing the goods which are sold by trade, and consequently manufacturing is second to agriculture in economic importance.

According to the United States Census of Manufactures for 1939, Minnesota industries collectively rank as follows in relation to the forty-eight states and the District of Columbia:

	Ranking of Minnesota 1929	1939
Value of Manufactured Products	15	17
Value Added by Manufacture	16	18
Wage Earners Engaged in Manufacturing	23	23
Wages Paid to Workers in Manufacturing	21	21
Industrial Areas According to Number of Wage Earners Minneapolis-St. Paul Area	21	22

The fact that, in 1880, Minneapolis ranked 20th in the list of manufacturing cities indicates that industry in Minnesota has lost its relative position by two points in this 60 year period.

Whatever may have been the trend since 1939, all of the foregoing emphasizes the importance of a careful analysis of the situation with respect to manufacturing within the State. The trend from 1929 to 1939 was in the wrong direction and every effort should be made to determine whether the State is doing all that can be done to maintain and improve its position nationally, particularly with respect to guarding against loss or removal of manufacturing units. For this reason, postwar possibilities should be carefully evaluated.

In the following discussion of the manufacturing situation in the State, the subject has been approached by two methods:

(a) The development of particular lines of manufacturing to date, and

(b) A statement reporting the results of a sampling survey made to determine the facts favoring the retention and development of manufacturing within the State, as well as conditions which might influence the removal of certain types of organizations and units to more favorable locations.

2. COMPARISONS — (MANUFACTURING-POPULATION RATIO)

Many of the early manufacturers built up a nation-wide business and over the years have held much of this early prestige. Changing conditions have influenced the business developments of the northwest area and competition has been a growing factor. Just as raw materials were the prime factor in the establishment of early mills, these materials have influenced the changes over the years. The most important industries have been and still are those which process natural raw materials from the area. In the first nine industries, graded as to importance in all manufacturing, six are related to products of the land.

Printing has developed into a large industry as has also the manufacture of heating apparatus, and one large manufacturer in each of these two classifications is responsible to a major degree for their size. Their position may be evaluated by what might be termed the "manufacturing-population ratio." This is a ratio which compares the extent of activity for any selected industry in Minnesota with the corresponding nationwide total when related to the population in the State as a percentage of the national total. It is the ratio between two other ratios and is obtained by dividing the value of product in Minnesota as a per cent of the total national product, by the population of Minnesota as a per cent of the national total; for example: Meat Packing in 1937 in Minnesota has a value of product of $201,468,000 and the total value for this classification was $2,787,358,000 which gives Minnesota 7.23% of the total. The population of Minnesota is 2.12% of the U. S. total by the last census. Hence, the "manufacturing-population ratio" is $\frac{7.23}{2.12}$ or 3.41 for the Meat Packing industry.

This ratio can be applied with equal correctness either to the percentage of "value added by manufacture" in Minnesota or to the percentage of "total value of products." Unless a specific industry can be shown to have a "manufacturing-population ratio" in excess of unity it can well be assumed that its market is primarily local.

Throughout the country, consumption of manufactured products is roughly proportional to population. There will be variations from this principle,

particularly in the southern agricultural states, but there is a fairly close relationship which is generally recognized by national industries between consumption of non-luxury goods and the population.

If in any state a specific industry has a "manufacturing-population ratio" exceeding unity, such as book printing and heating apparatus manufacture in Minnesota, it may be assumed that its market is larger than the State. The larger this ratio is, and the more industries that achieve it, the greater is the State's contribution to its own economic progress.

The following table shows the "Value of Product" in Minnesota compared to the United States total for all manufacturing industry from 1849 to 1939. The Minnesota percentage reached a peak of 2.16 in 1904 and was just below this high again in 1914, but since then the trend has been downward to 1.50% of the total in 1939. Population is also indicated in this table, as well as the percentage of the total United States population in Minnesota. The "manufacturing-population ratio" for the State's value of product reached its peak in 1889 when it was practically unity. It remained quite high until 1919, but has declined since.

MINNESOTA MANUFACTURING

Year	Value of Product (in $1,000) U.S. Total	Minnesota	% of U.S. Total	Population U.S. Total	Minnesota	% of U.S. Total	Mfg.-Population Ratio
1849	1,019,107	58	—	23,191,876	6,077	0.03	—
1859	1,885,862	3,373	0.18	31,443,321	172,023	0.55	0.33
1869	3,385,860	23,111	0.68	38,558,371	439,706	1.14	0.60
1879	5,369,579	76,065	1.42	50,155,783	780,773	1.56	0.91
1889	9,372,379	192,033	2.05	62,947,714	1,310,283	2.08	0.99
1899	11,032,951	223,693	2.03	75,994,575	1,751,394	2.30	0.88
1904	14,252,961	307,858	2.16				
1909	19,945,249	409,420	2.05	91,972,266	2,075,708	2.26	0.91
1914	23,049,632	493,354	2.14				
1919	59,964,027	1,218,130	2.03	105,710,620	2,387,125	2.26	0.90
1921	41,649,853	850,447	2.04				
1923	58,181,296	962,775	1.65				
1925	60,809,225	1,101,856	1.81				
1927	60,335,469	1,066,727	1.77				
1929	67,994,041	1,173,214	1.73	122,775,046	2,563,953	2.09	0.83
1931	39,829,888	719,064	1.81				
1933	30,557,328	529,733	1.73				
1935	44,993,699	746,351	1.66				
1937	60,712,872	937,463	1.54				
1939	56,843,025	845,772	1.50	131,669,275	2,792,300	2.12	0.71

According to the 1919 Census of Manufactures, the leading industries in Minnesota rank as follows on the basis of "Value of Product." (The Manufacturing-population ratio is obtained by dividing percentage of the U. S. total by 2.26 which is the Minnesota population percentage of the U. S. Total for that year).

1919 MANUFACTURING
RATIO BASIS — VALUE OF PRODUCT

Minn. Position No.	Classification of Industry	% of Total Mfg. in Minn.	% of U.S. Total for the Industry	U.S. Position No.	Manufacturing-Population Ratio
1	Flour Milling	31.3	18.58	1	8.22
2	Meat Packing	12.0	3.45	8	1.53
3	Butter	7.3	15.24	1	6.74
4	Lumber & Timber Products	3.1	2.69	14	1.19
5	Railroad Shops	2.9	2.76	9	1.22
6	Linseed Oil	2.7	27.55	2	12.19
7	Foundry & Mach. Shop Products	2.6	1.39	—	0.62
8	Bakery Products	1.9	1.98	11	0.88
9	Paper & Pulp	1.7	2.55	9	1.13
10	Printing, News	1.6	2.17	—	0.96

Using data from the Census of Manufactures for 1937, the leading industries in Minnesota have been compared with the United States total with the "manufacturing-population ratio" based on the "value added by manufacture." (This ratio is obtained by dividing the percentage of the United States total for each classification of industry by 2.12 which is Minnesota's percentage of the population of the United States for that year.)

1937 MANUFACTURING
RATIO BASIS — VALUE ADDED BY MANUFACTURE

Minn. Position No.	Classification of Industry	% of Total Mfg. in Minn.	% of U.S. Total for the Industry	U.S. Position No.	Manufacturing-Population Ratio
1	Meat Packing	10.51	8.19	2	3.86
2	Printing, News	5.63	1.76	—	0.83
3	Malt Liquors	4.87	4.54	—	2.14
4	Printing, Books	4.59	2.73	8	1.29
5	Flour Milling	4.53	10.61	1	5.00
6	Bakery Products	3.85	1.72	15	0.81
7	Heating & Cooking Apparatus	3.59	4.33	—	2.04
8	Paper & Pulp	3.33	2.15	13	1.01
9	Butter	3.11	12.21	1	5.76

From the foregoing tables, it is shown that between 1919 and 1937, the first seven industries of the 1919 list dropped in per cent of total manufacturing in Minnesota. The last three industries have moved up in percentage, but they are not moving up in the national percentage.

National percentages are most revealing of the trend in Minnesota's industries as all the leading manufactures of 1919 are lower in United States total except Meat Packing, which has more than doubled in percentage, and Railroad Shops. Values for those industries not included in the 1937 table are as follows on the basis of "Value of Product":

1937 MANUFACTURING (SUPPLEMENTARY)
RATIO BASIS — VALUE OF PRODUCT

Minn. Position No.	Classification of Industry	% of Total Mfg. in Minn.	% of U.S. Total for the Industry	U.S. Position No.	Manufacturing-Population Ratio
21	Lumber and Timber Products	0.95	0.56	20	0.25
10	*Railroad Shops	3.00	3.39	8	1.60
34	Linseed Oil	0.52	15.86	1	7.48
22	Foundry & Mach. Shop Products	0.89	1.05	—	0.50

* These are 1935 figures, as 1937 figures are not available.

In 1919 the "manufacturing-population ratio" for seven of the ten leading manufacturing classifications exceeded unity and two more approached unity. In 1937, the average ratio had dropped from 3.47 to 2.53, or 2.43 if the 10th ranking industry, Railroad Shops, is added.

From the 1937 table, it is evident that Meat Packing, Malt Liquors, Flour Milling, Heating and Cooking Apparatus, and Butter Manufacturers produce much more than the population of Minnesota can consume, and are national distributors of their products. The Book Printing Industry, which includes commercial printing, is just above unity in "manufacturing-population ratio," as is the Paper and Pulp Industry, indicating that their business is more than primarily local.

While the Printing of Newspapers and Periodicals is the second largest manufacturing business in Minnesota, it is of local importance only, as shown by its "manufacturing-population ratio." This is also the case with Bakery Products, which is local only, though ranking 6th in the State. Bakery products are perishable and can only be marketed within a limited area, depending on the time and cost of distribution.

A striking example of this distinction between local importance and national position of an industry is in the Malting business which ranks 16th in the State of Minnesota and 3rd in the United States ranking of the Malt Industry. This classification accounts for 1.22% of all manufacturing in Minnesota and 20.62% of all the malt produced in the United States on the basis of "value added by manufacture." The "manufacturing-population ratio" for the Malting industry is 9.73%, the highest for any industry in Minnesota. This industry thrives because of the availability of raw material (barley) in neighboring states, as well as in Minnesota.

In general, the "value added by manufacture" is a more satisfactory measure of the economic importance of industries to the State, than other indices. The ratio of "Value Added by Manufacture" to the "Total Value of Products" varies greatly for different types of industry. The following table shows this for the Census Year 1937:

1937 RATIOS OF MANUFACTURING VALUES

Classification of Industry	Value Added by Mfg.	Value of Product	Ratio (%) Value Added to Total Value
1. Meat Packing	$32,875,000	$201,468,000	16.3
2. Printing, News	17,628,000	24,296,000	72.6
3. Malt Liquors	15,223,000	22,539,000	67.6
4. Printing, Books	14,355,000	19,966,000	71.9
5. Flour Milling	14,180,000	97,018,000	14.6
6. Bakery Products	12,041,000	24,375,000	49.4
7. Heating & Cooking Apparatus	11,233,000	15,711,000	71.5
8. Paper & Pulp	10,407,000	27,315,000	38.1
9. Butter	9,727,000	96,131,000	10.1

From this table it appears that processing farm products adds less value to the raw materials than most lines of manufacturing.

A comparison of Minnesota's position with neighboring states on the basis of this ratio of "Value Added By Manufacture" to the "Total Value of Product" is shown in the following table:

1939 CENSUS OF MANUFACTURES

State	No. of Establishments	No. of Wage Earners	Wages Paid ($1,000's)	Value of Product ($1,000's)	Value Added by Manufacture ($1,000's)	% Value Added to Value of Product
Illinois	13,000	596,000	750,000	4,795,000	2,202,000	45.9
Michigan	6,000	522,000	790,000	4,348,000	1,798,000	41.4
Wisconsin	7,000	201,000	252,000	1,605,000	687,000	42.8
Misosuri	5,000	179,000	191,000	1,388,000	588,000	42.4
Minnesota	4,000	80,000	97,000	846,000	311,000	36.7
Iowa	3,000	65,000	73,000	719,000	245,000	34.1
Kansas	1,000	32,000	37,000	464,000	119,000	25.6

In the industries processing farm products, it is better to show the "manufacturing-population ratio" in terms of "Total Value of Product" than in "Value Added" because, generally, the raw materials are from Minnesota farms. The following table shows the "manufacturing-population ratio" based on "total value of product" in 1937 for leading industries using products of the farms:

INDUSTRIES USING FARM PRODUCTS (1937)
RATIO BASIS — VALUE OF PRODUCT

Minn. Position No.	Classification of Industry	U.S. Position (1935) *	% of U.S. Total for the Industry	Mfg.-Pop. Ratio
1	Meat Packing	4	7.23	3.41
5	Flour Milling	1	11.33	5.34
8	Paper & Pulp	13	2.27	1.07
9	Butter	1	16.30	7.69
12	Canning & Preserving	13	1.72	0.81
16	Malt	3	16.44	7.75
32	Poultry Dressing	2	11.70	5.52
34	Linseed Oil	1	15.86	7.48

* Not available for 1937.

Comparison of these "manufacturing-population ratios" with those in the previous table based on "value added by manufacture" in 1937 shows higher ratios in general when based on "value of product" but no particular reason is indicated for choosing one method in preference to the other.

The industrials which follow the Butter Industry in the order of ranking in Minnesota do not exceed unity as the "manufacturing-population ratio" except in a few industries as noted hereafter. This does not mean that none of them have a market outside of Minnesota as many manufacturers, covering many classifications, have a market that extends outside of the State. It is also true that competitors located outside of Minnesota are able to market their products within the State. However, few of these Minnesota industries with lower manufacturing-population ratios have attained positions of great importance. The exception of the Malt Industry already has been mentioned. The Poultry Dressing Industry is growing rapidly in importance, accounting for only 0.60% of all manufacturing in Minnesota, but it is 10.28% of the United States total for that industry classification in "value added by manufacture" (which makes the "manufacturing-population ratio" 4.85) and ranks second to Iowa among the states.

Processing of farm products in Minnesota has been materially affected by

the loss of flour milling production as shown by the following table. The first column gives the census year, the second column the total "Value of Product" for the group of manufacturers processing farm products, the third column the total value of all manufactured products in Minnesota, and the fourth column the per cent the farm group is of this total. The next two columns divide this percentage into flour milling and all the other manufacturers of the group processing farm products. The seventh column shows the percentage of the United States total value of products represented by the farm group of manufacturers while the last (eighth) column gives the percentage of the United States total value represented by all manufacturing in Minnesota.

MANUFACTURING FARM PRODUCTS

Year	Value of Product ($1,000's) Farm Group	Minn. Total Mfg.	Farm as % of Total	% of Total Milling	All Others (Farm)	Farm as % of U. S. Total	All Minn. Mfg. as % U. S. Total
1889	$67,313	$192,033	35.05	31.33	3.72	0.72	2.05
1899	104,015	223,693	46.50	37.50	9.00	0.94	2.03
1904	161,142	307,858	52.34	39.65	12.69	1.13	2.16
1909	206,872	409,420	50.53	33.98	16.55	1.04	2.05
1914	248,978	493,354	50.47	30.05	20.42	1.08	2.14
1919	663,525	1,218,130	54.47	31.30	23.17	1.11	2.03
1921	440,549	850,447	51.80	29.83	21.97	1.06	2.04
1923	436,905	962,775	45.38	18.42	26.96	0.75	1.65
1925	570,646	1,101,856	51.79	19.57	32.22	0.94	1.81
1927	540,379	1,066,727	50.66	17.36	33.30	0.90	1.77
1929	564,328	1,173,214	48.10	13.55	34.55	0.83	1.73
1931	357,052	719,064	49.66	13.03	36.63	0.90	1.81
1933	270,366	529,733	51.04	15.02	36.02	0.88	1.73
1935	402,204	746,351	53.89	13.55	40.34	0.90	1.66
1937	477,703	937,463	50.96	10.35	40.61	0.79	1.54
1939	422,076	845,772	49.90	7.97	41.93	0.75	1.50

From the foregoing table, the influence of milling is clearly indicated. The value of all products manufactured increased steadily until 1919, when it reached the peak at $1,218,130,000. Simultaneously, the value of the farm group of manufactured or processed products also was at its peak of $663,525,000. This group then represented 54.47% of all manufacturing in the State. Flour milling, which was at its peak in dollar value in 1919, reached its maximum position by percentage in the Census of 1904 at 39.65% of all manufacturing in Minnesota. In the 1904 census year the whole farm group at 52.34% was 1.13% of the

United States total value of products from all manufacturing, and Minnesota manufacturing reached its peak of 2.16% of the United States total.

The position of manufacturing in Minnesota has declined since 1914 following the decline in flour milling. The percentage of all manufacturing in the State represented by the farm industry group has held quite steady around 50%, other industries gaining slowly as flour milling declined, but it has lost ground in the percentage of the United States total value of product. This group has declined from 1.11% in 1919 to 0.75% in 1939 while the decline for all manufacturing in Minnesota has been from 2.03% to 1.50% of the United States total during this period.

There follows a similar table using the "Value Added by Manufacture" for the group of industries processing farm products and for all manufacturing in Minnesota.

MANUFACTURING FARM PRODUCTS

		Value Added by Manufacture ($1,000's)					
Year	Farm Group	Minn. Total Mfg.	Farm as % of Total	Milling %	All Others % (Farm)	Farm as % of U. S. Total	All Minn. Mfg. as % U. S. Total
1889	$9,466						
1899	12,164	$73,394	16.57	12.76	3.81	0.25	1.52
1904	18,706	97,304	19.22	13.36	5.86	.30	1.55
1909	23,680	127,798	18.53	11.67	6.86	.28	1.50
1914	32,609	156,505	20.84	13.37	7.47	.33	1.58
1919	75,436	335,040	22.52	12.95	9.57	.30	1.34
1921	70,020	264,973	26.43	16.72	9.71	.38	1.45
1923	60,885	315,452	19.30	7.22	12.08	.24	1.22
1925	71,363	331,132	21.55	7.76	13.79	.27	1.24
1927	72,413	340,336	21.28	7.89	13.39	.26	1.23
1929	90,094	404,995	22.25	6.82	15.43	.28	1.27
1931	66,746	261,747	25.50	8.22	17.28	.34	1.32
1933	57,950	201,540	28.75	9.05	19.70	.40	1.39
1935	69,895	245,507	28.47	6.95	21.52	.38	1.32
1937	79,314	312,898	25.35	4.53	20.82	.31	1.24
1939	80,514	310,628	25.92	4.38	21.54	.33	1.26

The maximum "Value Added by Manufacture" for all manufacturing in Minnesota was attained in 1929 and the farm products group of manufacturers also added their greatest amount of value in the same year. ($404,995,000 and $90,094,000 respectively). In that year, the Minnesota total represented 1.27% of the United States total value added for all manufacturing. The peak per-

centage of the United States total was reached in 1914 at 1.58% when the total value of product was also close to its high position from the first table.

The percentage of value added by the farm products group of manufacturers to the total of all manufacturing in Minnesota averages about 25% with the highest percentage reached in 1933 at 28.75% of the total. These percentages reflect the change from wheat to farm products requiring more advanced forms of processing.

The second table shows that the value added in processing farm products is not as large in percentage of the United States total as is the total "Value of Products." This adds evidence to the finding that processing of farm products is in the "pure" or slightly "advanced" competitive classifications of manufacturing as discussed later in this section of the report.

In comparing these two tables, it is to be noted that the decline in manufacturing as compared to the United States total is approximately the same; being 18% of the average for the first thirty years in the case of "Value of Product," and 16% of the first twenty-five year average in the "Value Added by Manufacture" table.

Confirming the situation revealed by these two tables, Exhibits III-B-16, III-B-17, III-B-18, and III-I-11 reflect generally similar trends in the manufacture of dairy products.

3. DEVELOPMENT

a. Specific Industries

In order to demonstrate the development of manufacturing in Minnesota through specific industries, one of the oldest, Flour and Other Grain Mill Products, will be presented first. This industry grew so fast in Minnesota that in the United States Census of Manufactures for 1889, it had taken first place in Value of Product and it held this position through the Census Year 1935. Its per cent of the United States Total Value of product rose from 8.22% in 1879 to 21.50% in 1921 after which its percentage of the United States Total Value dropped gradually to 10.38% in 1939. There are no comparable published figures since 1939.

Flour Milling in Minnesota deserves special mention in this report, inasmuch as it early took the premier position as the milling center, both nationally and internationally. Our observations indicate that the rise and decline of flour milling in Minnesota follows the historical pattern of other flour milling centers in the United States, such as Baltimore, Albany, and St. Louis, which lost their position under earlier but similar or identical influences. Flour milling took on economic significance for the State only as production rose above State needs late in the last century and found distribution in national and international

markets. This came with the invention of the purifier and the steel roller processes, which made possible satisfactory milling of the characteristically hard protein wheats of Minnesota and the Northwest.

Wheat flour production in Minnesota and principally in the city of Minneapolis rose to about 29,400,000 barrels in 1916. In 1900, some 5,500,000 barrels of Minnesota Flour found outlet in foreign markets. Minnesota flour production was at its height from 1909 to 1920, when the output averaged 26,500,000 barrels; Minneapolis alone producing an average of 16,000,000 barrels with a maximum of over 20,000,000 barrels in 1915-1916. Minnesota's production was then one-sixth of the United States total. After 1920, a persistent decline was noted. These facts are obtained from the following table of flour production and wheat raising in Minnesota:

MINNESOTA FLOUR AND WHEAT PRODUCTION

Year	No. of Flour Mills	Daily Flour Capacity (Bbl.)	Total Flour Production (Bbl.)	Flour Exported (Bbl.)	Wheat Crop (Bu.)
1900	324	140,000	22,705,000	*4,702,485	51,509,000
1909	322		22,771,362	2,051,000	94,080,000
1916	274	154,445	29,389,889	1,410,970	26,410,000
1929	160	143,050	20,710,923	28,028	7,977,000
1940	81	71,395	11,153,594	* 22,290	32,069,000
1941	75	70,400	11,244,203	* 30,458	20,104,000

* Minneapolis figures only.

After 1920, Minnesota flour distribution was almost wholly confined to the United States. Former export markets, generally speaking, had completely disappeared. Factors contributing to this decline are as follows:

(1) During this time per capita annual consumption of flour fell from over 200 lb. to less than 160 lb.

(2) Great progress was made in diversified farming. The production of easily and quickly grown cash grain crops, particularly wheat, on newly broken lands gave way to new and more extended culture of perishables and semi-perishables, which have proven far more remunerative to the producer.

Meanwhile, bread wheat supplies available to Minnesota millers from the Dakotas, flowing through Minnesota gateways (which at one time represented 25.7% of the bread wheat supply of the nation), had declined to 16.1%.

(3) Pioneer expansion in other sections of the country, particularly in the Southwest, and the discovery and development of new types of winter wheat rivalling in bread production qualities the Northwest's spring wheats, reduced the high preference and premium for hard spring wheats which Minnesota and other Northwestern states had formerly enjoyed both in the domestic and foreign markets.

(4) Shifts in the center of population, together with new freight rate bases, gave advantages to these new areas of wheat production at the expense of Minnesota and the Northwest.

(5) In its early history, Minnesota millers were aided in building up their business by schedules of freight rates which competing states subsequently claimed were unduly favorable. This structure of so-called favorable rates was gradually destroyed by decisions of the Interstate Commerce Commission. Thus the elimination of "milling in transit privileges" originating in certain areas, which Minnesota millers had formerly enjoyed, tended further to compress the raw material sources which were necessary to replace the declining wheat production in Minnesota.

(6) Uncontrolled lake freight rates, representing one of the cheapest forms of transportation for bulk products, made available to down-lake millers a wide range of both Northwestern spring and Southwestern hard winter wheats through the Duluth, Chicago, and Milwaukee gateways on a basis of wide advantage. This enabled these mills to reach advantageously into both the Eastern seaboard markets, as well as certain sections of the Central states on a more favorable basis than Minnesota mills. In addition, down-lake mills also enjoy the privilege of milling in bond for export Canadian wheat flowing from lake ports.

Under these conditions, Minnesota suffered an almost impossible handicap in the broader markets it formerly enjoyed. Minnesota's distribution, both nationally and internationally, became increasingly restricted. Its place as premier milling center gave way to Buffalo and Kansas City.

Flour milling is a more or less simple conversion of a primary product, wheat, into a usable form. Selling prices are sensitive to fluctuations in the prices of the raw material and are adjusted almost daily to the fractional change in price of the wheat. Average returns on the sales dollar range from little or nothing to $0.02, and in exceptional years, possibly $0.05. It will be seen from the close margin on which millers operate that small and seemingly insignificant influences are magnified in their results.

For example, a recent decision by the Supreme Court permitting individual states to tax gross income of business done in the receiving state results in a

multiplicity of taxes—those imposed by Minnesota and by the receiving state. This multiplicity of taxation will have further adverse effect on flour milling in Minnesota.

In the disappearance of the number of flour mills in Minnesota from a high of 349 in 1907 to 75 as of 1941, it will be noted that for the most part these represent complete eliminations because of declining opportunities. A few of the larger milling companies have moved a considerable portion of their manufacturing facilities to other and more advantageous locations outside of the State. For the most part, these companies still retain their main headquarters offices in Minnesota. Interviews with some of the chief executives of these companies indicate that the retention of headquarters is in part due to sentiment and that a new generation may not be similarly persuaded against advantages of location offered by other states.

The Paper and Pulp Industry grew in importance, reaching 2.55% of the United States total value of product in 1919 and falling off slowly from then to 2.10% in 1939. It reached 9th place among the states in 1919 and had dropped to 13th in 1935, the last year for which the ranking is available.

The processing of pulpwood is a clear example of the economic value of manufacturing to the State. In 1943, pulpwood was worth about $12.00 a cord but the processed products had a value of $65.00 which represents $53.00 of "value added by manufacture." About 35 to 40% of the pulpwood cut in Minnesota was processed in Wisconsin mills. Respective quantities in 1943 were:

700,000 cords cut in Minnesota

300,000 cords shipped to Wisconsin.

Minnesota stood 4th in 1890 for Lumber and Timber Products and 10th for the Planing Mill Industry; the former declined from 1890 to 20th place in 1935 (0.56% of U. S. total value), while the latter was in 8th place in 1904 and then declined to 14th place in 1935 (2.45% of U. S. total value).

Meat Packing, Malt Liquors, Bread and Other Bakery Products, Butter, Canning and Preserving, Malt, and Non-Alcoholic Beverages, are all industries of the Food Group which grew gradually over the years from 1879 to 1939. They reached different national rankings in value of product, as follows:

Meat Packing—Second place in 1937.

Bread and Other Bakery Products—11th place in 1909, but 15th place in 1935.

Butter—First place in 1921 and each census since then.

Canning and Preserving — 13th place in 1933 and 1935.

Malt — 2nd place in 1935.

Non-Alcoholic Beverages have no national ranking of any consequence, declining since 1900.

Poultry Dressing appears for the first time in the Census Year 1919 when it was ranked 8th. After 1933, its ranking improved each year to reach 2nd position in 1935.

The News Printing Industry has declined gradually in the per cent of United States total since 1899, when it was 2.60%, to 1.78% in 1939, based on Value of Product. Printing of Books has increased during this period from 1.55% to a high of 3.00% in 1933 and then down to 2.47% in 1937, with no figures available for 1939.

The Heating and Cooking Apparatus Industry was first reported in 1904 and the industry in Minnesota has gained quite steadily since then to reach a high value of 3.58% in 1937. Again there are no figures available for 1939.

Refrigerators were reported first in 1927 with Minnesota given as 8.81% of the United States total value of product. This value went up to 9.94% in 1939, dropped to 2.34% in 1933 and was 4.62% in 1937.

Drugs and Medicines is an industry that has varied considerably for Minnesota, but never has shown much importance. It was 3.16% of the United States total value in 1914 and 1.94% in 1937, after being down below 1% in 1931.

Marble, Granite and Stone Work, and Concrete Products are industries which have grown since 1879, the former to 4th ranking in 1933 and 5th in 1935 (6.11% of United States total value) while the latter went down from a high of 9.46% of United States total value in 1921 to 2.13% in 1927 and then up to 3.81% in 1935.

Foundry and Machine Shop Products, Sheet Metal Work not specifiically classified, Electrical Machinery, Machinery not elsewhere classified, Cranes and Dredging Machinery, Structural Iron, and Pumps and Equipment are metal industries which have been changed materially in recent Censuses. Most of these show little, if any, tendency to increase in percentage of United States total value. Those having "manufacturing-population ratio" exceeding unity are Sheet Metal Work with 3.36% of United States total value in 1937 and Cranes and Dredging Machinery at 3.37%, or 1.58 and 1.59 "manufacturing-population ratio", respectively.

The Furniture Industry and the Bed Spring and Mattress Industry have declined, the former from a high of 1.61% in 1889 to less than 1% in 1937 and the latter from a high of 4.61% of United States total value in 1919 to 2.83% in 1937.

The Confectionery Industry went up from 1889 to a high of 2.75% in 1927 and then declined to 1.89% in 1937. The Ice Cream Industry was separated from Confectionery in 1923 and has remained quite steady around 2%, being 1.83% in 1937.

Feeds, Prepared for Animals and Fowls, and Cereal Preparations were re-

cently separated and figures for Minnesota are rather vague. The latter is given as 3.74% of United States total value in 1937 and the former as 1.59%.

Wood Preserving is a recent industry classification which reached a high of 6.33% of United States total value added in 1937.

Linseed Oil has been a rapidly growing industry from 1879 to 1909 when it reached the high of 30.04% of the United States total value and then declined to 15.86% in 1937. The State of Minnesota nevertheless has retained first place ranking in Value of Product since 1929 before which it was placed 2nd. Paints, Pigments, and Varnishes have not grown with the Linseed Oil Business, being less than 1% of the United States total value since 1914.

The Photoengraving Industry is allied with printing, but has been reported separately since 1879. It grew in Minnesota to a high of 3.95% of United States total value in 1914 and has since declined to 1.60% in 1933, but rose to 2.54% in 1937, which is about the same as the Book Printing Industry.

Exact figures for 1937 in the related clothing group of industries were not available, but they are important industries to the State. The Knit Goods Industry has grown since 1879 to 1.96% of the United States total value in 1919 and then declined to 1.19% in 1935. Men's Clothing Iudustry has not exceeded 1% to any extent while the Women's, Misses' and Children's Apparel Industry in Minnesota has always been less than 0.5% of the United States total value.

These industry classifications represent three types of competitive manufacturing in Minnesota, the total of which can be summarized in the following table. In order to complete this table, it has been necessary to add to the three industries specifically mentioned the classifications of Railroad Repair Shops, Coke-Oven Products, Motor Vehicle Bodies and Parts, Dresses, and Boots and Shoes.

Competitve Type	No. of Industry Classifications	Percentage of Minnesota Total Value Added (1937)	Prorated On 100% Basis
"Pure"	23	33.00	42.05
"Advanced"	20	39.85	50.78
"Imperfect"	2	5.63	7.17
TOTALS	45	78.48%	100.00%

"Pure" Competition — Basically competitive, price governing sales.
"Advanced" Competition — Partially competitive, price only a factor in sales.
"Imperfect" Competition — Practically Non-Competitive, price relatively unimportant influence in sales.

The 45 industries are those which reported the greatest amount of value added by manufacture in the 1937 Census but all of the most important indus-

tries are not included. This is due to the census rule that three or more establishments must report in a classification and publication of data by the Census Bureau is not permitted when it would have disclosed the individual manufacturer's vital statistics. This excludes some industries in Minnesota which are represented by only one or two large manufacturers but the above figures are substantially correct and can be prorated for all manufacturing in Minnesota as shown in the last column. Some industries not listed by the Minnesota Resources Commission were not included in this tabulation but they were interviewed and these results included in the Sampling Survey of Manufacturers.

Thus the competitive position of manufacturing in the State is approximately represented. About 42% of all industry is highly competitive with approximately 7% having a preferred product that is not deeply affected by competition. To maintain their sales volumes, at least 93% of the industries are dependent on the net results of the effects of local freight rates, labor costs, fuel costs, and tax burdens.

The "Value Added by Manufacture" increases in relation to the total value of the product as the degree of competition decreases. This is shown for the three competitive types of manufacturing in Minnesota in the following table which compares the percentage of "Value Added by Manufacture" with the percentage of "Value of Product".

PERCENTAGE OF ALL MANUFACTURING

Competitive Type	Value Added by Manufacture	Total Value of Product	Ratio of Value Added to Value of Product
"Pure"	42.05%	62.29%	0.675
"Advanced"	50.78	34.69	1.464
"Imperfect"	7.17	3.02	2.374
	100.00%	100.00%	

b. Wealth in Minnesota

The following table shows the Wealth of Minnesota in comparison with the total wealth of the United States both in dollars and percentage. The peak was reached in 1904 at 3.12% of the United States total, with an almost steady decline since to 1.72% in 1937. Per capita values for Minnesota and the United States are also indicated. Minnesota exceeded the United States average up to 1925 but has not equalled the average since then. Iowa was higher than the average except in the period from 1927 to 1933 and Wisconsin has been higher since 1924. This decline is reflected in studies of leading industries such as Flour

and Other Grain Mill Products, Paper and Pulp, Concrete Products, Confectionery and Linseed Oil.

MINNESOTA WEALTH

Year	AMOUNT IN MILLIONS		% U.S. Wealth	PER CAPITA	
	United States	Minnesota		United States	Minnesota
1890	$65,037	$1,692	2.60	$1,036	$1,300
1900	88,517	2,514	2.84	1,165	1,435
1904	107,104	3,344	3.12	1,318	1,729
1912	186,300	5,432	2.92	1,950	2,529
1922	320,804	8,548	2.66	2,918	3,442
1922	300,825	8,115	2.70	2,738	3,340
1923	302,887	7,445	2.46	2,716	3,041
1924	299,649	6,779	2.26	2,647	2,750
1925	300,689	6,384	2.12	2,618	2,572
1926	303,374	6,055	2.00	2,603	2,423
1927	319,869	6,089	1.90	2,706	2,419
1928	334,248	6,187	1.85	2,789	2,442
1929	347,068	6,367	1.83	2,856	2,496
1930	337,483	6,060	1.80	2,742	2,359
1931	315,049	5,635	1.79	2,538	2,180
1932	293,064	4,969	1.70	2,345	1,914
1933	282,512	4,908	1.74	2,246	1.883
1934	276,556	4,629	1.67	2,184	1,767
1935	279,390	4,774	1.71	2,191	1,817
1936	294,481	5,057	1.72	2,293	1,919
1937	300,750	5,178	1.72	2,335	1,900

(These statistics are presented in chart form in Exhibit V-K-1)

By wealth is meant the value of land (comprising 54% of the national total), stocks of goods, public utilities and other productive assets. There is no general agreement on the components of a national wealth total. The foregoing table has been prepared from statistics published by the United States Census of Manufactures for the years 1890 through 1922, and from data assembled by The Conference Board from "Studies in Enterprise and Social Progress" from 1922 through 1937. The two figures for 1922 are in substantial agreement. Data compiled by The Conference Board are based upon the appraised value of land; the value of farm implements and machinery, livestock, manufacturing machinery and tools, motor vehicles, and goods in hands of producers and consumers, all as reported by the United States Census Bureau. The appraised

value of all Public Utilities is also included. Value of goods in hands of producers includes farm products in the hands of farmers, manufactured goods in the manufacturing plants, mined products at the mines, and goods in the hands of dealers, both wholesalers and retailers.

4. Present Conditions

There has been an increase in employment in Minnesota during this war period which is indicated as approximately 100% over 1939 employment. It also is probable that the volume of business has doubled. No figures are presently available to show the effect in Value Added by Manufacture or Value of Product.

Minnesota factories have enjoyed war prosperity. This is a false picture, however, as all economic considerations and transportation factors have been ignored. Competition has been negligible and price consideration a minimum. The labor market has been given utmost consideration in the placing of war orders, expansion of plants and construction of new facilities. Railroad facilities, adequacy of water supply, availability of ample power, and the housing conditions have also been factors which have helped Minnesota to expand manufacturing during the war.

A number of graphs have been made from the data published by the United States Census of Manufactures showing the trends in the more important industry classifications. Minnesota is compared with neighboring states in these charts and also with the leading state in each industry. Two graphs were made for each of the nine leading industries and these are found in Exhibits III-I-3 through III-I-11. These charts show the "Total Value of Products" in per cent of United States total for the selected states and the "Value Added per Wage Earner" in thousands of dollars. It is largely conjecture as to what has happened during the period since the 1939 Census of Manufactures was published by the Government. The available data are too indefinite to be used in bringing these charts up to date.

5. Trends in Manufacturing, 1939 through 1943

The industries are discussed in order of their importance within the State and where certain industries are skipped, data for comments were insufficient. Some of the data reported were obtained by personal interviews, the balance from available statistical sources.

a. Meat Packing — Rank 1st, See Exhibit III-I-3

There has been an increase in the Meat Packing Industry which in 1943 approximately doubled the volume of business for 1939. Employment in the packing firms interviewed increased from approximately 6,750 in 1939 to

10,500 in 1943. This is an increase of 56% which applied to the United States Census of Manufactures Number of Wage Earners for 1939 of 8,801 raises the employment to 13,728 in 1943.

b. News Printing — Rank 2nd, See Exhibit III-I-4

There has been an increase of 10% in the number of wage earners in the News Printing Industry from 1939 to 1943, as indicated by the firms interviewed. The Census of 1939 gives 3,108 wage earners in this industry and, applying the 10% increase, gives 3,420 employees for 1943. Interviews showed an increase of about 20% in the volume of business from 1939 to 1943.

c. Malt Liquors — Rank 3rd, See Exhibit III-I-5

Interviews with brewers indicated no increase in the number of employees. The volume of business in the Malt Liquors classification has decreased due to Federal limitations, but no data are available to extend the charts prepared from United States Census figures through 1939. The same employment with a decrease in the volume of business is explained by the replacement of men with women and the work being too heavy for one woman to replace one man.

d. Book Printing — Rank 4th, See Exhibit III-I-6

Interviews with manufacturers in the Book Printing Industry, including Commercial Printing, indicated an increase in employment of 27% from 1939 to 1943. The volume of business appears to have more than doubled from 1939 to 1943, but the United States Census of 1939 made a change in classifications which did not permit comparison so that the charts are not extended beyond 1937.

e. Flour and Other Grain Mill Products — Rank 5th, See Exhibit III-I-7

Employment in the Flour Milling Industry is up about 1.22% according to the data received from interviews with millers, but this increase is complicated by the fact that Cereal Preparations and Prepared Feeds classifications are included in these employment statistics. This same condition exists in regard to data on the volume of business, which appears to be up since 1939, and prevents comparison for extension of the charts beyond the values reported in the United States Census of 1930.

f. Bread and Other Bakery Products — Rank 6th, See Exhibit III-I-8

Interviews with bakers indicated an increase of about 13% in the number of employees from 1939 to 1943. This increases the United States Census figure for 1939 to approximately 4,445 for 1943.

g. Heating and Cooking Apparatus — Rank 7th, See Exhibit III-I-9

Manufacturers in this classification are engaged almost exclusively in war work and the information is, therefore, not comparable with the data on which the charts are based. Employment is up 200% over 1939 for the manufacturers interviewed, while the volume of their business has increased 300% from 1939 to 1943. The United States Census reports for 1939 are not comparable with previous years due to changes in classifications of industries so that the charts are not plotted beyond the year 1937.

h. Paper and Pulp — Rank 8th, See Exhibit III-I-10

Employment in the Paper and Pulp Industry has increased about 30% from 1939 to 1943 in the firms interviewed. This increase is not clearly defined, however, as one of the paper manufacturers is also included in the classification "Lumber and Timber Products". This makes it inappropriate to extend the chart beyond 1937, as the employment figures are not strictly comparable with the United States Census of 1939.

i. Butter — Rank 9th, See Exhibit III-I-11

Employment in the firms interviewed, which are engaged in the dairy products business, has increased about 30% from 1939 to 1943. The classifications for dairy products used by the United States Census of Manufactures include Butter, Cheese, Condensed and Evaporated Milk, Ice Cream and others. Volume of business for the firms interviewed has about doubled from 1939 to 1943, but the combined classification prevents any extension of the charts.

j. Canning and Preserving — Rank 13th

The number of wage earners employed by the firms interviewed in the Canning and Preserving Industry has increased about 24% from 1939 to 1943. Here again there is a breakdown of classifications by the United States Census which makes it impossible to differentiate the figures available. Furthermore, the Census data do not include part time employees, which constitute a large part of the total number employed in this industry. The volume of business for these firms has increased about 64% from 1939 to 1943, but these statistics are also complicated with other classifications.

k. Refrigerators — Rank 14th

Employment in the Refrigerator Industry by the manufacturers interviewed has declined during the period from 1939 to 1943, as has their volume of business, due to restrictions on the use of materials.

l. Drugs and Medicines — Rank 15th

Interviews did not produce sufficient information about this industry to offer any definite statements as to the trend in this business beyond 1939.

m. Planing Mill Products — Rank 16th

Employment in the Planing Mill Industry has decreased about 25% from the 1939 level as revealed by interviews, due to Government restrictions. The volume of business is also down by 25% from 1939 levels. This decline in business follows the trend in this industry since 1914.

n. Malt — Rank 17th

The result of interviews shows an increase of about 13% in employment in the Malt Industry from 1939 to 1943. The use of malt is less in the Malt Iiquors Industry, but it has increased in the distilling industry. Applying this increase percentage to the United States Census figure for 1939, gives total employment of 260 for 1943. The trend is in accordance with that preceding 1939.

o. Marble, Granite and Stone Work — Rank 18th

Interviews indicated a 10% increase in employment in the Marble and Other Stone Industry from 1939 to 1943. The number employed in 1943 then is 1,160, based on this percentage of increase since 1939.

p. Cereal Preparations — Rank 20th

Data on the Cereal Industry is quite indefinite because of the restrictions in the law which prevent the United States Census from publishing figures which would divulge information about individual manufacturers. Interviews, which included some of the Flour Millers manufacturing Cereal Preparations, indicated an increase in employment of 21% from 1939 to 1943. This would mean approximately 375 employees in 1943 on the basis of the 1939 Census number. An increase in volume of business of better than 50% is indicated.

q. Lumber and Timber Products — Rank 21st

As stated before, figures for this industry were combined with those for the Paper and Pulp Industry.

r. Foundry and Machine Shop Products — Rank 22nd

The United States Census statistics for this classification are not comparable since 1937 because of changes in their reporting. Firms coming within this classification have been entirely on war work for some time and have greatly expanded their plants, or are operating Government owned plants, and their employment is up about 600% since 1939.

s. Furniture — Rank 26th

Interviews revealed that employment in the Furniture Industry is down since 1939 by possibly 25% to 33%. These results do not appear comparable with those of the United States Census as they include floor coverings and bedding. Likewise, data on value of business are indefinite but the trend has been downward along with employment figures.

t. Sheet Metal Work — Rank 27th

Interviews with manufacturers in this category included only can manufacturers and it is not clear from the United States Census reports whether these can manufacturers are included by them in this classification. An increase in employment of about 33% is indicated from 1939 to 1943.

u. Ice Cream — Rank 28th

The manufacturers interviewed were unable to separate their figures for the several classifications of industry covered in their operations, as stated under "i. Butter". Due to Government restrictions, employment in this industry may be less than in 1939.

v. Confectionery — Rank 33rd

This industry was combined with other classifications in the interview data, but it is indicated that employment is 25% less in 1943 than in 1939, due to Government restrictions.

w. Beverages, Non-Alcoholic — Rank 34th

No information was obtained from interviews that would warrant comments on this industry except that it is also subject to Government restrictions because of the war.

x. Wood Preserving — Rank 35th

Data on this industry are combined with Paper and Pulp, and Lumber and Timber Products.

y. Poultry Dressing — Rank 36th

This industry is combined with the Meat Packing Industry in the data obtained from interviews. There is an apparent increase in employment in the Poultry Dressing classification of about 30%. The industry is definitely growing but for the war period no dollar figures could be obtained.

z. Linseed Oil — Rank 38th

An increase in employment of about 150% is indicated from 1939 to 1943, but data on the Linseed Oil Industry is combined with the Milling Industry and the Paints and Varnishes Industry in the interviews.

aa, Photoengraving — Rank 39th

The Photoengraving Industry is included with Printing of News and Books in the interviews and cannot be separated.

bb. Paints and Varnishes — Rank 40th

As stated under Linseed Oil, the Paints and Varnishes classification is included in these interviews and cannot be separated therefrom.

6. Sampling Survey of Manufacturers

As a factor of outstanding economic importance in the State, manufacturing differs from other industries, such as agriculture, forestry and mining, in that factories can be moved while farms, forests and mines cannot.

Migration of industry within this country can become a circumstance of extraordinary moment as typified by the migration of the cotton mills from New England to the South, of negro labor from the South to the North, of workers from the East and Central States to the Pacific Coast due to developments related to the present war.

In the case of Minnesota, it is important to analyze what considerations can bring about removal of industrial plants from the State and, conceivably, what can invite entrance into or development within the State.

In the following, certain of these determining elements and their conceivable effect are discussed, followed by the results of a series of interviews which can only be viewed as a sampling of the situations experienced during this investigation.

a. Classifications

Forty-five classifications of manufactures, as used by the United States Census Bureau, comprise about 78% of the total manufacturing for the State of Minnesota. In the course of the survey, what is estimated to have been between 60% and 65% of the manufacturers of the State were interviewed in order to develop a general impression, though not exhaustive, with respect to the status of this branch of industry within the State.

This estimate of 60% to 65% of all Minnesota manufacturers is based on various methods of measurement including indices primarily founded on the extent of employment by the manufacturers interviewed.

b. Interviews

The following tabulations summarize the results obtained from personal interviews with officers of manufacturing concerns. These results were divided

into groups, viz. Foods, Iron and Steel Products, Electrical Machinery, and Printing. All others are classified as Miscellaneous.

Because of the effect on the industry of the market for manufactured products, each group was further divided into three categories as to markets, as follows:

1. Manufacturers having a nation-wide market or a sectional market for their product, these sections varying from coast to coast.

2. Manufacturers having the Northwest market for their product. This area is generally the Ninth District of the Federal Reserve Bank (Minnesota, part of Wisconsin, North and South Dakota, Montana and part of Michigan). Part of Iowa also is often included in this market area.

3. Manufacturers having a local market, usually the Twin Cities area, but also covering the State of Minnesota.

In these tabulations, the first column indicates the market, the second column gives the total number of interviews, and the balance of the table lists the number of manufacturing firms who consider each specific item a disadvantage and the percent of the total interviews represented by this number.

It has been assumed in these tabulations that the percentage of complaints is in direct proportion to the percentage of actual disadvantage. It is clearly recognized that no section of the country is ideal for manufacturing but the scope of this report does not permit the rational determination of the factors which govern the industrial position of Minnesota with respect to the remainder of the country.

c. Tabulation of Results

BUSINESS DISADVANTAGES

FOOD GROUP

Market	No. of Interviews	Freight No. %	Labor No. %	Fuel No. %	State-Local Business Taxes No. %	State-Local Personal Taxes No. %
1. National & Sectional	19	13= 68	8=42	9= 47	10= 53	9=47
2. Northwest	9	9=100	2=22	1= 11	5= 56	2=22
3. Local	4	None	1=25	2= 50	3= 75	None
Total	32					
Average Disadvantage (%) (All Markets)		69	34	38	56	34

Market	No. of Interviews	Freight No. %	Labor No. %	Fuel No. %	State-Local Business Taxes No. %	State-Local Personal Taxes No. %
IRON & STEEL PRODUCTS GROUP						
1. National & Sectional	14	12= 86	2=14	7= 50	13= 93	7=50
2. Northwest	5	5=100	2=40	2= 40	4= 80	3=60
3. Local	None					
Total	19					
Average Disadvantage (%) (All Markets)		90	21	47	90	53
ELECTRICAL MACHINERY GROUP						
1. National & Sectional	6	2= 33	None	1= 17	2= 33	4=67
PRINTING GROUP						
1. National & Sectional	4	None	1=25	None	2= 50	1=25
2. Northwest	2	None	None	None	None	None
3. Local	2	None	None	1= 50	2=100	None
Total	8					
Average Disadvantage (%) (All Markets)		None	13	13	50	13
MISCELLANEOUS GROUP						
Processed Raw Materials from Outside Northwest Area						
1. National & Sectional	11	10= 91	4=36	7= 64	9= 82	7=64
2. Northwest	8	5= 63	4=50	3= 38	6= 75	2=25
3. Local	1	1=100	None	1=100	None	None
Total	20					
Average Disadvantage (%) (All Markets)		80	40	55	75	45
Processed Raw Materials from Northwest Area						
1. National & Sectional	7	3= 43	2=29	None	3= 43	3=43
2. Northwest	1	1=100	None	None	None	None
Total	8					
Average Disadvantage (%) (All Markets)		50	25	None	38	38

ALL GROUPS (SUMMARY BY SOURCE OF RAW MATERIALS)

Market	No. of Inter-views	Freight No.	Freight %	Labor No.	Labor %	Fuel No.	Fuel %	State-Local Business Taxes No.	State-Local Business Taxes %	State-Local Personal Taxes No.	State-Local Personal Taxes %
Processed Raw Materials from Northwest Area											
1. National											
Foods	19	13		8		9		10		9	
Miscel.	7	3		2		—		3		3	
Printing	4	—		1		—		2		1	
Totals	30	16	53%	11	37%	9	30%	15	50%	13	43%
2. Northwest											
Foods	9	9		2		1		5		2	
Miscel.	1	1		—		—		—		—	
Printing	2	—		—		—		—		—	
Totals	12	10	83%	2	17%	1	8%	5	42%	2	17%
3. Local											
Foods	4	—		1		2		3		—	
Miscel.	—	—		—		—		—		—	
Printing	2	—		—		1		2		—	
Totals	6	None		1	17%	3	50%	5	83%	None	
Grand Total	48										
Average Disadvantage (All Markets)		(%)	54		29		27		52		31
Processed Raw Materials Not in Northwest Area											
1. National											
Iron & Steel	14	12		2		7		13		7	
Miscel.	11	10		4		7		9		7	
Electrical Machy.	6	2		—		1		2		4	
Totals	31	24	77%	6	19%	15	48%	24	77%	18	58%
2. Northwest											
Iron & Steel	5	5		2		2		4		3	
Miscel.	8	5		4		3		6		2	
Electrical Machy.	—	—		—		—		—		—	
Totals	13	10	77%	6	46%	5	38%	10	77%	5	38%
3. Local											
Miscel.	1	1	100%	None		1	100%	None		None	
Grand Total	45										
Average Disadvantage (All Markets)		(%)	78		27		47		76		51

ALL GROUPS (GRAND SUMMARY) BUSINESS DISADVANTAGES

Market	No. of Interviews	Freight No. %	Labor No. %	Fuel No. %	State-Local Business Taxes No. %	State-Local Personal Taxes No. %
1. National						
Local Materials	30	16	11	9	15	13
Outside Materials	31	24	6	15	24	18
Totals	61	40=66%	17=28%	24=39%	39=64%	31=51%
2. Northwest						
Local Materials	12	10	2	1	5	2
Outside Materials	13	10	6	5	10	5
Totals	25	20=80%	8=32%	6=24%	15=60%	7=28%
3. Local						
Local Materials	6	—	1	3	5	None
Outside Materials	1	1	—	1	—	—
Totals	7	1=14%	1=14%	4=57%	5=71%	None
Grand Total	93					
Average Disadvantage (%) (All Markets)		66	28	37	63	41

d. Indications from Tabulation of Interviews

Manufacturers in the Food Group find freight rates have no effect whatever in the local market. All of those operating in the Northwest Market find themselves confined to that market by the rates. Of the group operating in the larger Sectional or National Market, 68% find freight rates to be a disadvantage. Generally, those manufacturers in the National Market who are not handicapped by freight rates have branch plants in other parts of the United States. Out of 32 interviews in the Food Group, 22 firms were affected to a disadvantage by freight rates, or 69%.

The labor disadvantage claimed is nearly twice as much for those manufacturers having a national market as for those in Northwest or local markets.

The disadvantage due to fuel costs is about the same for national and local markets, but is of slight importance in the Northwest market. State taxes on businesses are considered a burden by all market groups. The State personal

tax effects the national market group most, while the local manufacturers do not complain.

The same explanation is applicable to the tabulations for the Iron and Steel Products, Electrical Machinery and Printing Groups. It is to be noted that the Iron and Steel Group have no manufacturers with a local market, while all in the Electric Machinery Group have a national market for their products. The per cent of disadvantage is higher for each item in the Iron and Steel Products Group than for the other groups. The Printing Group has a disadvantage in taxes only. Practically all shipments by this latter group are express shipments so that freight rates are not a factor.

The Miscellaneous Group, comprising about 17 classifications of industry, is divided into 2 groups according to the source of their raw materials, either from outside of the Northwest Area or from the State of Minnesota. There are no manufacturers in the second half of this group whose products are confined to the local market. The per cent of disadvantage for these manufacturers who process raw materials from outside of the Northwest Area is higher in each case than for the manufacturers using local raw materials. The disadvantages are not as high in percentage as for the Iron and Steel Products Group (except for the Fuel Item) but are higher than for the other groups.

Results for these 5 groups are tabulated in a summary depending on the source of their raw materials; first, "Processed Raw Materials from Northwest Area", and second, "Processed Raw Materials Not in Northwest Area". The disadvantage per cents are much higher for the second grouping than for the first group, except in the case of labor which is substantially the same.

A grand summary of all groups of manufacturers by markets shows a variation in the per cent disadvantage for the different markets which is not as pronounced as for the individual groups of manufacturers. Labor shows the least disadvantage in the total percentages.

e. General Character of Interviews

Questions along the following lines were asked of manufacturers as to the disadvantages found in marketing their products:

(1) Freight Rates

Did freight rates limit the market? Were they added to the buyer's price? Did they have any effect? — and any other general information which might be offered. The answers were summarized as "Yes" or "No" in the tabulations of disadvantages.

(2) Labor Relations

Was there a Union Shop — Closed Shop? Was the check-off used? How did the wage scale compare with competitors? What was the number of em-

ployees (past, present and expected postwar)? What was nature of labor supply and general labor conditions? The labor situation was then summarized for the tabulations as "Yes" or "No", principally on the basis of competitive wage disadvantage.

(3) Fuel

They were asked about the type of fuel used (coal, gas or oil), their opinions of the prices and the effect on their business. A combined "Yes" or "No" answer as to any disadvantage was formulated for the summaries of interviews.

(4) Business Taxes

Manufacturers were asked about the Minnesota State and Local Taxes, divided into real estate, personal property, income, monies and credits, and other miscellaneous taxes. Specifically, they were asked whether, in their opinion, the taxes were low, normal, or high and what was the effect on their business. Under the personal property tax, they were asked the state of their inventory on May 1st compared to other inventory periods, and the assessed value of their plant and equipment with relation to their book figures. The answers were summarized as "Yes" or "No" in tabulating tax disadvantages.

A summary of the answers to these questions as to the disadvantage of specific taxes follows:

Type of Tax	Reported as DISADVANTAGE TO BUSINESS Number	% of Interviews
Income Tax		
Company	44	47%
Individual	38	41
Personal Property Tax	24	26
Real Estate Tax	5	5
Monies and Credits Tax	9	10
General (all taxes)	36	39

(5) Personal Taxes

They were asked as to the effect of Minnesota State and Local Taxes on individuals who are owners or officers of the company and if this was a condition which adversely affects the business.

f. Summary of Interviews

From these tabulations it can be stated that the manufacturers who obtain their raw materials mainly from the Northwest area are at a lesser disadvantage than those manufacturers who must bring in their raw materials from other sections of the country, as the latter group have freight costs both on incoming

and outgoing materials. Approximately the same number of manufacturers were interviewed in each of these two groups so that the results are uniformly weighted. The labor conditions are about the same for each group, as is logical. All other disadvantages show a greater percentage for those manufacturers who must get their raw materials from a distance. This also is logical, as each adverse condition magnifies the importance of the others. Manufacturers having a national or sectional market must sell against greater competition, which may mean a lower profit for the Minnesota manufacturer. Transportation costs have to be absorbed in the selling price, although there are some plants which sell f.o.b. Twin Cities, without any advantage either way.

In this group are also included manufacturers who have markets only in certain sections of the country, depending upon the product, and their markets may vary between the Atlantic and the Pacific Coasts. Freight rates and the source of raw materials largely control the area in which such goods can be marketed.

In general, manufactured products can be shipped from the Twin Cities until they meet a zone of freight rates equal to those from other locations where competitors have plants. Some products can be manufactured in Minnesota and shipped to the Pacific Coast, but only when there are no competing factories in the Pacific Coast area. This also applies to the Southwest and the southern part of the country. It is seldom that products manufactured in Minnesota can be shipped into the Industrial East, which is the large center of population with the greatest market.

The Northwest territory generally is the natural market for products manufactured in Minnesota because of favorable freight rates. For many items, however, goods shipped from the East via the Panama Canal meet the price of Minnesota manufacturers' products in the middle of Montana. Competition from the eastern manufacturers is not too great in this territory however, although in some lines, Chicago manufacturers have an equal opportunity on freight rates. Many branch plants of national manufacturers are located in Minnesota for the business in the Northwest territory, indicating that this is the natural market.

The Survey of Manufacturers, when tabulated according to market, divides the manufacturing industry approximately as follows:

Market	Percentage of Manufacturers
National	45%
Northwest	30%
Local	25%
	100%

In the group of local manufacturers are those industries which serve other local industries and consumers in nearby areas. The commercial printing industry gets business largely from other local establishments. This also applies to many manufacturers of various consumer goods, for which the population of the Twin Cities provides a good market. Many food producers are in this group. The perishable nature of food products limits the distance to which they can be transported, and favors only a local market. Branch factories are located in centers of population to share this business, as there can be little competition from manufacturers in other sections of the country.

Because the advantages to the citizens are so evident and universally acknowledged, it is a natural ambition in all areas and among all peoples to encourage and develop manufacturing. It is possible to manufacture in almost any locality. However, if the business is to be successful, the articles must be produced at a cost which will permit their sale in competition with similar articles manufactured elsewhere under possibly more favorable conditions. The cost of manufactured articles (at the point of delivery to the ultimate consumer) includes many extremely valuable elements.

Both the proximity and quality of raw materials are important. If the required materials must be transported relatively long distances from the source of supply, the cost of such transportation or the time during which the material is in transit may be of major importance. When articles are sold over a large area in competition with plants more favorably located with respect to raw materials and labor, it is not uncommon to find that the cost of transportation of the finished article is a serious if not a major factor in limiting the area in which a given article can be sold.

If the quality is inferior, its use soon ceases. When the finished article is a highly complex mechanism requiring expert and careful workmanship, such as a watch or other delicate instrument, the quality of the workmen is of primary importance. Fuel may be an important item in a cold climate, or location where it must be transported long distances. The initial cost of the plant is generally a large factor in the cost of the product which must include allowance for interest on the investment as well as depreciation of the plant and equipment.

The taxes paid by business have become a progressively increasing element of the cost of manufactured articles. Since the rates and forms of taxation vary widely in different localities, progressive business management is alert to the possibility of reducing the cost of its product by moving its plant to an area in which taxes have been consistently low and which gives evidence or even assurance that this policy will be continued. Such moves have often been made

because of steadily rising taxes even in situations where other factors were definitely favorable.

Problems of cost, risk and capital are primary considerations for industry which never can be fixed either in place or policy; hence, if the aggregate of the various factors results in a substantial increase in the cost of the product, alert management attempts to find a more favorable location. If it is unsuccessful and costs rise beyond the price at which the product can be sold at a profit, the plant is shut down, the employees cease to create value and the economic welfare of the area degenerates. In either case, unemployment soon becomes a critical social problem.

About 93% of the products manufactured in Minnesota can be classified as basically competitive without any special advantage. There is no particular reason for selecting a plant site other than consideration of economic conditions. The problem is one of cost to produce and to sell at a price that will insure a profit.

The other 7% of the products manufactured in Minnesota represent highly developed products that require expert and careful workmanship. Manufacturers of these products are not so much concerned with the usual items entering into the cost of their products and the proximity of the market, as they are in the quality of their labor.

Thus it would appear that the State of Minnesota must look to the welfare of 93% of their manufacturers in order to maintain these manufacturers as a State asset, even if advances in technology give them some advantages which they do not now possess.

g. Small City Manufacturers

In addition to the tabulation of interviews with manufacturing firms, a general survey was made of manufacturers located outside the Twin Cities. These cannot be tabulated because "Yes" and "No" answers were not obtained to specific questions. Usually, the information about these manufacturers was obtained from Chamber of Commerce secretaries, newspaper editors, the town banker or some other well posted person in the town.

These plants usually are small, the outstanding exception being the George A. Hormel & Co. packing firm at Austin. On the basis of number of employees, the percentage of total manufacturing in Minnesota so represented does not exceed 10%. These manufacturers are in the same industrial classifications as those tabulated so that general conclusions about this group of small city manufacturers can be deduced from the reported facts.

The advantage they have in lower labor rates and the greater productivity of their labor has offset disadvantages due to freight rates, power, fuel and

taxes. Whenever the adverse factors became too great, manufacturing plants were forced to close and it is stated that there are many instances verifying this fact. Shoe factories, foundries, machine shops, brick plants, an organ factory, and stone quarries are in this list of the industries lost to Minnesota.

It should be kept in mind that, as elsewhere in the United States, "Little Business" is a large percentage of total industry in Minnesota and small concerns do not have sufficient capital to continue long in business against conditions which wipe out profits.

There is an outstanding example of the closing of a manufacturing plant which should be noted here. A strike, which resulted in riots and property damage, closed a factory in Albert Lea several years ago. Members of the community reorganized this plant about four years ago and it is now one of the largest employers of labor in that city. Perhaps the citizens of Albert Lea learned a lesson from the hardships occasioned by the closing of this plant which will insure industry being given due consideration in the future. Every community needs the cooperation of labor, agriculture and industry to thrive and grow. When growth stops, decay begins.

h. Local Mills

The tabulated answers of those manufacturers who have local mills only, indicates lack of comparative knowledge more than any other controlling factor.

The disadvantage of freight rates is practically the same as for the entire group, which supports the conclusion already reached that the freight rate structure has a definite influence on manufacturing in Minnesota.

Those having local mills only think labor is more of a disadvantage, but this is probably due to the lack of actual knowledge about labor conditions in other parts of the country.

The other three factors are considered by this group to be slightly less of a disadvantage. This also may be due to lack of knowledge of such conditions in other sections or to their ability to get along in spite of these handicaps.

No important distinctions are shown by breaking down the tabulated reports of manufacturers into those having local mills only, and those having branch plants in other states. Hence their reports are combined.

i. Stability Factor

Many manufacturers have seriously considered moving their plants to locations where the disadvantages of Minnesota would be reduced. Of the manufacturers interviewed, the following tabulation shows the results with respect to this subject:

RECAPITULATION OF INTERVIEWS

Industry Group	No. of Interviews	Consider Moving	Per Cent of Total	Employees Affected (1939)
Foods	19	6	32	
Iron & Steel Products	14	6	43	
Electric Machinery	6	0	—	
Printing	4	1	25	
Miscellaneous	18	10	55	
Totals	61	23	Average 38%	23,005
Processed Raw Materials Not in Northwest Area				
Iron & Steel Products	14	6	43	
Miscellaneous	11	8	73	
Totals	25	14	Average 56%	11,425
Processed Raw Materials from Northwest Area				
Foods	19	6	32	
Printing	4	1	25	
Miscellaneous	7	2	29	
Totals	30	9	Average 30%	11,580

All manufacturers in this tabulation have a national market or a sectional market which is outside of the Northwest Area. Minnesota does have a slight advantage for manufacturers doing business in the Northwest only.

In this group tabulation, the Electric Machinery classfiication has been omitted. None of these firms reported that they were considering moving, because they are satisfied with present conditions. This group includes two firms doing a nation-wide business which already have plants in other locations and the other four have practically non-competitive businesses, so that as yet Minnesota disadvantages have not bothered them.

It appears that those manufacturing companies which have their headquarters (general offices) in Minnesota, but have branch plants in other states, should be given special study. These branch plants have been established at selected locations for the purpose of obtaining some advantage. For example,

flour mills have been built at Buffalo, N. Y. to take advantage of the low freight rate on wheat by lake steamers and the proximity of the large Eastern market.

The executives of these companies are extremely loyal to Minnesota, have their homes there, and want to keep the general offices in the Twin Cities. However, control is changing from close family ownership to a widely distributed group of stock holders who may gain control in the future and insist that these general offices be moved to more advantageous locations.

These manufacturers have a national market and the disadvantage percentages for the group compare with the general tabulations as follows:

BUSINESS DISADVANTAGES

No. of Interviews	Freight No. %	Labor No. %	Fuel No. %	State-Local Business Taxes No. %	State-Local Personal Taxes No. %	Consider Moving No. %
13	10=77	1=8	4=31	12=92	11=85	9=69
Grand Average Disadvantage	66%	28%	37%	63%	41%	38%

Of this group having branch plants located in other states, 69% are seriously considering moving out of Minnesota. They have prepared for his eventuality by locating plants in more advantageous places and can readily expand these plants and reduce or shut down entirely the production in their Minnesota plants. Between 1939 and 1943, as much as 55% of manufacturing capacity in some plants has been transferred from Minnesota to these other plants. During this period, war conditions prevented more plant production from being transferred. Minnesota was not one of the areas having an acute labor shortage and this was the principal reason for holding and even increasing production in many of these Minnesota plants.

Between 1939 and 1943, there was a substantial increase in the volume of flour and feed milling in Minnesota mills. Minneapolis is the primary market for Northwest grains, and even the best grain market varies from year to year. These are both factors in the increased volume of milling in Minnesota during recent years. It is highly desirable to encourage flour mills to stay in the Northwest because of the tremendous quantity of feeds for stock and flour mill by-products used in this section.

Between 1939 and 1943, there was a small increase in the per cent of canning production for Minnesota. This business is still in a favorable position as raw materials are largely local and the product is not so perishable as to require quick marketing.

The manufacturers in this branch plant group know the comparative costs

of production in Minnesota and other states. The advantage of the more favorable states over Minnesota is about 10%. This is due largely to better freight rates on both raw materials and finished products and the difference in state taxes.

Within the period 1921 to 1939, there was quite an exodus of manufacturing firms from Minnesota. The postwar economic conditions were harmful in the early part of this period but, in more recent years, this could not be given as a valid reason for such removals.

Exact information about manufacturers who have moved out of Minnesota is not available. A list of removals, obviously incomplete, has been estimated to have involved $47,000,000 of invested capital and affected the employment of 8,000 personnel. It is stated to be the unpublished fact that several firms moved out of the State in the past 10 or 12 years because labor conditions became an adverse factor. They were already operating under freight and tax handicaps so that the additional labor burden was too heavy a load to carry and they moved to more favorable locations.

Several establishments moved to Illinois where taxes are lower in the manufacturing group, (there is no state income tax), the market is close at hand, freight rates are favorable, and labor is stabilized. Some plants moved to Iowa, Wisconsin or Nebraska. The latter state has a lower tax than Minnesota, but the choice of the two neighboring states probably was governed by better labor conditions.

A shoe factory moved to Tennessee, an electrical manufacturer to Ohio, and printing establishments to Connecticut and Kentucky, which indicates a better labor market in at least two of these cases.

Types of manufacturing that were lost to the State of Minnesota included printing, machinery manufacturing, furniture making, leather manufacturing, candy making, and specialty metal products including electrical apparatus. The trend in the confectionery classification of industry has been definitely down since two large candy makers moved out of Minnesota.

There are instances of consolidations controlling the moving of some manufacturing establishments from the State of Minnesota. It should not be overlooked, however, that generally unfavorable manufacturing conditions in Minnesota were a reason for such decisions. Frequently, consolidations make no change in the physical arrangement of operating plants because a going concern has a value worth keeping.

It is an inescapable conclusion that some establishments in Minnesota were receptive to offers because conditions of operation were growing worse and they had a product of great potential value. For various reasons, such nationally known products as "Toastmaster," "Milky Way," "Log Cabin" syrup, and

"Blue Moon" cheese were lost to the State of Minnesota. There were many other firms which discontinued their businesses as a result of adverse operating factors, but this Report has regarded them as business failures and not attempted to include them with voluntary removals from Minnesota.

It is true that, within the same eighteen years, manufacturing concerns have moved into the State, including a number of branch plants of national organizations and quite a few other plants manufacturing products for local consumption. However, incomplete records would seem to indicate that losses by removal and failure far exceed additions. In any case, even were the gains to offset the losses, the record would be unsatisfactory as indicative of a lack of progress.

The available data on plant removals and acquisitions for the State, between 1921 and 1939, are presented below in two tabulations. The invested capital per employee has been estimated using values for 1929 taken from the table of "Net Capital per Wage Earner Employed in all Enterprises in Specified Manufacturing Industries, 1925-1941", as given on page 195 of "The Economic Almanac for 1944-45". These "net capital per wage earner" amounts are the average for all United States manufacturing in the specified industries.

BASIS OF ESTIMATING INVESTMENT VALUE
OF
PLANT REMOVALS FROM MINNESOTA
(Between 1921 - 1939)

Type of Industry	Location	Number of Employees*	Capital Per Employee**	Estimate of Invested Capital
Automobile Parts	St. Cloud	200	$ 6,874	$ 1,375,000
Automobile Parts	"	200	6,874	1,375,000
Lightning Rods	Owatonna	50	6,874	344,000
Chrome Plating		25	6,874	172,000
Bottling	"	20	8,285	166,000
Battery Mfg.	"	25	6,874	172,000
Milling	Blue Earth	40	8,285	331,000
Printing	Robbinsdale	100	7,095	710,000
Radiators	St. Paul	50	6,874	344,000
Shoes	"	1,000	3,724	3,724,000
Shoes	"	1,000	3,724	3,724,000
Barn Equipment	"	50	6,874	344,000
Leather	So. St. Paul	1,000	3,724	3,724,000
R.R. Shops	"	2,000	6,874	13,750,000
Box Mfg.	Cloquet	100	4,817	482,000
Bag Mfg.	"	25	9,275	232,000

Type of Industry	Location	Number of Employees*	Capital Per Employee**	Estimate of Invested Capital
Carbic	Duluth	50	18,082	904,000
Machine Shop	"	50	6,874	344,000
Overalls	New Ulm	40	3,699	148,000
Garments	Winona	40	3,699	148,000
Candy	"	25	8,285	207,000
Knitting	"	60	3,699	222,000
Road Machinery	Albert Lea	30	6,874	206,000
Automobile Heaters	Minneapolis	350	6,874	2,400,000
Gloves	"	50	3,724	186,000
Candy	"	250	8,285	2,071,000
Macaroni	"	100	8,285	829,000
Machine Shop	"	100	6,874	687,000
Electric Mfg.	"	100	6,874	687,000
Furniture (2)	"	150	4,817	722,000
Mattresses	"	50	3,699	185,000
Candy	"	100	8,285	829,000
Electric Mfg.	"	500	6,874	3,437,000
Machinery	"	50	6,874	344,000
Radios	"	200	6,874	1,375,000
Cheese	"	—	—	—
Electric Toasters	"	—	—	—
Syrup ("Log Cabin")	St. Paul	—	—	—
		8,180		$46,900,000

*Estimated as of date of leaving Minnesota

**From table on Page 195 of "THE ECONOMIC ALMANAC FOR 1944-45" using 1929 figures as median year of the period.

NEW MANUFACTURERS IN MINNESOTA
(BETWEEN 1921 - 1939)

Type of Industry	Location	No. of Present Employees*
Cement pipe	Austin	11
Concrete products	"	7
Car repairs	"	15
Chicken barn equipment	Owatonna	
Dairy products	"	
Farm seeders	"	
Gloves	"	
Milling	Waseca	
Milling	"	
Milling (Feeds)	"	
Canning	"	
Bottling beverages	"	
Radio parts	"	400
Bait & decoys	"	
Canning	Blue Earth	40
Novelties	"	
Sugar refining	East Grand Forks	
Food dehydrators	"	
Bakery products	Rochester	60
Sheet metal	"	
Gas furnaces	"	
Poultry feeds	"	
Milling feeds	"	
Bottling beverages (2)	"	
Machine shop (2)	St. Cloud	
Hardware	So. St. Paul	50
Meat packing (2)	"	2350
Oil refinery	"	55
Wood conversion	Cloquet	125
Pants maker	New Ulm	40
Rock wool	Red Wing	
Rubber products	"	
Malting	"	
Meat packing	Winona	
Gloves	"	
Chains	"	

Type of Industry	Location	No. of Present Employees*
Machine shop	Winona	
Knitting mill	"	
Candy bars	Minneapolis	56
Machine Shop	"	150
Bottling beverages	"	24
Telephone equipment	St. Paul	125

* Number of employees is given, where known, as of winter 1944-45.

7. Employment

a. Past

Minnesota has been favored with an ample supply of good labor over the 85 or more years since manufacturing began there. The healthy climate is undoubtedly an element in producing this good labor. Labor turnover in manufacturing plants was low, being less than 5% in 18 out of 93 plants which were visited during personal interviews, and not excessive in any of the others.

Data regarding the general subject of employment in Minnesota has been obtained from the United States Census of Manufactures, which shows the past trends.

(1) Number of Wage Earners.

The number of wage earners in all manufacturing industry in Minnesota in 1939 was slightly less than in 1909. Throughout this period the number has varied with changes in the general economic activity of the country.

A measure of fluctuation in manufacturing employment may be obtained by comparing the maximum and minimum years with the average of all census years. In the following tabulation these statistics are listed for the States of Minnesota, Wisconsin, Michigan, Iowa and for the United States as a whole:

No. of Wage Earners	Minn.	Wis.	Mich.	Iowa	United States
Average of all Census Years 1909-1939	91,100	216,200	442,500	67,600	7,700,000
Maximum year	115,623	264,745	660,676	81,678	9,096,372
Minimum year	69,633	158,730	231,499	52,137	6,055,736
Maximum year in % of Average	127.0	122.4	149.2	121.0	118.2
Minimum year in % of Average	76.6	73.3	52.3	77.2	78.7

Examination of this tabulation shows that the predominantly agricultural states of Minnesota, Wisconsin and Iowa have shown a smaller variation from average than does the industrial State of Michigan. In the former, the minimum has been 75% to 80% of average and the maximum 120% to 130% of average; while in the latter, the corresponding range has been from 52% to 150% of average. So far as stability of employment is concerned, the less highly industrialized states appear to have the advantage. Also the seven to one ratio of unpaid family workers to paid hired hands on farms in Minnesota appears to be a stabilizing factor.

However, when total number of employees is considered in relation either to growth of manufacturing employment, or to such employment per capita, the picture is not so favorable for Minnesota.

Between 1909 and 1939 employment grew as follows:

Year	Minn.	Wis.	Mich.	Iowa	United States
1909	84,767	182,583	231,499	61,635	6,615,046
1939	79,753	200,897	522,242	65,314	7,886,567
Increase	—5,014	10.0	125.5	6.0	19.18
Per Cent Increase	—5.9	18,314	290,743	3,679	1,271,521

Judged by this standard, Minnesota does not compare favorably even with Iowa, a predominantly agricultural state. When the number of wage earners is plotted by years, Minnesota, Wisconsin and Iowa are seen to have the same general trend varying with the business cycle from year to year, but all lacking the strong, long term upward trend of Michigan. On the basis of wage earners per capita, or as here expressed as wage earners per 1,000 population, Minnesota does not compare favorably with Wisconsin, Michigan or the United States as a whole.

In employees per 1,000 population in 1939, the selected states stand as follows:

Michigan	101.2
Wisconsin	64.4
Minnesota	28.9
Iowa	26.1
United States	60.2

Trends of employment per 1,000 population generally have been slightly downward during the past three decades, despite the large increases in total employment. In the group of states under consideration, all except Michigan have shown this decrease in employment per 1,000 population.

Year	Minn.	Wis.	Mich.	Iowa	United States
1909	41.3	78.9	83.5	27.7	73.3
1939	28.9	64.4	101.2	26.1	60.2
Per Cent Change	—30.0	—18.4	+21.2	—5.78	—17.9

Not only does Minnesota show a low employment per capita but, during the past three decades, it also shows a larger decrease than neighboring states.

(2) Wages Paid

Total wages paid by all manufacturing industry depend on both the number of employees and the wage rates at any given time. Such total wages are important as showing the volume of income regularly made available in the State, which so materially contributes to general prosperity. However, when taken alone, the total amount of wages paid has little significance with respect to the economic status of the wage earner or the labor obligation of industry. The amount is, however, readily convertible into wages paid per wage earner, which definitely reflects the average wage level.

The following tabulation shows the total wages paid in Minnesota and selected states:

WAGES PAID IN $1,000's

	Year	Minn.	Wis.	Mich.	Iowa	United States
	1909	47,471	93,905	118,968	32,542	3,427,038
	1939	96,887	255,947	789,976	73,466	9,089,941
Increase		49,416	162,042	671,008	40,924	5,662,903
Per Cent Increase		104.2	172.5	563.0	122.2	163.1

The total wages paid in Minnesota are somewhat larger than in Iowa, but much smaller than in Wisconsin and Michigan. In percentage increases since 1909, Minnesota ranks lower than any of the selected states. To determine the true significance of these data, consideration must be given to wages per wage earner.

Annual wages per wage earner for Minnesota and selected states for each census year from 1879 to 1939 are:

WAGES PAID PER WAGE EARNER

Year	U.S.	Minn.	Wis.	Iowa	Mich.
1939	$1,150	$1,215	$1,250	$1,120	$1,510
1937	1,180	1,190	1,265	1,120	1,490
1935	1,015	1,025	1,035	975	1,300
1935	1,020	1,040	1,045	995	1,300
1933	865	920	840	865	985
1931	1,100	1,150	1,030	1,115	1,225
1929	1,315	1,275	1,330	1,250	1,590
1927	1,300	1,255	1,310	1,235	1,555
1925	1,280	1,235	1,275	1,225	1,535
1923	1,255	1,210	1,200	1,205	1,530
1921	1,180	1,245	1,115	1,270	1,380
1919	1,160	1,100	1,100	1,115	1,355
1914	580	635	575	635	670
1909	515	555	515	535	515
1904	475	515	470	465	460
1899	440	455	410	410	405
1889	445	430	360	392	370
1879	345	425	335	353	320

From these statistics, it is evident that the wage level in Minnesota is fairly comparable with that of Wisconsin, is somewhat higher than that of Iowa and of the United States as a whole, but is 20% to 25% lower than that of Michigan. It is, therefore, evident that, on the one hand, the relatively small total wages paid in Minnesota are not to be ascribed to an unduly low wage level, but rather to the number of wage earners; and on the other hand, the wage level in Minnesota is not such as to put an undue charge upon existing industry or to discourage the location of new industry within the State.

The foregoing generalization is based upon the average wage per wage earner in all manufacturing industry, and it is recognized that it may not be true of every individual industry, nor of every section of the State.

The following table shows the distribution of salaries and wages as reported in the Census of Manufactures for 1939 for Minnesota, selected states, the average of this group of states, and the United States total.

State	Total Wages & Salaries ($1,000's)	Amounts ($1,000's) and Percentages Paid to— Officers Amount	%	Managers Amount	%	Clerks Amount	%	Wage Earners Amount	%
Minnesota	$125,442	$10,582	8.44	$10,814	8.62	$7,159	5.71	$96,887	77.24
Illinois	988,454	73,241	7.41	96,599	9.77	68,375	6.92	750,239	75.90
Indiana	439,829	21,684	4.93	41,969	9.54	30,701	6.98	345,475	78.55
Iowa	96,998	6,581	6.78	9,286	9.57	7,666	7.90	73,466	75.74
Kansas	48,923	2,998	6.13	5,375	10.99	3,611	7.38	36,938	75.50
Michigan	963,557	35,612	3.70	86,358	8.96	51,612	5.36	789,976	81.99
Missouri	249,673	22,227	8.90	21,610	8.66	15,101	6.05	190,736	76.39
Nebraska	28,123	2,475	8.80	3,040	10.81	1,985	7.06	20,624	73.33
New York	1,560,479	157,961	10.12	126,612	8.11	112,121	7.19	1,163,785	74.58
Ohio	1,033,427	58,009	5.61	91,022	8.81	71,720	6.94	812,676	78.64
Pennsylvania	1,256,571	64,887	5.16	110,613	8.80	77,721	6.19	1,003,349	79.85
Wisconsin	328,639	24,029	7.31	30,937	9.41	21,726	6.61	251,947	76.66
Average			6.94		9.34		6.69		77.03
U. S. Total	11,630,298	756,910	6.51	1,042,430	8.96	741,017	6.37	9,089,941	78.16

Another important factor in wage analysis is the productivity of labor. Without the accompanying output, wages tell only half the story. So far as all manufacturing industry is concerned, the best available information is given in "Value Added by Manufacture." This is computed by the Bureau of the Census by deducting from the total value of the product at factory, the cost of containers, raw materials, power and fuel. The difference covers payments for labor, management, interest, depreciation and taxes. This difference generally is considered "a more complete measure of the relative importance of an industry to the State economy than are payrolls, employment and total volume of business."

"Value Added by Manufacture" per wage earner also reflects the productivity of labor.

The total "Value Added by Manufacture" from 1909 to 1939 and "Value Added by Manufacture per Wage Earner Employed" for Minnesota and selected states from 1879 to 1939, are given in the following tabulations:

VALUE ADDED BY MANUFACTURE
ALL MANUFACTURING INDUSTRIES ($1,000's)

Year	U. S.	Minn.	Wis.	Mich.	Iowa
1909	$ 8,162,089	$127,798	$243,949	$ 316,497	$ 88,531
1914	9,422,276	156,505	277,757	493,361	105,299
1919	23,735,012	335,040	719,709	1,546,945	225,232
1921	17,252,775	264,738	486,920	900,468	182,742
1923	24,569,487	315,452	718,696	1,611,419	255,697
1925	25,667,624	331,132	774,496	1,906,760	258,185
1927	26,325,394	340,336	820,325	1,898,263	272,401
1929	30,591,435	404,995	949,842	2,067,344	323,820
1931	18,600,532	261,747	530,097	1,252,096	204,804
1933	14,007,540	201,540	370,037	940,946	140,601
1935	18,552,553	245,507	529,329	1,558,119	176,653
1937	25,173,539	312,898	709,824	2,091,663	236,064
1939	24,682,918	310,628	686,605	1,798,404	244,795

VALUE ADDED BY MANUFACTURE PER WAGE EARNER EMPLOYED

Year	U. S.	Minn.	Wis.	Iowa	Mich.
1939	$3,170	$3,900	$3,420	$3,760	$3,440
1937	2,930	3,480	3,030	3,480	3,160
1935	2,570	3,230	2,680	3,130	2,910
1935	2,640	3,170	2,720	3,110	2,970
1933	2,400	2,900	2,330	2,700	2,690
1931	3,040	3,245	2,880	3,360	3,380
1929	3,620	3,910	3,580	3,969	3,910
1927	3,300	3,440	3,300	3,690	3,900
1925	3,190	3,200	3,130	3,440	3,710
1923	2,940	3,050	2,900	3,290	3,200
1921	2,640	3,090	2,540	2,940	2,960
1919	2,760	2,900	2,740	2,790	3,290
1914	1,405	1,690	1,430	1,660	1,820
1909	1,290	1,510	1,330	1,440	1,370
1904	1,230	1,480	1,290	1,250	1,220
1899	1,070	1,150	1,070	1,075	970
1889	990	1,060	860	900	825
1879	723	945	735	775	755

In considering these figures, it must be borne in mind that the total value is related to both volume of production and price levels of products. While the price levels for certain manufactring products in the selected states probably differ from the general average, it is believed that the price level changes, taken as a whole, are reasonably uniform for the several states, and the value added, therefore, is a fair indication of the comparative industrial output.

For 1939, the total value added in Minnesota is larger than Iowa, but is only about one-half Wisconsin and about one-sixth Michigan, whose industries are more in the advanced competitive class. Between 1909 and 1939, Minnesota shows an increase of 143% in contrast with 177% for Iowa, 181% for Wisconsin, 468% for Michigan and 190% for the United States as a whole. When so measured, Minnesota does not make a favorable showing.

However, when value added per wage earner is considered, Minnesota's record is excellent. In 1939, the value added per wage earner was greater than that for any of the selected states and, in every census year over the entire period, the figures compare favorably.

From the viewpoint of wages per wage earner and of value added per wage earner in all manufacturing industry, Minnesota appears to be fairly competitive

with her sister states. The lower volume of employment and production must, therefore, be due to other influences in the industrial situation.

The foregoing discussion has been based on the various United States Censuses of Manufactures, the latest of which was made in 1939. Since that date, comparable data is not available, and such data as exists is much affected by abnormal war conditions.

However, statistical data on employment for the war period was available from the Department of Labor.

In a publication of the Department of Commerce entitled, "Regional Shifts in Populations, Production and Markets, 1939-1943," manufacturing employment is stated as:

AVERAGE EMPLOYMENT (1,000's)

Year	Minn.	Wis.	Mich.	Iowa	U. S.
1939	108	255	631	91.8	10.080
1942	156	366	907	134.7	14,571
1943	191	409	1074	147.3	16,218
		PER CENT INCREASE			
1939 to 1942	44.4	43.5	43.7	46.7	44.5
1939 to 1943	77.0	60.0	70.0	60.0	61.0

From the foregoing, it appears that Minnesota has secured its proportionate share of the increased manufacturing activity due to the war effort.

b. Present

War conditions have tended to standardize labor throughout the country. Due to many causes, such local factors as living costs have been overlooked in an effort to pay the same wages for the same type of work.

This is best shown in a comparison of costs for the same product as follows:

Year	Location	Worker's Average Hourly Earnings
1936	Minneapolis Manufacturer	55.4c
	Eastern Manufacturer	75.2c
1944	Minneapolis Manufacturer	92.6c
	Eastern Manufacturer	99.6c

The comparison shows that the Minnesota manufacturer had a labor cost in 1936 which was 74% of the cost to his eastern competitor, while by mid-1944 this advantage had shrunk so that his labor cost was 93% of the eastern manufacturer's cost.

Expressed another way, the Minnesota manufacturer's labor cost was 36%

less than his eastern competitor in 1936, but only 7.5% less in 1944. In a competitive market, this loss is serious.

Some manufacturers still have a better wage differential than shown above, but the longer the war continues, the greater is the possibility that they will lose their wage advantage. The printing industry has an advantage in wage rates over Chicago which varies with classifications from 10% to 32%. The smaller cities in Minnesota have a wage advantage of perhaps 25% over the three large cities, Minneapolis, St. Paul and Duluth.

Production is said to have fallen off because workers are physically tired from the long hours they have worked over the period of the war. Other factors said to reduce production are natural handicaps, such as women trying to do men's work, immature workers, physically handicapped persons and part time employees.

F. Agriculture

In this section there has been assembled pertinent information and statistics serving as a basis for an analysis of economic trends relating to agriculture within the State of Minnesota.

1. Farm Ownership and Operation

The farms of Minnesota are operated by owners, managers and tenants. The number of each of these and the proportion which each of these classes of operators bears to the total number of operators, as reported for census years, are indicated in the two following tables:

TABLE F-1. NUMBER OF FARMS BY TENURE OF OPERATOR
MINNESOTA — 1880-1940

	Owners	Managers	Tenants
1880	83,933	*	8,453
1890	101,747	*	15,104
1900	126,809	1,095	26,755
1910	122,104	1,222	32,811
1920	132,744	1,596	44,138
1925	136,382	766	51,083
1930	126,570	1,047	57,638
1935	134,012	878	68,412
1940	132,903	631	63,817

TABLE F-2. PER CENT DISTRIBUTION OF FARM OPERATORS
MINNESOTA — 1880-1940

	Owners %	Managers %	Tenants %
1880	90.9	*	9.1
1890	87.1	*	12.9
1900	82.0	0.7	17.3
1910	78.2	0.8	21.0
1920	74.4	0.9	24.7
1925	72.5	0.4	27.1
1930	68.3	0.6	31.1
1935	65.9	0.4	33.6
1940	67.3	0.3	32.3

*Included with Owners.

Source: 16th U. S. Census, 1940, Agriculture, Vol. III. General Report. Chapt. III. Table 25.

In Table F-3 are tabulated the numerical distribution of farm owners, managers, and tenants in the North Central States in 1910 and in 1940, with the net change and per cent change between these years. The corresponding distribution expressed in per cent of the total number of operators in those years is indicated in Table F-4.

TABLE F-3. NUMERICAL DISTRIBUTION OF FARM OPERATORS
NORTH CENTRAL STATES
1910 AND 1940

	1910	1940	Trend	Change	%
MINNESOTA					
Owners	122,104	132,903	Inc.	10,799	9
Managers	1,222	631	Dec.	591	48
Tenants	32,811	63,817	Inc.	31,006	95
IOWA					
Owners	133,003	110,616	Dec.	22,387	17
Managers	1,926	1,218	Dec.	708	37
Tenants	82,115	101,484	Inc.	19,369	24
NORTH DAKOTA					
Owners	63,212	40,391	Dec.	22,821	36
Managers	484	194	Dec.	290	60
Tenants	10,664	33,377	Inc.	22,713	213
SOUTH DAKOTA					
Owners	57,984	33,803	Dec.	24,181	42
Managers	429	253	Dec.	176	41
Tenants	19,231	38,398	Inc.	19,167	100
NEBRASKA					
Owners	79,250	56,561	Dec.	22,689	29
Managers	987	554	Dec.	433	44
Tenants	49,441	63,947	Inc.	14,506	29
MISSOURI					
Owners	192,285	163,763	Dec.	28,522	15
Managers	2,001	1,182	Dec.	819	41
Tenants	82,958	91,155	Inc.	8,197	10
KANSAS					
Owners	111,108	85,475	Dec.	25,633	23
Managers	1,335	630	Dec.	705	53
Tenants	65,398	70,222	Inc.	4,824	7

TABLE F-3. — (Continued)

	1910	1940	Trend	Change	%
WISCONSIN					
Owners	151,022	142,728	Dec.	8,294	6
Managers	1,451	1,079	Dec.	372	26
Tenants	24,654	42,928	Inc.	18,274	74
MICHIGAN					
Owners	172,310	154,928	Dec.	17,382	10
Managers	1,961	861	Dec.	1,100	56
Tenants	32,689	31,800	Dec.	889	3
INDIANA					
Owners	148,501	131,263	Dec.	17,238	12
Managers	2,297	1,076	Dec.	1,221	53
Tenants	64,687	52,210	Dec.	12,477	19
ILLINOIS					
Owners	145,107	119,830	Dec.	25,277	17
Managers	2,386	1,627	Dec.	759	32
Tenants	104,379	91,982	Dec.	12,397	12
OHIO					
Owners	192,104	171,156	Dec.	20,948	11
Managers	2,753	1,205	Dec.	1,548	56
Tenants	77,188	61,422	Dec.	15,766	20
UNITED STATES					
Owners	3,948,722	3,699,177	Dec.	249,545	6
Managers	58,104	36,351	Dec.	21,753	37
Tenants	2,354,676	2,361,271	Inc.	6,595	.003

Source: 16th U. S. Census, 1940, Agriculture, Volume III. General Report, Chapter III, Table 25.
Inc. = Increase; Dec. = Decrease

TABLE F-4. PER CENT DISTRIBUTION OF FARM OPERATORS
NORTH CENTRAL STATES
1910 AND 1940

STATE	FARM OWNERS			MANAGERS			TENANTS		
	1910	1940	Change	1910	1940	Change	1910	1940	Change
	%	%		%	%		%	%	
Minnesota	78.2	67.3	Down	0.8	0.3	Down	21.0	32.3	Up
Iowa	61.3	51.9	Down	0.9	0.6	Down	37.8	47.6	Up
North Dakota	85.0	54.6	Down	0.7	0.3	Down	14.3	45.1	Up
South Dakota	74.7	46.7	Down	0.6	0.3	Down	24.8	53.0	Up
Nebraska	61.1	46.7	Down	0.8	0.5	Down	38.1	52.8	Up
Missouri	69.4	63.9	Down	0.7	0.5	Down	29.9	35.6	Up
Kansas	62.5	54.7	Down	0.8	0.4	Down	36.8	44.9	Up
Wisconsin	85.3	76.4	Down	0.8	0.6	Down	13.9	23.0	Up
Michigan	83.3	82.6	Down	0.9	0.5	Down	15.8	17.0	Up
Indiana	68.9	71.1	Up	1.1	0.6	Down	30.0	28.3	Down
Illinois	57.6	56.1	Down	0.9	0.8	Down	41.4	43.1	Up
Ohio	70.6	73.2	Up	1.0	0.5	Down	28.4	26.3	Down
U. S. A.	62.1	60.7	Down	0.9	0.6	Down	37.0	38.7	Up

Source: 16th U. S. Census, 1940, Agriculture, Volume III General Report, Chapter III, Table 25.

a. Farm Owners

Tables F-1 through F-4 show the steady decline in the proportionate number of owners operating farms in Minnesota and afford opportunity for comparison with other states in the North Central group and the Nation.

In 1880, when there were 83,933 owners (including part owners) operating farms, this group constituted 90.9% of all operators. By 1935 the number of owner operators had increased to 134,012 which was but 65.9% of the total. From 1935 to 1940 there was a change to 132,903 owner operators, which constituted 67.3% of the total. This was higher than the national proportion for 1940 which amounted to 60.7%.

Between 1910 and 1940 in the North Central States there was general downward trend in the proportion of owner operators to all operators. Two states, Indiana and Ohio had upward trends. In 1940 the ranking of the states in this group as to highest percentages of owner operators was Michigan, Wisconsin, Ohio, Indiana and Minnesota.

b. Tenants

The increase in the proportionate number of tenant operators on Minnesota farms is shown by Tables F-1 through F-4, which also permit comparison with other states and the Nation.

Operation of farms in Minnesota by tenants increased from 8,432 tenant operators, constituting 9.1% of all operators, in 1880, to 68,412 tenant operators forming 33.6% of all operators in 1935. In 1940 there was a decrease in the number of tenant operators to 63,817 or 32.3% of all farm operators.

In 1940 the national proportion of tenant operators was 38.7% and in that year Minnesota had a smaller ratio of tenant operators to total operators than any of the other North Central States except Michigan, Wisconsin, Ohio, and Indiana.

c. Managers.

Referring to Tables F-1 through F-4, it will be seen that in Minnesota the long term trend in farm operation by managers has been downward. Manager operation rose from 1095 Managers, or 0.7% of all operators, in 1900, to 1,596 Managers or 0.9%, in 1920, and has been generally declining since then to 631 Managers or 0.3% in 1940. This trend has been parelleled to a degree in all of the North Central States. The national average was 0.6% in 1940.

d. Corporate Ownership

The ownership of farms by corporate businesses or agencies was 8.69% of the total farm units operated in 1940 and it is presumed that these were to a large extent operated by managers.

During recent years the ownership of Minnesota farms has been divided as follows:

	Private Owners %	Corporate Agencies %
1936	92.67	7.33
1937	91.67	8.33
1938	90.77	9.23
1939	91.27	8.73
1940	91.31	8.69

Source: University of Minnesota, Agricultural Bulletin No. 357-1942.

The greatest concentration of corporate holdings was in northwestern and west-central Minnesota followed by the east-central and southwestern areas. Life insurance companies owned more of the farm real estate than any other type of corporation. The Minnesota Department of Rural Credit ranked second. Greatest holdings were in areas where the decline in land prices was the greatest.

Since it is the policy of the State and corporate agencies to dispose of workable farms as rapidly as conditions justify, where there is an opportunity for the purchaser to conduct farm enterprises successfully, it is probable that the percentage of farms owned by corporations will continue to decrease.

2. Values in Farms

Under the heading, "Land and Buildings" are discussed first; followed by "Buildings," because these are the designations used in the United States Census from which the data have been principally derived.

a. Land and Buildings.

In Table F-5 are listed the average values of land and buildings combined, on a per acre and per farm basis as well as the total for Minnesota farms, reported by the Census Bureau to have been calculated from the average fair price in the State for the census years indicated, from 1850 through 1940.

TABLE F-5 AVERAGE AND TOTAL VALUES OF MINNESOTA FARMS
(INCLUDING LAND AND BUILDINGS)
1850-1940

	LAND AND BUILDINGS		
	Av. Value Per Acre	Av. Value Per Farm	Total Value Land and Buildings
1850 Territory	$ 5.61	$ 1,032	$ 161,948
1860 State	10.14	1,513	27,505,922
1870	12.07	1,683	78,277,954
1880	14.45	2,097	193,724,260
1890	18.22	2,910	340,059,470
1900	25.51	4,329	669,522,315
1910	45.62	8,085	1,262,441,426
1920	109.23	18,496	3,301,168,325
1925	79.63	12,717	2,393,741,745
1930	68.74	11,471	2,125,093,278
1935	42.14	6,803	1,383,072,263
1940	44.26	7,312	1,443,021,200

Source: 16th U. S. Census, 1940, Agriculture, Vol. III General Report, Chapter I, Table 18

The trend in average value per farm per acre in Minnesota, including land and buildings, increased from $45.62 per acre in 1910 to an inflation price of $109.23 per acre in 1920. Since then the trend has been generally downward to $44.26 per acre in 1940.

The trend in average value of Minnesota farms, including land and buildings, was upward from $8,085 in 1910, to $18,496 during the "boom" in 1920, then down to $6,803 in 1935 and then slightly up to $7,312 in 1940. The 1940 average value per farm was 90% of the 1910 value, on a dollar basis.

The average value per farm, including land and buildings, in each of the North Central States from 1910 through 1940, is shown in the following tabulation, F-6.

TABLE F-6. AVERAGE VALUE PER FARM
NORTH CENTRAL STATES
(LAND AND BUILDINGS)

State	1910	1920	1925	1930	1940
Minnesota	$ 8,085	$18,496	$12,717	$11,471	$ 7,312
Iowa	15,008	35,616	23,207	19,655	12,614
Missouri	6,190	11,646	7,691	7,018	4,324
North Dakota	11,063	19,160	13,428	12,199	6,628
South Dakota	12,945	33,132	18,071	15,455	6,976
Nebraska	13,983	29,836	19,760	19,274	9,399
Kansas	9,770	17,122	13,250	13,738	9,092
Ohio	6,080	10,368	7,951	7,720	6,176
Indiana	7,399	12,937	8,661	7,796	6,781
Illinois	13,986	25,289	18,615	15,553	11,887
Michigan	4,354	7,313	6,676	6,853	4,865
Wisconsin	6,784	11,558	9,830	9,526	6,365

Source: Statistical Abstract of the United States, 1930 p. 626, Table 583, and Sixteenth Census of the United States, 1940. Agriculture, General Report.

The value of land and buildings on an acre basis in the North Central States is indicated in Exhibit III-B-2. Comparing Minnesota's average value per farm including land and buildings, per acre, with the average value per farm in the other North Central States as shown on Exhibit No. III-B-2, Minnesota occupied about an average position among these states between 1910 and 1940. However, comparing 1910 with 1940, Minnesota's average value per acre for land and buildings has returned nearer to the 1910 value than any of these states except Michigan.

The value of the average Minnesota farm per acre, including land and buildings, is lower than in Iowa and Wisconsin, or in the states further east, but higher than the corresponding value per acre in the farms further west.

The trend in the total value of the land and buildings on Minnesota farms ranged from $1,262,441,426 in 1910 through a value of $3,301,168,325 in 1920, down to $1,443,021,200 in 1940.

b. Buildings.

Values of Minnesota farm buildings from 1910 through 1940, as stated in the Report of the Sixteenth United States Census in 1940, were:

1910	$243,339,399	1930	$671,133,181
1920	550,839,893	1935	Not available
1925	597,141,905	1940	545,657,066

The value practically doubled, on a dollar basis, from 1910 to 1940.

Farm buildings in Minnesota appear to compare favorably with those in other agricultural states. In a wide, general survey, few rundown or dilapidated buildings were noticed, except in the cutover areas in the north where some farms have been abandoned. A large number of buildings need minor repairs and painting, probably delayed because of present inability to get materials or labor on account of the war.

In surveys throughout the State relative to post-war employment and proposed expenditures (now being compiled at the University of Minnesota), farmers in many counties have indicated that they expect to spend large sums, particularly for repairs and new buildings, as soon as favorable opportunities are afforded. For example, in Freeborn County, 360 farmers' families expected to spend an average of $1,374 each on barns; 360 expected to spend an average of $539 each on silos, and 810 expected to pay $560 each on prefabricated or other small buildings—an intended expenditure of well over a million dollars in one county for farm improvements.

These needs exist in many other counties and, when implemented, will provide work for masons, bricklayers, carpenters and others, as well as a large demand for brick, tile, lumber, pipe and other building materials.

Expenditures for farm building repairs, from 1910 through 1941, are shown graphically in Exhibit III-B-23. This graph shows average expenditures of 5 million dollars per year during the pre-war years 1910-14 and an average of 4 million dollars per year during the pre-war years 1935-39. The peak expenditures for building repairs occurred during the period from 1915 to 1919, when they averaged 6.9 million dollars per year. Nearly 10 million dollars was expended in 1919 for this element of expense.

c. Implements and Machinery

The value of farm implements and machinery, including automobiles and tractors, in Minnesota, from 1850 to 1940, have been given in the various Census reports as follows:

VALUE OF FARM IMPLEMENTS AND MACHINERY IN MINNESOTA

Year	Value ($1,000)	Year	Value ($1,000)
1850	16	1910	52,329
1860	1,018	1920	181,088
1870	6,721	1925	137,966
1880	13,090	1930	181,767
1890	16,916	1935	Not available
1900	30,099	1940	193,444

From the above tabulation, it will be seen that the trend in the total value of farm implements and machinery on Minnesota farms generally has been upward and that the increase from 1910 to 1940 was nearly fourfold.

Expenditures for repairs to farm machinery from 1910 through 1941 are shown graphically in Exhibit III-B-23. The graph indicates average expenditures of 2.5 million dollars per year during the 1910 through 1914 period and 3.7 million dollars per year during the 1935 through 1939 period. A peak of about 5.4 million dollars was spent for machinery repairs in 1919.

The numbers of automobiles, trucks and tractors on Minnesota farms, from 1910 to 1941, are shown graphically in Exhibit III-B-24. Operating expense for these, during the same period, is shown in Exhibit III-B-25. Charges for various machine operations on Minnesota farms are shown in Exhibit III-B-26.

d. Livestock on Farms

Values of livestock on farms at the time of Census counts, based on the then current average State price per head, are indicated in various Census Reports as follows:

1910	$161,641,000	1930	$288,298,000
1920	305,164,000	1940	229,034,000
1925	229,977,000		

The trend in the total value of livestock on the farms of Minnesota was up from about 162 million dollars in 1910 to a peak of 305 million dollars in 1920 and then down to 229 million dollars in 1940.

e. Assumptions in Estimating Investment in Farm Land

The farm land "investment" for the State, as of 1910, was estimated as being the difference between the Census Report of "Value of Land and Buildings" for that year, given as $1,262,441,000, and "Value of Buildings," given as $243,339,000, or an assumed land value of $1,019,102,000. It is recognized that this was not the true investment but was chosen as a base from which to compute trends. In turn this assumed land value was used as the basis of the index of 100 for 1910.

Indices representing changes in the "purchasing power" of the dollar, based on 1910 as 100, were calculated to be 219 for 1920; 147 for 1925, 123 for 1930 and 112 for 1940, by converting the indices, based on 1926, of the Bureau of Labor Statistics for wholesale prices for all commodities.

The land "investment" for the years 1920, 1925 ,1930, and 1940, were each obtained by utilizing the 1910 unit acreage value and applying it to any increase, or decrease, in the total acreage for the year in question, as compared to the total acreage of 1910. Then applying the index, a value for the land was obtained for the purpose of determining trends. This procedure gave the following "investment" trend values for land for the years noted:

1910 — $1,019,102,000
1920 — 2,437,126,000
1925 — 1,627,077,000
1930 — 1,400,119,000
1940 — 1,344,746,000

f. Estimate of Investment in Farms

The "Investment in Farms" was calculated for the various years mentioned by adding together the estimated value of the land, Census value of buildings, Census value of implements and machinery and the Census value of livestock, previously given in this section.

It was assumed that "values" of buildings, implements and machinery, and livestock, more nearly represented theoretical investment than was true in the case of land "values"; particularly as the period under consideration was one in which the bulk of the buildings, implements and machinery, and livestock, were acquired.

The resulting estimates are shown in Table F-7.

TABLE F-7. ESTIMATE OF FARM INVESTMENT IN MINNESOTA ($1,000's)

Elements in Investment	1910	1920	1925	1930	1940
Value of Land	1,019,102	2,437,126	1,627,077	1,400,119	1,344,746
Index-1910=100	100	219	147	123	112
Value of Buildings	243,339	550,840	597,142	671,133	545,657
Value of Machinery	52,329	181,088	137,966	181,767	193,444
Value of Livestock (Inv.)	161,641	305,164	229,977	288,298	229,034
Total Farm Investment	1,476,411	3,474,218	2,592,162	2,541,317	2,312,881
Average Investment per Farm (dollars)	9,456	19,465	13,771	13,718	11,720

Applying the index to correct the foregoing for dollar purchasing power:

	1910	1920	1925	1930	1940
Total Investment in State (millions)	$1,476	$1,590*	$1,760	$ 2,060	$ 2,060
Average Investment per Farm	9,456	8,900	9,370	11,150	10,460

*By contrast this figure evidences the exaggeration of values due to the inflation of 1920 shown in Exhibit III-I-2.

g. Comparison of Farm Property Values With Other States

There is some basis for comparison of farm property values between Minnesota and those of other states in the Census Bureau Reports of "Total Value of Specified Classes of Farm Property," which is composed of "Value of Land and Buildings," "Value of Implements and Machinery" and "Value of Livestock," as shown in Table F-8.

TABLE F-8. TOTAL VALUE OF SPECIFIED CLASSES* OF FARM PROPERTY

	1910 Million	1920 Million	1925 Million	1930 Million	1940 Million	% Decrease 1930 to 1940	Average per Farm 1930	Average per Farm 1940
Minnesota	$1,476	$3,787	$2,762	$2,595	$1,865	–28.1	$14,009	$ 9,453
Iowa	3,746	8,524	5,602	4,969	3,269	–34.2	23,120	15,325
Missouri	2,053	3,591	2,287	2,135	1,383	–35.2	8,342	5,402
North Dakota	975	1,760	1,191	1,182	647	–45.3	15,167	8,743
South Dakota	1,166	2,824	1,659	1,570	670	–57.4	18,884	9,243
Nebraska	2,080	4,202	2,874	2,920	1,396	–52.2	22,559	11,533
Kansas	2,039	3,303	2,504	2,685	1,675	–37.6	16,171	10,718
Ohio	1,903	3,096	2,237	2,001	1,722	–14.0	9,126	7,364
Indiana	1,809	3,042	1,932	1,667	1,492	–10.5	9,182	8,087
Illinois	3,905	6,667	4,628	3,772	2,934	–22.2	17,586	13,745
Michigan	1,089	1,763	1,524	1,423	1,172	–17.6	8,401	6,249
Wisconsin	1,413	2,677	2,272	2,198	1,622	–26.2	12,090	8,684

*Value of Land and Buildings, Implements and Machinery and Livestock.

Source: 16th Census of the United States, 1940, Volume III Agriculture, Chapt. I, Table 16, and Statistical Abstract of the United States, 1930, Table 582, p. 624.

The above table is based on the dollar value as of each Census year and is not adjusted with respect to land values or by indices.

According to Table F-8, in 1940 Minnesota ranked third among the North Central States as to total value of farm property, being surpassed by Iowa and Illinois.

However, the trend in total value from 1910 to 1940 increased in Minnesota, whereas it decreased in Iowa and Illinois. Total values increased in the same period in Wisconsin and Michigan but decreased in the other states.

The tabulation, F-8, indicates an average value per farm for Minnesota of $9,453 in 1940, which is less than the average value per farm in Iowa, Illinois, Nebraska or Kansas, but higher than the average value per farm in the other North Central States.

3. Number, Size, Distribution and Population of Farms.

a. Number and Size

The number of farms in Minnesota, their average size and total acreage, together with the per cent which total farm acreage bears to the total land area of the State, are shown from 1850 until 1920 by decades, and since by five-year periods, in the following tabulation, F-9.

TABLE F-9. MINNESOTA FARMS 1850-1940

Census Year	No. of Farms	Av. Size of Farm Acres	Total Acreage In Farms	Per Cent of Land Area
1850 (Territory)	157	183.9	28,881	0.1%
1860 (State)	18,181	149.2	2,711,968	5.2
1870	46,500	139.4	6,483,828	12.5
1880	92,386	145.1	13,403,019	25.9
1890	116,851	159.7	18,663,645	36.1
1900	154,659	169.7	26,248,498	50.7
1910	156,137	177.3	27,675,823	53.5
1920	178,478	169.3	30,221,758	58.4
1925	188,231	159.7	30,059,137	58.1
1930	185,255	166.9	30,913,367	59.7
1935	203,302	161.4	32,817,911	63.4
1940	197,351	165.2	32,606,962	63.7*

Source: 16th U. S. Census, 1940, Agriculture, Volume III General Report, Chapter I, Table 18.

*Following recalculation by the Federal government in 1935, the total land area of the State was reduced in subsequent census reports by 543,360 acres from 51,749,120 acres to 51,205,760 acres.

As shown in Table F-9, the State had a steady increase in the number of farms until 1935, when they reached their maximum, 203,302. Since 1935, the number decreased slightly to 197,351 in 1940. The increase in number between 1910 and 1940 amounted to 41,214, or 26%.

For the last fifty years, the average size of farm was between 160 and 170 acres, or slightly over a quarter of a square mile. During this time the maximum average size was reported for 1910 as 177.3 acres. In 1940 the average size was 165.2 acres, a reduction of about 7% from the 1910 figure.

Comparison of the number and average size of farms in each of the North Central States in 1910 with the same data for 1940, is afforded in the following Table F-10:

TABLE F-10. NUMBER AND SIZE OF FARMS
NORTH CENTRAL STATES

State	Number of Farms		Total Acreage in Farms		Average Size Of Farms In Acres	
	1910	1940	1910	1940	1910	1940
			(1,000's)	(1,000's)		
Minnesota	156,137	197,351	27,676	32,607	177.3	165.2
Iowa	217,044	213,318	33,931	34,149	156.3	160.1
North Dakota	74,360	73,962	28,427	37,936	382.3	512.9
South Dakota	77,644	72,454	26,017	39,474	335.1	544.8
Nebraska	129,678	121,062	38,622	47,344	297.8	391.1
Missouri	277,244	256,100	34,591	34,740	124.8	135.6
Kansas	177,841	156,327	43,385	48,174	244.0	308.2
Wisconsin	177,127	186,735	21,060	22,876	118.9	122.5
Michigan	206,960	187,589	18,941	18,038	91.5	96.2
Indiana	215,485	184,549	21,300	19,801	98.8	107.3
Illinois	251,872	213,439	32,523	31,033	129.1	145.4
Ohio	272,045	233,783	24,105	21,908	88.6	93.7
United States	6,361,502	6,096,779	878,798	1,060,852	138.1	174.0

Source: 16th U. S. Census, 1940, Agriculture, Volume III, General Report, Chapter I, Table 18.

Table F-10 indicates that between 1910 and 1940 the total number of farms decreased in each of the North Central States except Wisconsin and Minnesota, where the number of farms increased 5% and 26% respectively. During this period the number of farms in the United States decreased 4%.

Also, from 1910 to 1940 there were increases in the total acreages in farms in Minnesota (about 18%) and all the other West-North Central States. During this period the total acreages in farms decreased in all of the East-North Central States except Wisconsin, which showed an increase of nearly 9%. From 1910 to 1940 the total acreage in farms in the United States increased over 182 million acres, or about 21%.

Comparing changes from 1910 to 1940 in the average size per farm, in acres, of Minnesota with the other North Central States and with the national averages, Minnesota shows a decrease of 12.1% acres, or about 7%, with increases in all the other states of the group. The increases were most marked in the West-North Central States, and less marked in the eastern states of this group. Between 1910 and 1940, the average size of farms in the United States increased 35.9 acres, or 26%.

There are many farm enterprises in Minnesota requiring different acreages depending on their function and operation, such as truck farms, horticultural farms, dairy farms, cash crop farms, animal-fattening farms, animal specialty farms, combinations of these, as well as general farms. The average acreage in the various types of farms is presented in Table F-13.

The following table, F-11, shows changes in numbers of farms, according to acreage groups from 1910 to 1940:

TABLE F-11. DISTRIBUTION OF MINNESOTA FARMS ACCORDING TO SIZE — 1910 AND 1940

Acres Farms By Size	1910		1940		Change	
	Number	% of Total	Number	% of Total	Increase In Number	% of Total Increase
Under 3	294	0.2	444	0.2	150	0.4
3 to 9	2,555	1.6	6,251	3.2	3,696	9.0
10 to 19	2,770	1.8	4,971	2.5	2,201	5.3
20 to 49	12,028	7.7	18,355	9.3	6,327	15.3
50 to 99	26,571	17.0	35,580	18.0	9,009	21.9
100 to 174	55,424	35.5	67,386	34.2	11,962	29.0
175 to 259	27,972	17.9	33,116	16.8	5,144	12.5
260 to 499	24,864	15.9	27,078	13.7	2,214	5.4
500 to 999	3,359	2.2	3,743	1.9	384	0.9
1,000 and Over	300	0.2	427	0.2	127	0.3
Total	156,137	100.	197,351	100.	41,214	100.

Source: 16th U. S. Census, 1940, Agriculture, Volume III, General Report, Chapter III, Table 25.

According to Table F-11, from the standpoint of the total distribution of farms, it appears that between 1910 and 1940 there has been a greater proportionate increase in the number of Minnesota farms under 100 acres, than over 100 acres. The number of farms of 100 acres, or over, constituted 71.7% of the total in 1910, and 66.8% of the total in 1940.

b. Distribution of Farm Land According to Use

The distribution of Minnesota's farm land according to use and per cent of U. S. total during 1929, 1934 and 1939 was as follows:

TABLE F-12. DISTRIBUTION OF MINNESOTA FARMS ACCORDING TO USE

		1929	1934	1939
Cropland harvested	Acres	18,445,306	17,161,044	18,807,114
	%	5.13	5.81	5.85
Crop failure	Acres	254,979	2,475,322	251,119
	%	2.01	3.85	1.22
Cropland idle or fallow	Acres	790,407	880,371	1,074,970
	%	1.91	1.57	1.80
Plowable pasture	Acres	2,249,203	2,273,698	2,840,821
	%	2.06	2.31	2.16
Woodland	Acres	4,746,303	5,383,250	2,931,805
	%	3.17	2.90	2.14
All other land (A)	Acres	4,427,169	4,644,225	6,701,133
	%	1.41	1.31	1.70
Land available for crops (B)	Acres	21,739,895	22,790,436	22,974,024
	%	4.16	4.43	4.33
Land used for crops (C)	Acres	18,700,285	19,636,366	19,058,233
	%	5.03	5.47	5.58

(A) Includes pasture other than plowable and woodland; also all wasteland, houseyards, barnyards, feedlots, lanes, roads, etc.
(B) Cropland harvested, crop failure, idle or fallow cropland, and plowable pasture.
(C) Cropland harvested and crop failure.
Source: 16th U. S. Census — Agriculture — Volume III General Report.

During the 10 year period, there was a marked decrease in the proportion of farm land in woodland and a slightly increased use of land for crops.

There are nine different "Type of Farming Areas" in the State of Minnesota, as shown on the map, Exhibit III-B-6. Table F-13 lists the locations with the counties in each of these areas, their utilizations, diversification, types, and average acreages for the types of farms in each area.

TABLE F-13. TYPES OF FARMING AREAS IN MINNESOTA

FARMING AREA TYPE 1 — SOUTHEAST — DAIRY AND LIVESTOCK

Counties and Diversification of Products			Use of Tillable Land	Type of Farming	Av. Total Acres Per Farm (1930)
Dakota	Mower		Small grain	Dairy	157
Dodge	Olmsted		Hay and pasture	General	210
Fillmore	Wabasha		Intertilled crops	Animal specialty	161
Goodhue	Washington			Cash grain	203
Houston	Winona				

Dairying, hay. Hogs, beef cattle, poultry, sheep, oats, barley. Some wheat, rye, flax, little corn. Most crops fed to livestock.

FARMING AREA TYPE 2 — SOUTH CENTRAL — DAIRY AND LIVESTOCK

Counties and Diversification of Products			Use of Tillable Land	Type of Farming	Av. Total Acres Per Farm (1930)
Blue Earth	McLeod	Sibley	Small grain	Dairy	141
Brown	Meeker	Stearns	Intertilled crops	General	146
Carver	Nicollet	Steele	Hay and pasture	Animal specialty	183
Le Sueur	Rice	Waseca		Cash grain	174
Freeborn	Scott	Wright			

Intensive dairying. Cows, predominantly for milk. Many hogs and chickens. Few sheep. More beef and milk-beef cattle in southern counties. More corn and grains, less hay than in 1.

FARMING AREA TYPE 3 — SOUTHWEST — LIVESTOCK AND CASH GRAIN

Counties and Diversification of Products			Use of Tillable Land		Av. Total Acres Per Farm (1930)
Cottonwood	Lyon	Pipestone	Small grain	General	186
Faribault	Martin	Rock	Intertilled crops	Animal specialty	217
Jackson	Murray		Hay and pasture	Cash grain	231
Lincoln	Nobles	Watonwan		Dairy	169

Intensive livestock. Fattening purchased beef and milk-beef cattle. Many hogs, chickens, turkeys. Cash grain sales principal source of income. Oats, barley, corn.

Source: University of Minnesota Agricultural Bulletin 347-1940 and Field Observations.

TABLE F-13 (CONTINUED)

FARMING AREA TYPE 4 — WEST CENTRAL — LIVESTOCK AND CASH GRAIN

Counties and Diversification of Products			Use of Tillable Land	Type of Farming	Av. Total Acres Per Farm (1930)
Big Stone	Redwood	Pope	Small grain	General	209
Chippewa	Renville	Swift	Intertilled crops	Animal specialty	240
Grant	Stevens		Crops	Dairy	199
Kandiyohi	Traverse		Hay and pasture		
Lac qui Parle	Yellow Medicine				

Some dairying. Hogs and beef cattle. Northern edge of cornbelt. Wide variations in yield. Corn big crop. Oats and barley important. Some wheat.

FARMING AREA TYPE 5 — EAST-CENTRAL — DAIRY AND POTATOES

Counties and Diversification of Products			Use of Tillable Land	Type of Farming	Av. Total Acres Per Farm (1930)
Anoka	Isanti	Morrison	Small grain	Dairy	131
Benton	Kanabec	Pine	Intertilled crops	General	140
Chisago	Mille Lacs	Sherbourne	Hay and pasture	Crop specialty	129
				Self sufficing	70

Most of the area originally in hardwood forest. Coniferous forests along northern edge. Dairying most important. Lower crop yields. Oats, rye, barley, some corn. Potatoes important crop. Tame hay, timothy, clover. Large pastures.

FARMING AREA TYPE 6 — NORTHWESTERN — DAIRY AND LIVESTOCK

Counties and Diversification of Products		Use of Tillable Land	Type of Farming	Av. Total Acres Per Farm (1930)
Becker, Pennington, Polk (East)		Small grain	Dairy	173
Douglas	Red Lake	Intertilled crops	General	186
Mahnomen	Roseau	Hay and pasture	Self sufficing	84
Marshall (East)	Todd			
Otter Tail	Wadena			

East part of area originally in forest. White Earth Indian Reservation in central portion of this area. West part borders original prairie. Lower yields in crops than areas to south. Oats, flax, barley, corn, potatoes, hay. Dairying most important. Some beef and milk-beef cattle. Hogs, sheep and chickens.

Source: University of Minnesota Agricultural Bulletin 347-1940 and Field Observations.

TABLE F-13 (CONTINUED)

FARMING AREA TYPE 7 — RED RIVER VALLEY — SMALL GRAIN, POTATOES AND LIVESTOCK

Counties and Diversification of Products		Use of Tillable Land	Type of Farming	Av. Total Acres Per Farm (1930)
Clay	Norman	Small grain	General	268
Kittson	Polk (West)	Hay and pasture	Dairy	239
Marshall (West)	Wilkin	Idle and fallow	Cash grain	368
		Intertilled crops	Crop specialty	267
			Animal specialty	342

Area most remote from principal markets. Wheat used to be principal crop. Diversification, with oats, barley and forage crops, has replaced much wheat. Potatoes are increasing as a crop. Corn is a minor one. Hay, alfalfa and sweet clover. Dairying, and livestock; beef, milk-beef, hogs, sheep, poultry.

FARMING AREA TYPE 8 — NORTHERN CUTOVER — DAIRY, POTATOES AND CLOVER SEED

Counties and Diversification of Products	Use of Tillable Land	Type of Farming	Av. Total Acres Per Farm (1930)
Aitkin, Cass, Crow Wing, Cook	Hay and pasture	Dairy	134
Beltrami, Koochiching, St. Louis	Small grain	General	134
Carlton, Hubbard, Itasca, Lake	Intertilled crops	Self sufficing	132
Clearwater, Lake of the Woods		Crop specialty	84

Cutover forest area; mostly coniferous. Poorest agricultural area in the State. Some farms have been relocated and use diverted to forestry. Lumbering important. Iron mining most important. Local markets for farm products to these industries. Farm woodlots increasing in importance. Dairying is principal farm enterprise. Some hogs and sheep. Small poultry flocks. Potatoes, clover seed production increasing. Important recreation area.

FARMING AREA TYPE 9 — TWIN CITY — SUBURBAN TRUCK, DAIRY AND FRUIT

Counties and Diversification of Products	Use of Tillable Land	Type of Farming	Av. Total Acres Per Farm (1930)
Hennepin Ramsey	Hay and pasture	Dairy	92
Intensive vegetable gardens close	Intertilled crops	Truck	24
to State's densest metropolitan	Small grain	General	59
area. Dairying, producing fluid	Truck crops and	Crop specialty	76
milk and cream.	berries	Fruit	23
		Poultry	14

Production of small fruits and berries. Fresh eggs. Oats, barley, corn, potatoes, hay. Small number of beef-cattle and hogs. Small poultry flocks.

Source: University of Minnesota Agricultural Bulletin 347-1940 and Field Observations.

Table F-13 indicates the great diversity in farm enterprises throughout Minnesota and the variation in the sizes of the same kinds of farms in different parts of the State. The diversity is evidence of a willingness upon the part of the Minnesota agriculturist to pioneer locally in many forms of farming. This Report has not been concerned with the degree of success that has been met in all or any of these types of farming endeavor.

Variations as to size are of peculiar interest as evidence of the extent of the character of the growing number of small farms which has had a distinct bearing upon the State's average.

Table F-13, in conjunction with the map, Exhibit III-B-6, also shows the geographic distribution of the principal farm enterprises in the State.

c. Farm Population

Exhibit III-B-4 indicates the farm population and the percentage it represents out of the total population, also the number of rural farm families in Minnesota and the other North Central States.

According to this Exhibit, the farm population in Minnesota increased 9.8% from 833,131 in 1910 to 914,609 in 1940. However, as a percentage of the total population, the farm population dropped from 40.1% in 1910 to 32.8% in 1940. The non-farm population, including rural and urban, increased by 51.1% from 1,242,577 in 1910 to 1,877,691 in 1940. These trends indicate a declining proportion of the State's total population on the farms, which increased in numbers 26.4% from 1910 to 1940.

The number of children under five years of age on the nation's farms (based on the 1930 Census) exceeded by 50%, the number required to maintain the present level of population. There was a deficit of 6% to 8% in the same age group in urban places of 2,500 to 100,000 in population. This indicates a trend toward a surplus population above that required for farm labor requirements, especially during a period of increasing mechanization, and the need for business opportunities off the farms to support this excess farm population.

Exhibit III-B-4 indicates a decreasing trend in the farm population, as a part of the total population, in all of the states listed and for the United States, as a whole, from 1910 to 1940. The 1940 percentage of farm population to total population in Minnesota was higher than in Missouri and in the North Central States to the east, but lower than in Iowa and the North Central States to the west.

4. Products of Agriculture

The principal farm products in Minnesota fall into four classes; crops, livestock, dairy products, and other livestock products.

The important items sold by farmers in each of these classes are:

Crops: wheat, corn, oats, barley, rye, flax, potatoes, and hay.

Livestock: hogs, cattle and calves, sheep and lambs.

Dairy products: butterfat, milk and farm butter.

Other livestock products: chickens, eggs, turkeys, wool.

a. Crops

(1) Ranking and trends in Volume of Production of Principal Crops

From the standpoint of the average number of acres harvested per year during the ten years from 1931 through 1940 the relative ranking of the various crops in Minnesota was as follows:

TABLE F-14. RANKING OF CROPS IN MINNESOTA BY ACRES HARVESTED 1931-1940

	Million acres harvested		Million acres harvested
(1) All Corn	4.64	(5) All wheat	1.72
(2) Oats	4.21	(6) Flax	1.37
(3) Tame hay	2.75	(7) Rye	0.48
(4) Barley	1.95	(8) Potatoes	.30

Source: University of Minnesota Agricultural Extension Bulletin No. 228.

The rankings of Minnesota, in the United States and with other states in the North Central group, as to volume of the principal crops produced in 1940, are shown in Table F-15:

TABLE F-15. MINNESOTA'S CROP PRODUCTION 1910 AND 1940 AND ITS RANKING WITH OTHER STATES IN 1940

Crops	1940 Production Ranking in U.S.A.	1940 Production Ranking In N. Central States	Production** Million Bushels 1910	1940	Change	Trend
Corn (all)	3	3	56.4	172.5	+116.1	Up
Oats	2	2	78.5	180.8	+102.3	Up
Barley	1	1	26.9	58.3	+ 31.4	Up
Wheat (all)	13	6	64.0	31.4	— 32.6	Down
Rye	3	3	1.9	5.6	+ 3.7	Up
Potatoes	4	1	10.1	23.8	+ 12.7	Up
Hay (all)	2	2	2.9*	4.6*	+ 1.7*	Up
Flax	1	1	3.5	16.7	+ 13.2	Up

*Million Tons

**Derived from U. S. Department of Agriculture "Yearbooks" and "Agricultural Statistics".

The comparison of the volume of crops produced in Minnesota in 1910 and in 1940 (Table F-15), shows rising trends and increased volume in the production of all the crops except wheat, which has declined about 50 per cent.

Trends in the production of these crops are also shown, graphically in Exhibits III-B-7, III-B-11, and III-B-12. Yields are shown graphically in Exhibits III-B-9, III-B-11 and III-B-12.

(2) Distribution of Principal Crops

The distribution of crops in Minnesota is shown, during the war years 1942 and 1943, in Table F-16.

TABLE F-16. DISTRIBUTION OF MINNESOTA CROPS — 1942 AND 1943
(1,000 BUSHELS)

Crops		Production	Fed to Livestock	For Farm Household Use	Used for Seed	Sold
Corn	1942	207,190	181,696*	26	Combined*	25,468
	1943	215,468	190,459*	28	Combined*	24,981
Oats	1942	177,567	154,483*	—	Combined*	23,084
	1943	142,791	119,444*	—	Combined*	22,847
Barley	1942	50,327	27,680*	—	Combined*	22,647
	1943	22,718	12,268*	—	Combined*	10,450
Wheat	1942	23,170	4,171	375**	1,596	17,028
(All)	1943	18,008	3,602	373**	1,755	12,278
Rye	1942	3,345	1,171	6**	221	1,947
	1943	1,538	538	3**	159	838
Potatoes	1942	18,050	1,895†	3,625	2,777	9,753
	1943	23,571	2,122†	4,185	2,426	14,838
Hay	1942	6,831	6,387††	—	—	444
(All)	1943	6,929	6,513††	—	—	416
Flax-	1942	15,950	—	—	788	15,162
seed	1943	15,456	—	—	638	14,818

* Used for feed and seed.
** Ground at mill for home use or exchanged for flour.
† Fed to livestock and loss after harvest.
†† Kept on Farms (for all uses).
Source: Bureau of Agricultural Economics, United States Dept. of Agriculture, May 1944, Report by Crop Reporting Board.

This table shows that a great proportion of the corn and oats, nearly all the hay, and much of the barley produced is not sold but used for feed for livestock or for seed.

(3) Trends in Farm Prices for Principal Crops

The following tabulation, F-17, indicates the trends in the average annual statewide farm prices of the principal crops in Minnesota from 1910 through 1940 together with the maximum and minimum average annual prices and a comparison with the average annual price in the United States during the thirty year period:

TABLE F-17. TRENDS IN AVERAGE ANNUAL FARM PRICES OF CROPS IN MINNESOTA — 1910 THROUGH 1940
(PRICES PER BU. EXCEPT HAY PER TON)

Crops	1910	1940	Long Term Trend	Maximum Amount	Maximum Year	Minimum Amount	Minimum Year	Minnesota Av. Price Compared With U.S. Av.
Corn	$0.45	$0.53	Up	$1.20	1919	$0.28	1932	Lower
Oats	0.32	0.24	Down	0.64	1919	0.13	1932	Lower
Barley	0.60	0.37	Down	1.16	1919	0.22	1932	Lower
Wheat	0.94	0.72	Down	2.50	1919	0.44	1932	Higher
Rye	0.64	0.37	Down	1.30	1919	0.29	1932	Lower
Potatoes	0.64	0.40	Down	1.54	1925	0.23	1932	Lower
Hay (Tame)	10.00	5.00	Down	14.50	1919	5.00	1940	Lower
Flaxseed	2.30	1.41	Down	4.45	1919	0.91	1932	Higher

Derived from "Yearbooks" and "Agricultural Statistics." Published by the United States Department of Agriculture.

This table shows a long term declining trend in prices of the principal Minnesota crops, during the thirty year period covered, except for corn. It also shows that during the thirty years the State's average annual price for these crops has been lower than the United States average price, except for wheat and flaxseed.

Trends in the average annual farm selling prices for all these crops except hay, are shown graphically in Exhibits III-B-8, III-B-11 and III-B-12.

(4) Trends in Principal Crops as Sources of Income

The following table, F-18, indicates the proportionate part represented by each crop as a source of cash farm income from 1910 to 1940, as compared with the total cash income from all the principal products of agriculture in Minnesota during that time.

TABLE F-18. MINNESOTA FARMERS' CASH SALES
PER CENT CROPS TO TOTAL CASH SALES
FIVE YEAR AVERAGES

Crops	1910-14 %	1915-19 %	1920-24 %	1925-29 %	1930-34 %	1935-39 %	1940 %
Corn	3.3	3.1	4.0	2.4	2.9	3.6	8.4
Oats	4.2	4.5	4.7	2.9	1.9	1.9	2.1
Barley	5.3	3.4	1.6	1.7	1.6	3.1	2.3
Wheat (All)	22.1	21.4	9.2	6.1	3.6	5.3	4.4
Rye	1.6	2.1	3.2	1.1	0.5	0.9	0.4
Potatoes	5.1	4.7	4.9	3.8	2.9	1.8	1.6
Hay (All)	3.1	0.9	1.2	1.1	0.8	0.6	0.4
Flax	2.6	1.6	3.4	3.5	3.2	2.9	4.8

Derived from Exhibit No. III-B-3.

This table clearly indicates the downward trend in wheat, oats, rye, potatoes and hay and the fairly stabilized positions of corn and flax as income crops.

(5) Other Crops

There are other crops grown in Minnesota for which long-term statistics are not available but which may become important in the future. These are fiber flax, sugar beets, and soybeans.

(a) Fiber Flax

The operation of the experimental fiber flax plant at Windom, discussions with persons familiar with the problem, and a review of the reports of conferences and visits of the Fiber Flax Committee appointed by Governor Stassen, lead to the tentative conclusion that in Minnesota there may be a real opportunity to produce flax fibers suitable for linen. There also may be a possibility of developing a linen industry in the State near the raw material. Production costs and long term trends covering linen and competitive fabrics and comparative demands must be given careful consideration to determine whether such developments would be economically justified.

(b) Sugar Beets

Sugar beets have been grown in the vicinity of East Grand Forks and Chaska where they form the raw material for beet sugar. Acreage and production are limited by federal restrictions and quotas.

(c) Soybeans

Soybeans are produced extensively in the North Central States in which Minnesota ranks fifth in volume of production. While there are important uses of soybeans on the farm and as raw material for manufacture, production of soybeans has not been a major source of farmers' income up to 1940. In 1943, a war year, 246,000 acres of soybeans were harvested in Minnesota, which was 3,000 acres more than were harvested in potatoes.

(d) Forage Crop Seeds

Minnesota leads the Nation in the production of sweet clover seed. In the war year 1942, 245,000 bushels were raised, 225,400 bushels were sold and the rest used as seed on the farm where grown. The average season price received in the State that year was $3.85 a bushel.

During 1942, Minnesota farmers produced and sold the following seed crops at the average season prices indicated below:

Seed Crop	Production (bushels)	Sold (bushels)	Average Price (per bushel)
Alsike Clover	53,000	50,000	$11.00
Red Clover	42,000	31,500	12.00
Alfalfa	22,000	17,400	17.70

During 1943, the sweet clover seed production and amount sold was about half that in 1942 but the three other seed crops were greater than in 1942. The 1943 bushel prices were higher than those received the previous year.

(The above statistics are given in the Report issued by the Crop Reporting Board, Bureau of Agricultural Economics, United States Department of Agriculture, May 1944).

(e) Vegetables

In 1929, the value of vegetables for sale and for farm households (excluding Irish and sweet potatoes) in Minnesota, amounted to $8,155,795. In 1939 this item amounted to $7,779,277. Recently developed processes for drying vegetables and improved quick freezing methods indicate opportunities, in addition to the rapidly growing canning industries, for an increased demand with new processing industries for vegetables from Minnesota farms.

(f) Horticultural Products

The production for sale of nursery stock; fruit, flower and vegetable seeds and bulbs; constitutes a worthwhile item in the State's agricultural development. The income to nurserymen and farmers of the State from sales of horticultural specialties was $3,170,990 in 1929 and $2,685,693 in 1939.

b. Livestock

The principal meat animals raised in the State, or brought in from other states for fattening purposes, are beef cattle, milk-beef (or dual-purpose) cattle, sheep, and hogs. Most of the hogs are raised in the State, few being brought in compared with cattle and sheep. A large portion of the beef cattle sold are raised and fattened calves, from beef or from milk-beef cows that are milked. Many sheep and lambs are fed and grazed in the State. About one-third are brought in from individual public stockyards and about two-thirds are shipped direct from other states.

Hogs are bred and raised in every county. The greatest number are produced in the south central, southeastern and southwestern portions of the State where great quantities of skim milk or corn are available for feed. It is in this southern area that most of the swine are prepared for the packing houses. In the northern portion of the State most of the hogs are eaten on the farms or sold for local consumption.

(1) Ranking and Trends in Number of Principal Livestock on Farms.

The following table, F-19, indicates the rankings of Minnesota in the United States and in the North Central States as to the number of livestock on farms in 1940 and the trends in the number of livestock on Minnesota farms, from 1910 through 1940:

TABLE F-19. LIVESTOCK ON MINNESOTA FARMS
1940 RANKING WITH OTHER STATES

	1940 RANKING		NUMBER ON FARMS			
			MILLIONS			
	In U.S.A.	In N. Central States	1910	1940	Change	Trend
Hogs	3	3	1.00	3.82	+ 2.82	Up
All Cattle and Calves	4	3	2.35	3.40	+ 1.05	Up
Sheep and Lambs	14	6	0.48	1.03	+ 0.55	Up
Horses and Colts	3	2	0.77	0.64	− 0.13	Down

Derived from "Yearbooks" and "Agricultural Statistics" published by the United States Department of Agriculture.

This tabulation shows an increasing number of hogs, cattle and sheep and a decreasing number of horses. Most of the horses are used for draft purposes and the decline probably reflects the increased use of machinery, automobiles and tractors on the farms.

(2) Trends in Farm Prices for the Principal Livestock

The average statewide prices received by Minnesota farmers for livestock in 1910 and 1940 with long term trends based on all the annual prices between these years, together with the maximum and minimum prices during this period, are shown below:

TABLE F-20. TRENDS IN AVERAGE ANNUAL FARM PRICES FOR LIVESTOCK IN MINNESOTA, 1910 THROUGH 1940

Livestock	1910	1940	Long Term Trend	MAXIMUM Amount	MAXIMUM Year	MINIMUM Amount	MINIMUM Year	Minnesota Av. Price Compared with U. S. Av.
Hogs	$11.50	$ 9.30*	Up	$ 24.00	1920	$ 4.40	1934	Higher
All Cattle and Calves	14.30	45.10	Up	63.30	1929	14.30	1910	Higher
Sheep and Lambs	4.00	6.10	Up	11.20	1926	2.70	1933	Higher
Horses and Colts	111.00	77.00	Down	116.00	1915	56.00	1933	Higher

*Not indicative of real trend.

Derived from "Yearbooks" and "Agricultural Statistics" published by the United States Department of Agriculture.

This tabulation shows the wide variation between minimum and maximum average annual prices paid to Minnesota farmers for livestock and the general long term upward trend from 1910 to 1940, except in the price of horses. The Minnesota farm prices for all these classes of livestock have averaged higher than the national average.

(3) Trends in Principal Livestock as Sources of Income

Indexes of price, quantity and sales of livestock are shown graphically in Exhibit III-B-20. The trend in quantity of sales generally has been upward from 1910 to 1940, the five year average from 1935 through 1939 being about double that of 1910 to 1914.

Sales of meat animals, in Minnesota during the five year period 1936 to 1940 amounted to an average of $134,000,000 per year or 38% of the total cash farm income, according to Bjorka, Dowell and Engelman, in their pamphlet, "Feeder Cattle and Sheep Shipped into Minnesota", (University of Minnesota Agricultural Bulletin 359-1942). In 1910 sales of meat animals provided about 25% of the total cash income. A considerable portion of the cattle sales included the sale of dairy stock. Only 4% of the total number of cows were kept mainly for beef.

The numbers of hogs on the farms of Minnesota and of other North Central States with average annual prices per head are given in Exhibit No. III-B-21. This tabulation indicates that Minnesota's hogs brought higher average prices,

in most of the years reported between 1910 and 1940, than were paid in the other states listed.

The following table, F-21, presents the proportion of the total farm cash sales income represented by the farm cash sales of each of the principal livestock items during five year periods from 1910 through 1939 and for the year 1940:

TABLE F-21. MINNESOTA FARMERS' CASH SALES
PER CENT LIVESTOCK PRODUCTS TO TOTAL CASH SALES
FIVE YEAR AVERAGES, AND 1940

Livestock	1910-14 %	1915-19 %	1920-24 %	1925-29 %	1930-34 %	1935-39 %	1940 %
Hogs	14.3	19.7	21.9	24.3	22.5	21.1	19.2
Cattle and Calves	10.5	14.0	11.2	13.7	15.6	17.0	18.2
Sheep and Lambs	0.5	0.5	0.6	1.0	1.7	2.4	1.9

Derived from Exhibit No. III-B-3.

This table shows the increasing trend in sales from cattle and calves, and from sheep and lambs; also that sales from hogs averaged slightly over 20% of the total from all sources since 1914, and have had a slightly downward trend since 1929.

c. Dairy Products

Minnesota had 1,710,000 milk cows in 1940 as compared with 1,085,000 in 1910. The increase amounted to nearly 58%.

The number of cows, total gallons of milk and the milk per cow from 1924 through 1943 are shown graphically in Exhibit III-B-13. This Exhibit shows an increase in total milk, from about 6.5 billion pounds in 1924 to about 8.4 billion pounds in 1940. The average annual production in milk per cow increased from about 4,400 pounds in 1924 to over 5,100 pounds per cow in 1940.

Most of the milk produced is used for the production of butterfat. The milk and butterfat provide the raw material for the State's important dairy industry. Minnesota's creameries produce more creamery butter than any other state. Cheese factories, milk processing plants and drying plants are other manufacturers using the raw dairy products of Minnesota.

(1) Ranking and Trends in Production of Dairy Products

Minnesota ranks second in the United States in the production of dairy products. Wisconsin is first. Minnesota ranks first among all the states in the production of butterfat by creameries and on farms, but is second to Wisconsin in the amount of butterfat produced on the farms alone.

The Minnesota production of all cow's milk, milk skimmed for sale as cream, and the butterfat produced on the farms, from 1932 through 1940, was:

TABLE F-22. MINNESOTA PRODUCTION OF DAIRY PRODUCTS ON FARMS, 1932-1940

Year	All Milk Produced (Million Lb.)	Milk Skimmed For Sale As Cream (Million Lb.)	Butterfat Produced On Farms (Million Lb.)
1932	7,810	5,850	293
1933	8,166	6,111	304
1934	7,482	5,511	276
1935	7,384	*	*
1936	7,745	5,746	290
1937	7,646	5,560	287
1938	8,175	5,982	307
1939	8,160	6,052	306
1940	8,405	6,140	315

*Not available—Reported data said to require revision.

From: United States Department of Agriculture, "Yearbooks" and "Agricultural Statistics".

Table F-22 shows considerable stability in the production of dairy products for the period, with a slight up trend prior to the war period.

(2) Trends in Dairy Products as Sources of Income

The quantities of dairy products sold by the farmers of Minnesota from 1910 through 1937 were:

TABLE F-23. QUANTITIES OF DAIRY PRODUCTS SOLD BY MINNESOTA FARMERS — 1910-1937

	Milk (Million Lb.)	Butterfat (Million Lb.)
1910	289	77
1915	331	98
1920	410	107
1925	553	197
1930	698	213
1935	686	205
1937	772	208

From: "Minnesota and the Agricultural Situation", April 1939—issued by The Minnesota Institute of Governmental Research.

Table F-23 shows the great increase in dairying between 1910 and 1937 and the upward trend in the volume of dairy products sold.

Prices received by the State's farmers for butterfat bought by creameries

from 1906 through 1943, are indicated graphically in Exhibit No. III-B-15. This exhibit shows the 1910 price to have been slightly over 30 cents per pound and the 1940 price as about 34 cents per pound. The maximum price during this period (1910-1940) was 63 cents per pound in 1920 and the minimum price slightly above 20 cents per pound in 1932. The long term trend in butterfat prices has been upward.

Trends in price, quantity and value of sales of dairy products in Minnesota from 1910 through 1940 are represented in Exhibit No. III-B-19. The long term trends in quantity and value have been upward. Prices fluctuated widely but averaged about the same from 1935-39 as from 1910-14.

The following table F-24, indicates the proportion of the total sales of the principal farm products represented by the sales of Minnesota's dairy products, expressed in percentages, by annual averages for five-year periods, and for 1940:

TABLE F-24. MINNESOTA FARMERS' CASH SALES
PER CENT DAIRY PRODUCTS OF TOTAL CASH SALES
FIVE-YEAR AVERAGES AND 1940

Dairy Products	1910-14 %	1915-19 %	1920-24 %	1925-29 %	1930-34 %	1935-39 %	1940 %
Butterfat	13.9	12.8	19.6	22.0	23.1	20.7	18.5
Milk & Farm Butter	7.2	5.1	5.8	5.4	7.7	6.9	6.8

Derived from Exhibit No. III-B-3.

Table F-24 shows that sales of butterfat have had an increasing share in the total farm cash sales income from 1910 to 1935 and its share has declined somewhat since then. Sales of milk and farm butter had a decreasing share in the total from 1910 through 1929, but increased during the 1930-34 period. Since 1934, their percentages have slightly decreased.

In 1910 Dairy Products accounted for 21.1% and in 1940 they accounted for 25.3% of the total income from sales.

d. Other Livestock Products

In 1910 the farm cash sales income from chickens, eggs, turkeys, and wool, which have been the principal "other livestock products" in Minnesota, constituted 6.1% of the total farmers' cash income from sales of all the principal farm products. In 1940 the cash sales income from these other livestock products amounted to 11.1% of the total and comprised nearly twice as much a proportionate share as the 1910 percentage.

(1) Trends in Production of Other Livestock Products

The number of chickens and turkeys reported on the farms of Minnesota for selected dates through 1940, as of the first of January of the years listed, were:

TABLE F-25. CHICKENS AND TURKEYS ON MINNESOTA FARMS

	Chickens (thousands)	Turkeys (thousands)
1930	19,100	402
1932	19,170	394
1934	18,727	434
1936	17,626	396
1938	17,300	370
1940	20,896	433

From: United States Department of Agriculture "Yearbooks" and "Agricultural Statistics".

Table F-25 indicates a stabilized condition for the period. These quantities are not indicative of the numbers of birds sold.

The quantities of chickens and eggs sold on Minnesota farms from 1910 through 1937 were as follows:

TABLE F-26. CHICKENS AND EGGS SOLD BY MINNESOTA FARMERS

	Chickens (1000 lb.)	Eggs (1000 dozen)
1910	22,111	29,099
1915	25,246	34,562
1920	28,381	40,356
1925	32,963	51,982
1930	55,031	86,080
1935	45,718	73,436
1937	50,267	82,849

From: "Minnesota and the Agricultural Situation", 1939.

Table F-26 indicates the trends in quantities of chickens and eggs sold. In recent years the trend has been upward. During the war year 1943, in Minnesota, 55,000,000 chickens were raised, nearly 3,000,000 turkeys were produced for market and 3,477,000,000 eggs were produced.

The quantities of wool shorn from Minnesota sheep have been increasing since 1920, as follows: (From Minnesota Department of Agriculture Report 45)

Year	Pounds	Year	Pounds
1920	3,536,000	1935	7,007,000
1925	3,151,000	1940	8,058,000
1930	6,115,000	1942 (war year)	9,298,000

(2) Trends in Other Livestock Products as Sources of Income.

The following table shows the proportionate part of the total sales of all the principal agricultural products represented by the Minnesota farm income, from the sales of other livestock products as an annual average percentage for 5-year periods and for 1940:

TABLE F-27. MINNESOTA FARMERS' CASH SALES
PERCENT OTHER LIVESTOCK PRODUCTS OF TOTAL CASH SALES
FIVE-YEAR AVERAGES AND 1940

Other Livestock Products	1910-14 %	1915-19 %	1920-24 %	1925-29 %	1930-34 %	1935-39 %	1940 %
Chickens	1.2	1.2	2.4	3.2	4.2	3.4	2.5
Eggs	4.0	4.5	6.2	5.9	6.0	5.9	6.0
Turkeys	0.6	0.5	0.9	1.0	1.3	1.7	2.0
Wool	0.3	0.3	0.3	0.3	0.4	0.6	0.6

Derived from Exhibit No. III-B-3.

Table F-27 shows that each of the products named increased since 1910 as a source of income. Eggs have accounted for about 6% of the total farm sales income since 1919, and since 1929 have provided more income than any single crop except that of corn in 1940.

5. EMPLOYMENT

a. Trend in Number of Workers

As reported in the United States Census, 1940, General Report, Agriculture, there were 322,039 persons in Minnesota working in agriculture during the last week of March 1940. These were classified as follows:

	Family Labor	Hired Labor	Total
White	281,294	40,418	321,712
Non-white	314	13	327
Totals	281,608	40,431	322,039
Percent of Total	87.4%	12.6%	100%

The ratio of family labor to hired labor (about 7 to 1) in Minnesota is much higher than the national ratio which has averaged about 4 to 1 for over forty years.

According to the United States Census Reports on Occupations, the ratio of the workers in agriculture to the total gainfully employed in Minnesota was as follows:

1910	33.2%	1930	30.6%
1920	32.2%	1940	31.1%

These percentages show a relatively stable condition and indicate that the State's capacity for farm employment may have been reached.

b. Hired Farm Labor

The following Table, F-28, indicates that the number of Minnesota paid farm laborers (including foremen) decreased by over twenty thousand or 23.9% from 1930 to 1940. It also shows that this was greater than the national decrease (17.9%) during that decade, and was slightly more than the loss in Iowa and Wisconsin.

TABLE F-28. FARM LABOR — WAGE WORKERS
NORTH CENTRAL STATES — 1930 AND 1940

	1930	1940*	Per Cent of Decrease 1930-1940
Minnesota	77,238	58,763	— 23.9
Iowa	89,048	71,219	— 21.5
Missouri	82,268	64,597	— 21.5
North Dakota	38,853	20,887	— 46.2
South Dakota	32,546	16,260	— 50.0
Nebraska	47,084	27,861	— 40.8
Kansas	46,702	27,940	— 40.2
Ohio	89,876	61,474	— 31.6
Indiana	65,737	45,554	— 30.7
Illinois	113,376	72,755	— 35.8
Michigan	64,239	48,313	— 24.8
Wisconsin	78,433	60,728	— 22.6
U. S. A.	2,714,588	2,227,783	— 17.9

*Includes farm foremen.
Source: U. S. Census Reports, 1930 and 1940. Agriculture.

Cash expenditures for farm labor in Minnesota in five year averages, from 1910 to 1939, and for the years 1940 through 1943, are shown in Table F-29.

TABLE F-29. AVERAGE CASH EXPENDITURES PER YEAR IN MINNESOTA FOR FARM LABOR

Average per yr.	Million Dollars	% of Total Farm Exp.	Average per yr.	Million Dollars	% of Total Farm Exp.
1910-14	17.1	26.7	1934-39	19.3	15.7
1915-19	26.7	23.1	1940	22.0	16.7
1920-24	30.2	19.8	1941	27.0	18.5
1925-29	29.5	19.3	1942	36.9	20.6
1930-34	15.7	13.8	1943	47.0	24.3

Analysis of the cash expenditures for hired labor in Table F-29 shows that the farmers spent a smaller percentage of their total cash expense for labor from 1914 through 1934 and that the proportionate outlay for labor has been rising since 1934, but by the end of 1943 was not as high as it was between 1910 and 1914.

c. Part-time Farm Labor

In Minnesota there has been a great deal of work done by farm laborers away from the farm which is their principal employment, or from which they obtain their subsistence.

The number of Minnesota farm operators reporting days worked off the farm for pay or income, and the total days so worked, in 1929, 1934 and 1939, were as follows:

	Reporting Farm Operators	% of all Farm Operators	Total Days Off
1929	42,315	22.8	3,272,961
1934	67,987	31.8	3,727,172
1939	47,459	24.0	4,984,487

Source: "Part Time Farming in the United States," U. S. Dept. of Agriculture 1935 and Sixteenth Census of the United States. General Report. Agriculture Vol. III—1940.

This tabulation indicates the large number of farmers who report part-time work off of their own farms and the increasing trend in the number of man days worked off their farms. In 1939, 4,457,906 of the man days were on non-farm work and 526,581 days were worked on other farms.

In 1930 the major distribution of 18,213 Minnesota farmers in non-agricultural employment was:

Transportation	19.7%	Food and Allied Industries	3.8%
Building	15.6%	Extraction of Minerals	3.5%
Trade	12.2%	Automobiles and Factories	3.5%
Professional Service	7.4%	Lumber and Furniture	3.0%
Forestry and Fishing	7.2%		
Automobile Agencies, Garage and Filling Stations	5.4%		

The above tabulation, from "Part Time Farming in the United States," published by the United States Department of Agriculture in 1935, shows the principal enterprises affording employment for over 80% of the farmers working part time in 1930.

d. Hours Worked

In Minnesota the family farm laborers work nearly two hours more per day than the hired farm laborers, and have been putting in more time than before the war, probably to assist the war effort as well as to compensate for their relatives who have entered war service, as follows:

	Sept. 1 1939	Sept. 1 1943	Sept. 1 1944
MINNESOTA (Hours Per Day)			
Farm Operators and Family Labor	12.8 hrs.	13.2 hrs.	13.0 hrs.
Hired Farm Workers	11.2 hrs.	11.2 hrs.	11.0 hrs.
UNITED STATES (Hours Per Day)			
Farm Operators and Family Labor	—	12.4 hrs.	12.1 hrs.
Hired Farm Workers	—	10.0 hrs.	10.2 hrs.

Source: Bureau of Agricultural Economics, Department of Agriculture.

The farm laborers in states belonging to the North Central Group west of the Mississippi River work a little longer every day than those east of the Mississippi. All classes of farm labor in Minnesota and the other states of the North Central Group (Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska and Kansas) work more hours per day than the average for the United States.

e. Wages

Farm wage rates are represented in Exhibit III-B-27 and shown graphically for Minnesota and two neighboring states in Exhibit III-B-28. Quarterly farm wage rates during the war years 1942 and 1943, showing composite weighted

averages estimated by the Bureau of Agricultural Economics, Department of Agriculture, for Minnesota and other states, are shown in Table F-30.

TABLE F-30. AVERAGE PER MONTH SEASONAL (QUARTERLY) FARM WAGE RATES*

State	1942 Jan.	1942 Apr.	1942 July	1942 Oct.	1943 Jan.	1943 Apr.	1943 July	1943 Oct.
Minnesota	$38.50	$51.50	$57.00	$68.25	$55.25	$68.00	$78.25	$83.25
Iowa	43.75	55.75	60.75	65.00	62.75	76.50	80.00	82.50
Wisconsin	46.50	56.00	59.25	64.25	60.75	68.50	74.25	76.00
Michigan	48.00	51.50	55.50	60.00	62.75	67.00	71.75	75.50
S. Dakota	34.00	51.25	59.00	84.75	54.00	74.00	86.00	110.00
N. Dakota	36.00	50.00	56.00	72.50	60.75	73.50	79.75	88.25

*Weighted averages of composite per month with board, per month without board and per diem without board.

6. Market for Agricultural Products.

According to the Division of Agricultural Economics of the University of Minnesota, the products of Minnesota's farms have had in-State and out-of-State sales, expressed in percentages, as follows:

TABLE 31. PERCENTAGE OF TOTAL MINNESOTA FARM SALES CONSUMED WITHIN AND WITHOUT THE STATE

Year	In-State %	Out-of-State %	Year	In-State %	Out-of-State %
1910	52	48	1926	36	64
1911	51	49	1927	37	63
1912	48	52	1928	39	61
1913	47	53	1929	38	62
1914	47	53	1930	37	63
1915	44	56	1931	35	65
1916	43	57	1932	39	61
1917	43	57	1933	37	63
1918	38	62	1934	38	62
1919	43	57	1935	41	59
1920	48	52	1936	36	64
1921	47	53	1937	38	62
1922	45	55	1938	32	68
1923	45	55	1939	33	67
1924	42	58	1940	36	64
1935	38	62	1941	30	70
			1942	27	73

The percentages given in Table F-31, have been plotted to form a graph which is shown on Exhibit No. III-B-10. Reference to this graph shows a fairly steady downward trend in the in-State sales, from 52% of all sales of farm products consumed within the State in 1910 to 36% of all sales of farm products being consumed within the State in 1940. The out-of-State consumption has consequently increased from 48% in 1910 to 64% in 1940.

These trends in location of markets point to the dependence of the State upon the national market for nearly two-thirds of the sales of its farm products.

7. Farm Income

The relative ranking of states in the United States with the income from the marketing of crops, livestock and livestock products (including dairy products and other livestock products), accounting for more than 99% of the total from farm products of Minnesota and other leading agricultural states, in 1925, 1930, 1935 and 1940, is shown in Table F-32.

TABLE F-32. RANKING OF STATES IN FARM MARKETINGS

1925		1930	
State	Income ($1000)	State	Income ($1000)
1. Texas	769,899	California	672,666
2. Iowa	687,507	Iowa	657,931
3. California	639,060	Texas	529,381
4. Illinois	616,438	Illinois	497,775
5. Minnesota	432,179	New York	373,059
6. New York	396,665	Minnesota	363,895
1935		**1940**	
State	Income ($1000)	State	Income ($1000)
1. California	566,177	Iowa	669,279
2. Iowa	451,353	California	649,249
3. Texas	416,427	Illinois	543,235
4. Illinois	382,428	Texas	510,079
5. New York	286,592	Minnesota	380,375
6. Minnesota	274,718	New York	333,690

Source: Bureau of Agricultural Economics, United States Department of Agriculture, "Cash Farm Income, etc." July 1942.

The Minnesota farmers' gross cash income, including return from marketings of crops, livestock and products, plus government payments, but excluding the value of products consumed on the farm, or stored, from 1924 through 1943, is shown graphically on Exhibit III-B-30.

The income per farm and per acre from the farm marketings in each of the North Central States in 1940 is shown in the following table, F-33.

TABLE F-33. INCOME FROM FARM MARKETINGS PER FARM AND PER FARM ACRE MINNESOTA AND SELECTED STATES—1940

	Income From Farm Marketings 1,000 Dollars	Number of Farms	Average Income From Farm Marketings Per Farm	Average Acreage Per Farm	Average Income Per Acre of Farm Land
Minnesota	380,375	197,531	$1,926	165.2	$11.66
Iowa	669,279	213,318	$3,137	160.1	19.59
Missouri	274,951	256,100	1,074	135.6	7.92
North Dakota	126,900	73,962	1,716	512.9	3.35
South Dakota	119,760	72,454	1,653	544.8	3.03
Nebraska	223,472	121,062	1,846	391.1	4.72
Kansas	245,495	156,327	1,571	308.2	5.10
Ohio	324,491	233,783	1,388	93.7	14.81
Indiana	277,337	184,549	1,503	107.3	14.01
Illinois	543,235	213,439	2,545	145.4	17.50
Michigan	234,088	187,549	1,248	96.2	12.97
Wisconsin	311,326	186,735	1,667	122.5	13.61

This comparison places Minnesota third among the North Central States as to average income from farm marketings per farm and seventh as to average income from farm marketings per acre of farm land.

The number of Minnesota farms in 1939 that were in various income groups, from those earning less than $500 per year, to those earning $5,000 and more per year, together with the group sales during that year, have been estimated to have been as shown in Table F-34.

TABLE F-34. ESTIMATED NUMBER OF FARMS AND TOTAL GROSS CASH SALES BY GROUPS OF FARMS IN DESIGNATED INCOME GROUPS, MINNESOTA, 1939

Values of Sales Per Farm	Number of Farms (1000's)	Proportion of Farms (%)	Total Cash Sales (Million $)	Proportion of Sales (%)
Under $500	51	25.9	12.8	4.2
$500-$999	41	20.8	30.8	10.2
$1000-$1499	32	16.3	39.8	13.2
$1500-$1999	24	12.2	41.3	3.7
$2000-$2499	15	7.6	32.3	10.7
$2500-$2999	12	6.1	33.0	10.9
$3000-$3499	6	3.1	19.5	6.5
$3500-$3999	5	2.5	18.8	6.2
$4000-$4999	6	3.0	27.0	8.9
$5000 and over	5	2.5	47.0	15.5

Source: University of Minnesota Agricultural Bulletin 366-1943.

Table F-34 indicates that in Minnesota in 1939, 51,000 farms, or over one fourth of the total number, had but 4.2% of the total farm cash sales for the State. This large proportion of farms had sales of less than $500 per farm. The same year 92,000 farms, including the 51,000 already mentioned, were in the less-than-$1,000-sales-per-farm bracket. These 92,000 farms constituted 46.7% of all of the farms in the State, yet they produced but 14.4% of the total farm sales.

The average annual income from each of the different classes of farms in Minnesota with comparisons for Wisconsin, Iowa, and the United States average is shown in Exhibit III-B-5.

Comparing the gross income per farm and the net income per farm of the states in the North Central Group for the year 1939, Minnesota's position was shown above the average. The State ranked 20th in the United States as to gross income per farm and 13th, nationally, as to net income per farm. In 1939 Minnesota had a higher net income per farm than any of the states in the North Central Group, except Illinois and Iowa, and had a higher gross income per farm than any of the states in this group, except Iowa, Illinois and Nebraska, as indicated in Table F-35.

TABLE F-35. GROSS AND NET INCOME PER FARM, NORTH CENTRAL STATES—1939

State	Gross Income Per Farm 1939 National Rank	Gross Income Per Farm 1939 Income (Dollars)	Net Income Per Farm 1939 National Rank	Net Income Per Farm 1939 Income (Dollars)	Per Cent Net Income of Gross Income
Minnesota	20	$2,129	13	$906	42.5
Iowa	7	3,298	5	1,305	39.5
North Dakota	24	2,062	32	668	32.4
South Dakota	27	1,926	30	684	35.5
Nebraska	17	2,289	29	698	30.5
Kansas	26	1,975	35	621	31.4
Missouri	36	1,360	38	610	44.8
Wisconsin	29	1,844	25	741	40.1
Illinois	12	2,794	9	1,050	37.6
Indiana	30	1,796	27	719	40.6
Michigan	35	1,506	33	661	43.9
Ohio	32	1,771	18	796	45.0

(From Preliminary Draft, U. S. Dept. of Agriculture—Bureau of Agricultural Economics. Income Parity for Agriculture, Page 63—Table 13—May 1944).

a. Trends of Cash Income

(1) Total Agricultural Income for State.

The principal sources of farmers' cash income in Minnesota are from the sales of wheat, corn, oats, barley, rye, flax, potatoes, hay, hogs, cattle and calves, lambs and sheep, milk and butterfat, chicken, eggs, turkeys, and wool. These 19 products account for about 95% of the total sales in most years. The estimates of gross cash income used are those appearing in "Income and Expenditures of Minnesota Agriculture" by Rex W. Cox, Warren C. Waite and W. B. Garner, Agricultural Experiment Station, University of Minnesota Bulletin No. 366. In them, no allowance has been made for agricultural products used in the home, or for income received from other sources, such as for work off the farm or government payments. Changes in inventory values of livestock or stored products have not been taken into account.

The gross cash income of Minnesota farmers from the sales of the products mentioned are shown by annual averages for five-year periods from 1910 through 1939 and for the years 1940 and 1941, in Exhibit III-B-3. That tabulation indicates that the trend was upward from $180,400,000 average during each year of the 1910-14 period, to $330,400,000 average during each year of the 1915-19 World War I period, then downward to $313,000,000 average during each year of the 1920-24 period, then upward to $408,100,000 average during each year of the 1924-29 period, and then downward to an average of $232,300,000 yearly during the 1930-34 "depression" years, with a recovery or up-

ward trend to an average of $310,900,000 during the years of the 1935-39 period. This trend steepened its upward slope to 1940, when the estimated income was $361,300,000 and has risen more abruptly since then, due to the demands for increased production during World War II. The overall trend from 1910 to 1940 has been fluctuating, but upward.

The Minnesota income from the 19 principal products of agriculture, yearly, from 1910 through 1941 are shown graphically in Exhibit III-B-34.

(2) Income by Class of Production

Comparing the average income per year during five years (1910-1914) of the period before World War I with the average income per year of the five years (1935-1939) of the period before World War II, the following trends are noted in Table F-36.

TABLE F-36. TRENDS IN MINNESOTA GROSS FARM CASH INCOME BY CLASS OF FARM PRODUCTS

			FROM		TO	
Source of Income	Trend	Overall Change (Million $)	Aver. 1910-14 (Million $)	Approx. Part of Total Sales Income	Aver. 1935-39 (Million $)	Approx. Part of Total Sales Income
Crops	Down	$ −22.7	$ 85.7	1/2	$ 63.0	1/4
Livestock	Up	+80.1	45.7	1/4	125.8	2/5
Dairy products	Up	+48.2	37.9	1/5	86.1	1/4
Other livestock products	Up	+24.9	11.1	1/16	36.0	1/8
Total	Up	+130.5	180.4	all	310.9	all

The distribution of farm income according to source is shown graphically in Exhibit III-B-29.

(3) Income from Principal Products

The sales income from each product received during the pre-war period 1910-14, and during the pre-war period, 1935-1939, are summarized in the following tabulation, F-37, which shows the income trend for each source of income.

TABLE F-37. TRENDS IN MINNESOTA GROSS CASH FARM INCOME FROM SALE OF EACH PRINCIPAL PRODUCT

PRODUCTS PRINCIPAL FARM	AVERAGE ANNUAL INCOME 1910-14	1935-39	TREND	INCREASE	DECREASE	CHANGE
	(Million $)	(Million $)		(Million $)	(Million $)	%
CROPS						
Wheat	$39.9	$16.4	Down		$23.5	58.9
Oats	$ 7.7	$ 6.1	Down		$ 1.6	20.8
Rye	$ 3.0	$ 2.8	Down		$ 0.2	6.7
Potatoes	$ 9.2	$ 5.7	Down		$ 3.5	38.0
Hay	$ 5.6	$ 1.9	Down		$ 3.7	66.1
Corn	$ 6.0	$11.1	Up	$ 5.1		85.0
Barley	$ 9.6	$ 9.9	Up	$ 0.3		3.1
Flax	$ 4.7	$ 9.1	Up	$ 4.4		93.6
LIVESTOCK						
Hogs	$25.8	$65.5	Up	$39.7		153.8
Cattle & Calves	$19.0	$52.9	Up	$33.9		178.4
Sheep & Lambs	$ 0.9	$ 7.4	Up	$ 6.5		722.2
DAIRY PRODUCTS						
Butterfat	$25.0	$64.5	Up	$39.5		158.0
Milk & Farm Butter	$12.9	$21.6	Up	$ 8.7		67.4
OTHER LIVESTOCK PRODUCTS						
Chickens	$ 2.3	$10.6	Up	$ 8.3		360.9
Eggs	$ 7.3	$18.4	Up	$11.1		152.1
Turkeys	$ 1.0	$ 5.2	Up	$ 4.2		420.0
Wool	$ 0.5	$ 1.8	Up	$ 1.3		260.0

Derived from information shown on Exhibit III-B-3, as given in University of Minnesota Agricultural Bulletin No. 366-1943.

b. Trends of Cash Expenses

The estimates of farm cash expenditures for Minnesota are those found in the aforementioned "Income and Expenditures of Minnesota Agriculture". They were estimates of annual farm expenditures for production purposes and covered the proportions of the actual cash outlays for commodities and services

used in the year, and for the maintenance of goods such as were in use more than one year and were considered chargeable to production. It was stated that these estimates "probably account for more than 90% of the total cash outlay". See Exhibit III-B-1.

The average Minnesota cash farm production expenditures increased from $64,700,000 average per year during the 1910-14 period, to $115,600,000 average during the 1915-19 period; then the upward trend continued, somewhat more gradually, to a yearly average of $152,300,000 during the 1920-24 period. Then the expense was practically stabilized, rising but slightly to $153,000,000, yearly average, during the 1925-29 period. During the five years following, the trend was sharply downward to an average annual expenditure of $113,900,000, from 1930-34; since then the trend has been upward to $121,100,000 yearly average from 1935-39 and $132,000,000 in 1940, with steeper trends during the World War II years.

The trend in farm expense as compared with farm income from 1910 to 1941 is shown graphically in Exhibit III-B-34.

The percentage represented by taxes as a part of the farmer's total expense has varied slightly during the past twenty years and it now appears to be less than the corresponding percentage paid by the taxpayers in other enterprises, such as manufacturing and commerce.

Minnesota farmers' total expenses, total taxes and the ratio of taxes to total expense, for certain periods and years, were:

	Total Expense* (Million $)	Total Taxes* (Million $)	Percentage Total Taxes to Total Expense
			%
1910 through 1914	64.7	8.7	13.45
1920 through 1924	152.3	27.4	17.99
1940	132.0	23.7	17.95
1941	146.0	23.2	15.89

*From Exhibit III-B-1.

The total farm tax load and farm tax delinquency have decreased since 1932. See Exhibit III-B-31.

The farm assessed valuation in 1920 was 1½ times the average assessed valuation from 1910 through 1914 and the assessed valuation in 1940 was 1.1 times that which prevailed from 1910 through 1914. Hence, the total assessed valuation decreased from 1920 to 1940 by 26.7%. See Exhibit III-B-32.

In 1920 the average tax rate on farm real estate was about 64 cents per $100 of real estate value. The average tax rate amounted to about $1.60 per

$100 of real estate value in 1940, a rate 2½ times that of 1920. See Exhibit III-B-33.

c. Trend in Farm Net Income

The theoretical net income for a given year, obtainable from available data on gross income from farm sales and farm production expenditures, is the difference between these two items for the given year. For 1910, 1920, 1925, 1930, and 1940 these were as shown in Table F-38.

TABLE F-38. MINNESOTA'S GROSS CASH FARM INCOME FROM SALES OF PRINCIPAL PRODUCTS FARM PRODUCTION EXPENDITURES AND NET INCOME FROM FARMING — (IN MILLIONS OF DOLLARS)

For the Whole State	1910	1920	1925	1930	1940
Cash Gross Income	163.5	386.0	416.3	345.2	360.9
Cash Farm Expenditures	54.5	175.6	148.3	144.8	135.3
Net Income	109.0	210.4	268.0	200.4	225.6

Derived from data compiled by the Division of Agricultural Economics, University of Minnesota.

This table shows an increasing trend in the amount of net income derived by Minnesota farmers from their sales of the principal products of agriculture.

d. Rate of Return on Investment

Using the estimated "investment" figures for farm property, indicated previously under "2f" of this section, which are based on 1910 dollars, and reducing the theoretical net income figures shown in the foregoing paragraph to 1910 dollars in purchasing power, the following table indicates the method used to obtain what is considered to be a conservative estimate of the return on the investment per farm in Minnesota.

	1910	1920	1925	1930	1940
Average Investment Per Farm	$9,456	$8,900	$9,370	$11,150	$10,460
Theoretical Total Net Income All Farms in State* Millions	$ 109.0	$ 96.1	$ 182.3	$ 162.9	$ 201.4
Theoretical Net Income Per Farm*	$ 698	$ 538	$ 968	$ 879	$ 1,020
Return on Investment Per Farm, %	7.4	6.0	10.4	7.9	9.8

*Based on 1910 index of 100%.

IV. ECONOMIC DEVELOPMENT IN GOVERNMENT

IV. ECONOMIC DEVELOPMENT IN GOVERNMENT

Everyone is familiar with the dictum, "The power to tax is the power to destroy." In this investigation, it is assumed that all taxation in the State of Minnesota is for revenue only. This section is intended to explore how the existent taxation bears upon the various taxpaying interests of the state and, if possible, to discover a basis upon which certain rearrangements of the burden would improve the State's economy.

A. State and Local Revenue

1. Taxation

This study of Minnesota's state and local taxes, among which are included personal income taxes, is made from the viewpoint of competition with the taxes of other states whose products or whose conditions are somewhat similar to Minnesota.

Most kinds of taxes are an element of production costs, regardless of whether one is farming, manufacturing, or otherwise engaged in business. It can be quite readily appreciated, that if in the field of industry all other elements of Minnesota production costs are approximately equal to those of competitive states, Minnesota must impose no greater tax burden than is imposed by other states. To do so is to create a competitive disadvantage to Minnesotans which, of course, tends to discourage employment, new industries, and markets for Minnesota products. Therefore, one of the first questions in an appraisal of this kind is — Are Minnesota's state and local taxes "in line" with its competitors? Are certain types of taxes that discourage economic development used to a greater extent in Minnesota?

In determining the importance of the various factors entering into the economic well being of a people, it is necessary to measure the burden each of them represents in relation to the ability of the people to carry the load. The following tabulation shows the relation over the years between Minnesota's economic income (the combined income of all persons and businesses) and the state and local taxes collected.

COMPARISON STATE ECONOMIC INCOME WITH STATE AND LOCAL TAXES

Year	State Economic Income*	State and Local Taxes**	State & Local Taxes to Economic Income
1929	1,443,800,000	163,226,611	11.3%
1933	811,800,000	136,012,579	16.7
1939	1,378,300,000	173,753,551	12.6
1940	1,434,200,000	178,030,169	12.4
1941	1,654,700,000	193,654,651	11.7
1942	2,034,400,000	192,468,200	9.5
Total	8,757,200,000	1,037,145,761	11.8%

*Reprint from Survey of Current Business, June 1943.
**Report of the Department of Taxation, 1942.

It can be seen in this tabulation that Minnesota, through the State and its subdivisions, collected as taxes an average of 11.8% of the total economic income of the State for six selected recent years for which data were available.

It is the purpose of this section to study first, the relative ability to pay of the citizens and industries of Minnesota compared with other states, and second, the distribution of the taxes among the various economic groupings of the citizens to defray the costs of the services demanded from the government.

a. Method of Procedure

In approaching this problem it may be well to look first at the whole tax picture to see if the over-all tax burden is too heavy and then review the principal taxes to see if any particular tax is causing any harmful competitive disadvantages upon the citizens or industries.

In seeking the answers to the above questions, it must be admitted that there is no scientific laboratory method of measuring the tax burden of the various states. The science of public administration has not reached such a stage as yet. However, there are methods of measurement that are fairly reliable.

(1) Comparative Method

One method is to compare tax practices in one state with another and with the average of all forty-eight states, or to compare practices with the average of neighboring or competing states.

(2) States Are Competitive

States are highly competitive today. Each state is attempting to attract new industries and protect the ones it has. During the past decade, a great many states have thrown up state trade barriers in order to protect their local business interests. The Council of State Governments has taken steps to counteract this trend but the policy clearly shows the competitive position in which the various states find themselves.

In recent years, many states have adopted tax legislation giving special privileges to new industrial developments. In some instances, tax exemption is granted for a period of five or ten years. Most tax economists frown on this type of tax policy as unsound in the long run.

It is, therefore, apparent that state governments must follow rather closely the tax practices of other states. No state can pioneer too far in some tax field or follow so-called model tax systems without running into retaliatory actions of other states which will attract industry to such states. It, therefore, follows —a state cannot always use the most equitable method of taxation if it wishes to attract industry.

(3) Relative Economic Ability to Pay

This comparative type of analysis takes on additional validity by the inclusion of indexes on the relative ability or capacity of a state to support its governmental activities. A state government may levy heavier taxes than the average of a number of states, and such may not result in an excessive tax burden if the state had proportionately greater wealth or tax paying ability than the average state. Two states might levy the same tax burden per capita, yet one might have 15% better economic ability to pay and this would materially ease the tax burden of that state. A combination table of income indexes and tax burden thus gives a fairly suitable answer in respect to the weight of taxation borne. This method of comparison is used in this Report.

(4) State and Local Taxes Included

In comparing the tax burden of one state with another, it is necessary to consider taxes levied by local units of government as well as by the state government if a fair comparison is to prevail. This is due to the fact that many functions of government are handled differently in the various states. For example, the amount of state aids granted to local units varies from state to state. Further, some state governments finance and administer functions that are handled by local governments in other states. State and local taxes are, therefore, included together in certain of the following charts for the purpose of presenting the tax burden as a whole. In certain other of the charts the State and local taxes will be dealt with separately.

The year 1941 is used in all the tables for the reason that it represents conditions in the various states more nearly free from distortion by war conditions.

b. Industry To Be Encouraged in Minnesota

Minnesota needs to give special consideration to one phase of its tax system—that relating to manufacturing industry. In other sections of this Report it has been shown that Minnesota is in dire need of new industrial development. A sound tax system for Minnesota should provide sufficient incentives and

stimulation to create new manufacturing and processing industries and businesses, as well as to bring about the expansion of existing plants.

c. Existing Tax Sources in 1941 in Minnesota.

The major sources from which taxes are derived are given as follows:

Property tax	$112,701,966*
Severance (Iron Occupation & Royalty)	10,222,979
Motor Fuel	18,851,275
Alcoholic Beverage	5,920,342
Motor Vehicle License	18,865,555**
Public Utilities (Gross Earnings)	9,584,588
Insurance (Gross Premiums)	2,117,888
Income	13,141,472
Inheritance and Gift	1,190,663
All Others	1,057,923
Total	$193,654,657

*This figure includes $2,586,286 of Monies and Credits Taxes.
**This figure includes 2 years collection.

d. Index of Ability to Support Government

The Federal Bureau of the Census* has prepared an index to show the relative economic ability of the various states to support their governments. The report was made in 1942 and covered the year 1941.

Three components are used to judge this, first, economic income; second, the output of various industries; and third, retail sales. All of these items are computed on a per capita basis. The output of industries is in turn made up of three factors, namely, values added by manufacture, values created by farming, and values created by mineral production. This in effect places five factors in the index. The per capita for the entire United States is used as a basis against which each state is compared in terms of a percentage.

The per capita economic income of Minnesota (first column of Exhibit IV-A-1) is $501 and in relation to $532, the national per capita economic income, indicates a rank for the State of 94, or 94% of the national average. The same process is followed for output of industries and retail sales. The average of these three indexes gives the final average rank of the state. A rank below 100 indicates less than average relative economic ability, and a rank above 100 indicates above average relative economic ability. Twenty-six states are below and

* Special Study No. 20, Sept. 1942 — "Financing Federal, State and Local Governments, 1941."

twenty-two above the average of the country as a whole. Minnesota had a rank of 102, thus indicating relative economic ability slightly higher than the national average.

e. Index of Revenue Produced

A second index, Exhibit IV-A-2, is prepared with reference to state and local revenues collected, which are principally in the form of taxes. In making up this index, the State and local revenues of each state per capita are taken as represented by the percentage they bear to the national average. The State and local revenues of Minnesota come out at 104% of this national average, meaning in general that, per capita, the State and local taxes in Minnesota are 4% higher than the average of the United States.

f. Combined Index — Relative Ability to Pay in Relation to Revenue Produced

To determine the resulting combined index, the relative order or rank of a state in respect to state and local revenue produced (principally by taxation) is taken as a percentage of the relative order or rank of that state in respect to relative economic ability to pay. When the two relative orders are equal, the index is 100%.

g. Ranking of Minnesota in Respect to Taxation

It has been seen that in respect to relative economic ability to pay, Minnesota has a rank of 102% of the United States average; and in respect to revenue collected, it has a rank of 104% of the United States average. From this it follows that, notwithstanding its greater than average ability to pay, it has a still greater than average burden of taxation by the amount of 2%, namely in the ratio that 104% bears to 102%.

h. Separate Analysis of State and Local Taxes

While the combined State and local governmental units of Minnesota place a tax burden on its citizens approximately 2% higher than the average of other states in respect to relative ability to pay, there is the additional question as to whether Minnesota uses sources of taxation similar to those in other states, and whether certain particular taxes are used in greater or lesser degree.

This question can best be analyzed by separating the State taxes from the local taxes, because the local taxes throughout the country are almost wholly property taxes, and they are so relatively large that, when combined with State taxes, they obscure the relative magnitudes of State taxes with respect to each other.

(1) State Taxes

(a) "Average Tax Structure" — A Measuring Device

As a first step in the separate consideration of State taxes, a device facilitating

their analysis has been worked out by the authors of this report. It is called the "average tax structure" and represents the tax structure in a hypothetical state, in which the taxes are the averages of all the states. The list comprises only the principal taxes in effect throughout the country. In order to keep it simple, no tax is included which in 1941 did not produce at least 2½% of the total taxes of the 48 states.

Since states are competitive in respect to tax levies, comparison with this "average tax structure" does measure the extent one state is out of line with another with respect to particular taxes. It is to be noted that such taxes as chain store, poll, oleomargarine, racing, admission and a few others, do not qualify for this list because the amount of tax revenue from them is less than 2½% of the tax revenue of the 48 states. Severance taxes, which are used in connection with iron ore in Minnesota, do not qualify because the tax revenue from them throughout the United States is less than 2½% of the tax revenue of the 48 states. The following list of State taxes are those of the "average tax structure":

1. Alcoholic Beverages
2. Death
3. Franchise
4. Net Income
5. Gasoline
6. Insurance Company
7. Motor Vehicle
8. Property
9. Tobacco
10. Utility
11. Sales

The eleven taxes of the "average tax structure" produce 95.22% of the total state tax revenue of the 48 states, but all of these taxes are not found in all of the states. Their distribution throughout the states is shown in Exhibit IV-A-5. Alcoholic beverage, gasoline, insurance and motor vehicle taxes are levied by all the states; property taxes by all except New York; and sales taxes by 23 states, but there is no sales tax in Minnesota.

(b) Comparison of Minnesota Tax Structure with "Average Tax Structure"

The purpose of the "average tax structure" is not to compare the tax burden in one state with the tax burden in another as to total amount, but to discover how the burden is distributed among the various taxes. It is to see where the principal burden lies in the state tax structure of Minnesota, as compared to other states.

In Minnesota the taxes listed in the "average tax structure" produce 86.42% of the State Government income as compared with 95.22% in the hypothetical state as shown in Exhibit IV-A-3.

With the exception of the Sales Tax and after 1941 with the exception of

the Tobacco Tax, Minnesota employs all of these taxes in its State tax structure. It has, in addition, the Severance Tax (Occupation and Royalty Taxes) on iron ore which in 1941 produced 11.85% of the State's revenue. When the revenue derived from the Severance Tax is added to that collected from the taxes in the "average tax structure", 98.27% of the State tax revenue is accounted for.

Minnesota exceeds the average materially in four types of State taxes, namely: a State Property Tax (which is additional to local property taxes), exceeding the average by 9.37%; an Income Tax, exceeding the average by 6.45%; a Utility Tax, exceeding the average by 5.42%; and Severance Taxes.

The Utility Tax is an "in lieu of" tax. The industries which pay this tax are relieved of other taxes and their over-all tax burden is not unduly excessive.

The Severance Taxes are not comparable with the national average, as the majority of the states are not so fortunate as Minnesota in having so great a deposit of minerals and other natural resources upon which Severance taxes are levied. Severance taxes are not levied in 29 of the states. The large Severance taxes permit Minnesota to collect a smaller percentage of its revenue than the national average in such other taxes as the Gasoline, Alcoholic Beverage, Inheritance, Tobacco, Franchise, and other minor taxes.

Detailed analysis of the State Property and Income Taxes has been made under the separate discussion of each tax found later in this volume.

Minnesota's largest divergence from the "average tax structure" is in the absence of a Sales Tax, which it fails to impose. The Sales Tax in the "average tax structure" produces 15.65% of the revenue of the average state, which represents the rest of the country.

i. Comparison of Minnesota's Local Taxes with United States Average Local Taxes.

For the year 1941, Minnesota collected local taxes amounting to $42.64 per capita, at a time when the average for the United States was $39.89 (See Exhibit IV-A-2). This ranked Minnesota sixteenth among the various states. As demonstrated earlier in this section, the relative ability to pay of a citizen of Minnesota was 102%, or 2% greater than the relative ability to pay of the average citizen of the rest of the United States. If there be taken into account this extra ability to pay in connection with local taxes, as has already been taken into account in connection with state taxes, the burden carried by the citizen of Minnesota in local taxes, instead of being expressed by the ratio of $42.64 to $39.89, would be more correctly expressed by the ratio of $42.64 to $40.69, the latter figure being obtained by increasing the United States average by 2%. After adjusting for the Minnesota citizen's greater ability to pay, the figures

show he is still paying above the average in local taxes alone, in the ratio of $42.64 to $40.69.

j. Discussion of Taxes Imposed

The over-all position of Minnesota's state and local taxes both in combination and separately, has been presented. It is desirable that each tax now be discussed separately to discover the incidence of certain specific taxes.

(1) Ad Valorem Property Tax

(a) Classification of Property

According to Minnesota laws, property is assessed at varying percentages of its "full and true" value, depending upon the classification of the property. There are four major classifications, some of which are sub-divided into several minor classifications. The assessment rates vary according to type of property from 50% of "full and true" value to 10% of "full and true" value.

This in effect means that when two types of property of the same "full and true" value are assessed, one in the 10% classification and one in the 50% classification, the latter is carrying five times as much tax burden as the former.

None of Minnesota's competitive states discriminate in such a manner by law, although it is well known that assessment values vary greatly and uncertainly between types of property in all the states.

(b) Assessment

The basis for the ad valorem property tax is the assessment value of the property. The assessments can be no sounder than assured by the skill and intelligence of the men elected as assessors. In Minnesota there are nearly 3,000 assessors. Each has his own method of arriving at a valuation. These valuations, coming from so many different sources, are not and cannot be uniform, although uniformity in valuation would mean a more even distribution of the tax burden. This is true particularly as the assessment value is the uncertain and varying factor in the ad valorem system. It is the relationship of each piece of property to the remainder of the property in the taxing district that determines the relative proportion of the tax burden that a piece of property will bear. Valuations that reflect true relative value uniformly among all properties are more important from a tax standpoint than accuracy of assessment.

The assessors are not full time employees, and usually can perform their duties in a few weeks. Their rate of pay is very low and, therefore, does not attract the best qualified men.

(c) Mill Rates

In Minnesota the various mill rates (mills of tax per dollar of assessed value) by which the taxes are levied are determined by as many as 10,409 (Book of the States, Page 94) different units of local government. Therefore, it is pos-

sible to have a wide diversity among the mill rates. There is a wide variation in average mill rates between the counties (See Exhibit IV-A-13). There are further large differences between the townships and school districts within the counties. In 1942 the average mill rate of the various counties of the State ranged from 49.90 to 203.85 mills. These different mill rates tend to add further to the disproportionate distribution of the tax burden.

(d) Limitations

There are limitations of the tax levies imposed on local governments which tend to restrict the variation in amounts levied. To restrict the levies of the local units effectively, it is necessary to impose both a per capita and a mill rate limitation. There are no mill rate limitations on Home Rule Charter cities unless a mill rate limitation is specified in their charter. As indicative of possibilities, this lack of limitation can, in the near future, lead to excessive levies in some of the iron range cities.

(e) Burden

Visits to various industries, excepting iron mining, disclosed few complaints against the ad valorem Real Property taxes. There were numerous complaints against ad valorem Personal Property Tax. The assessment being made as of May 1st finds many industries with large stocks of raw materials and merchandise on hand, and therefore subject to tax.

In the classification system in use, there is no distinction between materials in manufacture, stocks of merchandise and raw materials as differentiated from machinery and fixtures forming part of plant. Without distinction, these all are included in Class 3 and assessed at 33-1/3% of Full and True Value. A distinction has been recognized in agriculture and Class 3a covers agricultural products in hands of producer which are assessed at only 10% of Full and True Value. Class 3d covers agricultural machinery and is assessed at 20% of Full and True Value. In agriculture, the ratio of machinery to products, in respect to the tax they bear, is two to one.

(2) Auxiliary Forest Tax

Forest Taxation presents a problem similar to that of Mining Taxation. Many trees require a growing period of 75 to 100 years. During this period no revenue accrues to the owner. Only at the cutting of the timber does he realize any return therefrom. In the past, timber was considered as a natural resource existent at the time settlers came into possession of the land. It was not necessary for them to finance the timber and land throughout the growing period. This favorable condition largely has ceased to exist owing to the extensive "mining" of the forests. Timber should now be considered as a crop with an extended growing period. The value of timber at maturity probably will be less than the accumulated taxes paid during the long growing period if it con-

tinues to be taxed principally on the same basis as agricultural land. The major portion of agricultural crops never appears on the tax rolls because they are harvested within the year.

The realization of the inability of trees as a crop to stand the present tax burden is indicated by the introduction of the principle of taxation employed in the Auxiliary Forest Law, previously discussed under "Forestry". However, there are certain administrative problems presented by the present Auxiliary Forest Law.

These administrative problems largely lie in the difficulty in having a woodlot or forest tract declared an auxiliary forest. A very large part of the woodlands in Minnesota still are taxed under the general ad valorem system. This is largely because of the lack of knowledge by the taxpayers of the existence of the Auxiliary Forest Law and the complexity of the administrative procedures required to have a tract declared an auxiliary forest.

(3) Gross Earnings Taxes

The Gross Earnings Taxes produced almost 12½ million dollars in 1943. This is 6.6% of the State and Local Revenues for that year. In the period 1930 to 1943, revenue collected by these taxes increased 36.4%.

The Gross Earnings Tax on various utilities as applied in Minnesota has been declared to be a Property Tax. Gross earnings are used as a measure of value. The utilities have properties in many taxing districts and would be subject to the assessment of the various assessors if normal Property Taxes were applied. Under the present assessment system, to coordinate the assessment of utility properties would be a major, if not impossible, task. Therefore, Gross Earnings Taxes are levied in many of the states in an effort to overcome the difficulties of assessment of utility property. During visits to utilities in Minnesota, no complaints were received that these taxes were unduly burdensome. In 1941, Minnesota collected 8.5% of the State's revenue from Gross Earnings taxation, which appears to be much above the "average structure" of 3.8%. This tax, being "in lieu of" Property Taxes in all cases, is rightfully a part of the classified Property Tax, rather than a Utility Tax as such.

The Gross Earnings Tax does not make allowance for ability to pay, but is easy to administer and appears not to be placing an undue burden on the utilities.

(4) Gross Premium Tax — On Insurance Companies

The Gross Premium Tax produced slightly less than 2¼ million dollars in 1943. This is 1.2% of the revenue of State and Local Governments. The revenue from this tax has increased 12.6% during the period 1930 to 1943.

This tax is a part of the Comprehensive Classified Property Tax. It is in lieu of all taxes except Real Estate taxes and is employed by all 48 states. Minne-

sota collected in 1941 2.5% of its revenue from this source of taxation as compared to the national average of 2.53%. The rate imposed by Minnesota is 2% of gross premiums, as compared with the national average of 1.97% of gross premiums.

(5) Grain Tax

The Bushel or Grain Tax produced $138,000 in 1943. This is 0.74% of the State and Local Revenue for that year. The revenue derived from this tax has increased 92% during the period 1930 to 1943.

This tax is a Property Tax and is in "lieu of all" Property Taxes on the grain. The bushels of grain handled throughout the year are used as a base for this tax, rather than the inventory as of May 1st. It appears to be the belief of the industry that this is a fair tax and that volume of grain handled throughout the year is a more equitable basis for taxation than the May 1st inventory. The mill rate remains uniform and thus can be anticipated in computing costs of operation.

(6) Money and Credits Tax

The Money and Credits Tax produced 2-2/3 million dollars in 1942. This was 1.4% of the State and Local Revenue collected that year. The revenue from this tax increased 97% in the period 1930 to 1942.

The Money and Credits Tax has been suspended for the years 1943 and 1944. In 1945, it will again become effective unless the legislature takes action to suspend it further.

Since the time of the Civil War the problem of taxing Moneys and Credits which, under Minnesota law, are regarded as intangibles, has been a major problem throughout the United States. Moneys and Credits are easily hidden and, therefore, very hard to assess. By the passage of the Money and Credits Tax Law, Minnesota attempted to ease the difficulties of assessment by reducing the rate. This was done to encourage citizens to declare their money and credits for assessment. Because of this, the revenue derived from this tax has increased and many citizens have declared more fully their money and credit holdings. A survey made by Roy G. Blakey in 1932 indicated that at that time, much less than fifty per cent of taxable money and credits were being taxed. This spot check was made by a comparison of the estates of deceased persons with their money and credits assessment. In 1940 the Minnesota Institute of Governmental Research conducted a study of the Money and Credits Tax Law, and made a comparison between the reported bank deposits and the assessment of money and credits by counties. In 26 counties, money and credit assessments were less than 33-1/3% of bank deposits reported. In 47 additional counties, the assessment was less than 66-1/3% of bank deposits. In 5 more counties the assessment was less than 100% of bank deposits. In only 9 counties did the assessment exceed the bank deposits.

The Income Tax is levied on the income derived from money and credit holdings in addition to the Money and Credits Tax. In many instances a Property Tax also is levied on the property which is represented by these credits.

There are 14 states that now tax the revenue from so-called intangibles under the Income Tax rather than by the intangible Property Tax. There are 20 states that tax intangibles at special low rates and 14 states that tax intangibles as all other property.

In states where a Property Tax is levied against so-called intangibles, inquiries from the Minnesota Institute of Governmental Research indicated that evasion of the tax was so extensive that money and credits contributed little to the total Property Tax revenue.

(7) Mortgage Registry Tax

The Mortgage Registry Tax produced 240 thousand dollars in 1943. This was 0.13% of the State and Local revenue collected for that year. The revenue collected from this tax decreased 79% from 1930 to 1943.

This tax is included in Comprehensive Classified Property Tax. Mortgages taxed under it are exempt from the Money and Credits Tax. Money and Credits Taxes were suspended for the years 1943 and 1944, but the Mortgage Registry Tax was left in effect. This means that an asset represented by a Minnesota Mortgage must pay a tax while all other Money and Credit assets are excused from taxation.

(8) Transient Merchant Tax.

The revenue from this tax has not been segregated from the Personal Property revenue, but is negligible in amount.

This tax is a part of the Comprehensive Classified Property Tax. It was levied so that an itinerant merchant who brings merchandise into the State and sells it without any permanent location within the State would be subject to his share of the tax burden. In effect, the tax is higher than that paid by local merchants as all merchandise handled throughout the year is assessed and taxed, whereas a local merchant is only taxed on merchandise on hand as of May 1st. The transient merchant usually can stand this additional burden on account of low overhead expenses.

(9) Vessel Tonnage Tax

The Vessel Tonnage Tax produced 22 thousand dollars in 1943. This is less than 0.01% of the State and Local Revenue for that year. The revenue collected from this tax has decreased 18.5% in the period 1930 to 1943.

This tax is a part of the Comprehensive Classified Property Tax. It is an optional alternate to the general Property Tax. This method of taxation of vessels is accepted as being equitable and fair and is the method usually employed.

(10) Income Tax

The Income Tax produced slightly more than 23½ million dollars in 1943. This is 12.6% of the State and Local Revenue. The revenue collected from this tax increased 990% in the period 1934 to 1943.

GENERAL

The Income Tax in Minnesota applies against both the individual and the corporation. These must be discussed separately as their effects are different. They are computed on different bases.

In 1943, 29 states and the District of Columbia levied Personal Income Taxes. Thirty-one states and the District of Columbia levy a Corporate Income Tax. Connecticut, Pennsylvania and Tennessee levy a Corporate Income, but not Personal Income Tax. Delaware levies a Personal Income Tax, but no Corporate Income Tax. From Income Taxes in 1941, Minnesota derived 18.31% of its revenue as compared to the "average structure" of 11.86%.

In Exhibit IV-A-4, it will be noted that in the Income Tax, Minnesota's divergence from the "average structure" is one of the greatest deviations shown. This is balanced somewhat by the fact that Minnesota imposes no Sales Tax. As a Sales Tax is paid by all levels of income and an Income Tax is borne in proportionately greater degree by the higher income groups, Minnesota, by having no Sales Tax, is placing on corporations and the higher personal incomes the tax burden a Sales Tax would otherwise represent. This, however, is not unusual in states imposing Income Taxes. As seen in the Exhibits, Minnesota spreads the base for its Income Tax over a wider range of incomes than do most of the other states. If the states are ranked in an order in which the highest income taxation is first, this feature lowers the rank of Minnesota as the amount of net income increases.

(a) Personal Income Tax

The chart, Exhibit IV-A-15, shows that at the $3,000 income level, Minnesota is exceeded only by North and South Carolina in the Income Tax it collects. Eleven states and the District of Columbia collect no tax at this level, although they have Personal Income Tax laws. Minnesota collects almost 7 times as much per individual return as the lowest, and a little less than 3 times as much as the average of the 30 states levying Personal Income Taxes.

At the $5,000 net income level, Minnesota is exceeded, per return, only by North Carolina. Minnesota collects over 11 times as much at this level as the smallest tax collected by states having Personal Income Tax laws and a little less than 2½ times the average for the 30 states (See Exhibit IV-A-16).

At the $10,000 level, Minnesota is exceeded, per return, only by North Carolina and Oklahoma. Minnesota collects almost six times as much as the

lowest state and a little less than twice the average for the 30 states, (See Exhibit IV-A-17).

At the $25,000 net income level, Minnesota is exceeded in amount collected per return by five states: North and South Carolina, North Dakota, Wisconsin, and Oklahoma. Minnesota collects over five times as much as the lowest state and a little more than 1½ times the average for the 30 states, (See Exhibit IV-A-18).

The Personal Income Tax, being in addition to the Federal Income Tax, means that a great burden is placed on incomes derived within the State of Minnesota. The above comparisons show that Minnesota places a much greater burden on personal incomes than do most of the other states.

(b) Corporate Income Tax

The Corporate Income Tax is a little higher than the average for the 32 states levying Corporate Income Taxes, (See Exhibits IV-A-19 and IV-A-20). This is true for a company conducting all of its business in Minnesota. However, a corporation whose sales are made largely outside of the State, but whose property and payroll are largely within the State, would appear in a much more favorable position compared with the other states. This is owing to the ratio applied to apportionment of income to Minnesota when sales are weighted at 70% and property and payroll at 15% each, which is the case in Minnesota.

The dividends paid to a parent company in Minnesota by a subsidiary company located out of the State are taxable by the State of Minnesota as income to the parent company. This is true even though Minnesota contributed nothing to these earnings and in earning these profits the subsidiary companies did no business in Minnesota.

All profits of corporations located in Minnesota upon which dividends are paid to Minnesota stockholders are subject to double taxation; once from the corporation and again from the individual. Should the stockholder live in a state which has no Personal Income Tax, he will realize more profit from the same dividend than the residents of Minnesota.

(c) Revenue — Personal and Corporate

The Income Tax has been producing progressively more revenue. In its first effective year, 1933, revenue produced amounted to slightly over $2,000,000. This increased to $6,500,000 in 1937. At that time the law was rewritten to produce more revenue and from then revenue has greatly increased. In 1943, $23,500,000 was collected. In its present form, the Income Tax cannot be expected to continue to produce such large returns. The war years have shown constantly increasing economic income. The provision which has been made that the Federal Income Tax paid may be deducted from personal income will cause the State revenue derived from this tax to decrease as soon as income becomes

more or less stabilized, provided there is no decrease in Federal Income Tax rates. In any consideration of revenue to be derived from this tax, the years 1942 and 1943 must be considered as abnormal years and the possibility is remote that revenue will continue at the level of these years.

(11) Gasoline Taxes

Gasoline Taxes produced slightly less than $13,500,000 in 1943. This is 7.1% of the State and Local Taxes collected that year. The revenue collected from this tax increased 22% in the period 1930 to 1943.

This form of taxation was used by all 48 states in 1941 and amounted to more than 15% of the State revenue in all but five states. Only one state collects less than 10% of its revenue from this tax, while from this source, 14 states collected more than 30% of their revenue. Minnesota is below the average of 20.59% of the total State revenue collected by all states, with a collection of 17.88% of its revenue from gasoline taxation. The arithmetic average tax imposed by the states is 4.8¢ per gallon. The weighted average tax assessed is $.04027 per gallon. In Exhibit IV-A-11, it may be seen that in Minnesota, the revenue collected from this tax has been increasing gradually from $10,000,000 for the calendar year 1930 to almost $19,000,000 for the calendar year 1942. For the calendar year 1943, the revenue dropped off to $13,390,000. This probably is because of the war measure of rationing gasoline and the revenue will return to normal at the end of the war.

(12) Severance Taxes

The discussion of the Occupation and Royalty Taxes on iron ore is found in the chapter entitled "Iron Ore Industry."

(13) Motor Vehicle Taxes

The Motor Vehicle Tax produced slightly less than $9,000,000 in 1943. This is 4.8% of the State and Local Taxes collected that year. The revenue collected from this tax decreased 9.4% in the period 1930 to 1943.

In 1941, all 48 states imposed a Motor Vehicle Tax. In the "average structure" this form of taxation produced 12.39% of all revenue. In Minnesota for the year 1941 this form of taxation produced 12.94% of the State's revenue. The rate on new passenger cars, as shown in Exhibit IV-A-21, appears to be higher than the rate charged in 14 of the 15 competitive states of Minnesota, being exceeded only by Iowa. When a passenger automobile becomes 5 years old, the rate in Minnesota decreases materially. Minnesota ranks 12th among the competitive states. In Exhibit IV-A-22, a similar comparison has been made on the basis of a 5-ton truck. Minnesota ranks 6th wthin the competitive states.

(14) Utility Taxes

For discussion of these taxes, see (3), Gross Earnings Taxes.

(15) Insurance Taxes

For discussion of this tax, see (4), Gross Premium Taxes.

(16) Alcoholic Beverage Taxes

The Alcoholic Beverage Taxes produced slightly less than $5,250,000 in 1943. This is 2.8% of the State and Local Taxes collected that year. The revenue collected from these taxes increased 85% in the period 1934 to 1943.

Alcoholic Beverage Taxes are levied in all 48 states. For Minnesota, this tax produces 6.23% of the State's revenue. In the "average structure," this form of taxation produces 7.36% of total revenue. Minnesota levies this tax on both a license and a production basis. By the employment of these two methods of taxation, both the brewer or distiller and the distributors share the tax burden.

(17) Inheritance and Gift Taxes

The Inheritance and Gift Taxes produced slightly less than $1,500,000 in 1943. This is 7.6% of the State and Local Taxes collected that year. The revenue collected from these taxes has decreased 39% in the period 1930 to 1943.

(a) Inheritance Tax

The Inheritance Tax is imposed by 47 of the 48 states. In 1941, this tax furnished Minnesota with 0.983% of its income, as compared with 2.73% for the national average. From this tax, 14 states collected a smaller percentage of their income than did Minnesota. On a per capita basis, Minnesota collected $.342 as compared with the average per capita of all states of $.919, as shown in the following tabulation:

INHERITANCE TAX

	Year	Tax	Population*		Per Capita
MINNESOTA	1941	934,728	2,734,259	=	$.342
UNITED STATES	1941	119,925,286	130,583,581	=	$.919

*Population based on average between 1940 Census and 1942 estimated population.

For a complete analysis of this tax in comparison with other states, the following facts would have to be taken into consideration:

1. A grouping of estates by size.
2. Number of estates falling within each grouping.
3. Wealth of population of the various states by grouping.
4. Application of rates and exemptions of the several states to sample estates to ascertain effective rates for comparison.

These studies would require more time than is available and as in Minnesota this tax is relatively a minor item in the production of revenue, such an exhaustive study has not been made.

However, the effect of the Inheritance Tax is to place no additional burden on the taxpayer as it is credited against taxes levied by the Federal Government.

It will be noted in Exhibit IV-A-11 that the revenue derived from this tax varies greatly from year to year so that it is difficult to establish a trend in the revenue produced by this tax.

(b) Gift Tax

This tax was imposed in 1937 to prevent evasion of the Inheritance Tax. Before the passage of this tax law, the Inheritance Tax could be evaded by making direct gifts two years prior to death. It should be observed that the rates imposed are ¾ of the Inheritance Tax rates. Revenue derived from this source is of minor significance, as shown in Exhibit IV-A-11, but the tax appears to distribute the burden of the Inheritance Tax more fairly.

(18) Tobacco Tax

In Minnesota this tax was levied by the counties, cities and villages for their own revenue. It was imposed in the form of a license to dealers in tobacco products. In the "average structure," tobacco taxation produces 3.03% of the revenue derived throughout all the states. In Minnesota this form of taxation produced only 0.26% of the State's revenue. It was a very minor tax and probably produces no undue hardship. This tax was repealed in 1941.

(19) Oleomargarine Tax

This tax produces little revenue to the State and from that aspect is of small importance. It appears to reduce the amount of oleomargarine sold within the State. It may lead to retaliatory taxes on butter and other dairy products sold in other states.

(20) Tax on Income for Tax Exempted Properties of Educational Institutions

This tax was imposed to prevent the various educational institutions throughout the State whose property is tax exempt, from going into business by having various business enterprises transferred to them to avoid taxation. They in turn would pay an annuity to those so conveying their property. This tax is purely a regulatory tax and has not contributed to the State revenue.

(21) Chain Store Tax

In 1942 this tax was levied by 18 states, but is no longer levied in Minnesota. This form of tax has been subject to much litigation, indicating that it is a discriminatory tax.

2. Other Sources of Revenue

In addition to tax revenues in 1942, Minnesota received 20-3/4 million dollars in the form of grants from the Federal Government. This represented an increase of 11.3% in revenues received from taxes. In 1932 the grants from the Federal Government amounted to 5-1/3 million dollars, which represented an increase to the tax revenue of 3.95%. A large increase in Federal Aids oc-

curred in 1937, but the increase is represented in large part by grants for Social Security payments. In Exhibit IV-A-23, it can be seen that Minnesota is receiving 15% above the average per capita Federal grant to the states. These revenues are for specific purposes and the moneys must be expended in accordance with Federal Regulations.

The State receives revenue from the sale of State owned land and royalties from iron ore leases. The revenue so derived is allocated to permanent funds and cannot be used for current operating expenses. Other sources of revenue include fees, service charges and interest on bonds.

These sources of revenue are controlled by factors that are of an operational nature or that are regulated by the Federal Government. Therefore, no detailed study has been made.

B. State and Local Expenditures

Because of their different character and the rigidity of their methods of control, government expenditures need to be surrounded with more safeguards and to be more closely watched than private expenditures to ensure their continued adaptation to the purposes for which they were incurred. This section looks at the expenditures of the State of Minnesota retroactively to test their justification and to discover whether they can be more efficiently directed in the public interest.

In the following pages certain records are confined to the period 1937 through 1943 because comparable statistics for prior years do not exist. The trends developed in the pre-war years, 1937 through 1940, are too brief to be reliable indicators. The trends between 1940 and 1943 definitely are influenced by war conditions. Consequently both the peace time and war time trends have been reported; in many respects the conclusions unavoidably are affected by the brevity of these periods.

1. Net Government Expfnditures, State and Minor Civil Divisions, 1939 through 1943

Records of net government expenditures of the State of Minnesota and all the minor civil divisions, containing the items and totals after elimination of duplications caused by inter-division transfers, have not been compiled by the Public Examiner for years prior to the fiscal year 1937-1938. The data for this year are not as complete as they are for succeeding years. Generally speaking, published statistics for state expenditures are incomplete because they omit the expenditures of minor civil divisions—counties, towns, municipalities, school and other districts—supported by local taxes or otherwise, except those sums appearing as state-aid.

Over a period of several years trends in total expenditures follow the trends of state and local taxes. In Minnesota, as is shown in Exhibit IV-A-11, these taxes decreased from about $161,000,000 in 1930 to $136,000,000 in 1933 and then increased to $178,000,000 in 1940.

a. Total Net Expenditures for Current Expenses, Capital Outlays and Interest.

The following summary is based on the Reports of the Public Examiner. During the years 1939 through 1943, after eliminating duplications due to inter-division transfers, the total net expenditures for current expenses, capital outlays and interest of all civil divisions of Minnesota were approximately $220,500,000 in 1939, increasing to $224,000,000 in 1940 and then decreasing to $198,000,000 in 1943.

Note: The year named is the year in which the fiscal period of the State and most school districts end. The other divisions end with the preceding calendar year or with dates near its end.

b. Current Annual Operating Expenses and Capital Outlays by Principal Functions — 1941 through 1943.

Exhibit IV-B-1 contains summaries for the years 1941, 1942 and 1943, extracted from the reports of the Public Examiner, of selected net expenditures, after eliminating duplications due to grants from one government agency to another and taxes collected by one for the benefit of other divisions. It also shows offsetting revenues from Departmental Fees and Service Charges. The record of Employment Security Benefits, Costs of Administration and Unemployment Compensation Revenues is included, although they are not really government expenditures or income. Although total expenditures for the various government levels are available for the two preceding years, certain details are not.

Exhibit IV-B-1 is confined to such operating expenditures as exceed $10,000,000 annually: education, highways, public welfare (charities), public safety, general government and interest payments in order of dollar value. That tabulation indicates the amounts spent by the State and the different divisions of the local units for each of the important functions. Public education has cost the people of Minnesota about $63,000,000 annually, of which the school districts have spent about three-quarters.

Highway operation, maintenance and capital outlay during 1941 and 1942 cost about as much as the school districts spent for education—$49,000,000. The State spent nearly one-half, and the counties one-quarter of the total. In 1943 the total was substantially reduced, the State spending only half as much as in 1942. Public welfare has been the third largest object of expenditure—decreasing from $39,000,000 in 1941 to less than $33,000,000 in 1943. The counties carried over three-quarters of the burden. General government costs, ranging from about $12,764,000 to $13,884,000, have weighed most heavily on the counties which have carried nearly one-half.

These divisions of expenditures reflect the policy of the people of Minnesota in allocating governmental functions among the various divisions of the

government. Any substantial change would mean a reallocation of functions and might involve a major administrative reorganization of the State. Comparable statistics for other states do not exist so an appraisal of these expenditures by comparison has not been possible. Such a comparison would be valueless unless accompanied by a thorough analysis and evaluation of the policies and procedures followed by the various states.

(1) Education

Two economic aspects of education are important:

(a) Fundamentally public education represents a cooperative effort to develop the human resources (children) of a community both for their own benefit and to furnish man-power for all kinds of human endeavor. In the realm of public higher education, effort also is made, by research and experiment, to add to the sum total of human knowledge.

(b) The character of education furnished in any community may influence prospective or newly arriving citizens to a degree subordinate only to the desirability of their employment and the availability of suitable living quarters.

Any public educational system affects the people in many ways. Pupils are taught a great deal besides the three R's. The returns for the money spent are of a sociological nature even more than they are economic. Political influences are potent. A thorough appraisal of the qualities and successfulness of the school administration in such a large area as a state is so involved and requires such expert analysis that it is far beyond the scope of this report. But, from the standpoint of the expenditures needed to support the school system of Minnesota, the subject deserves considerable analysis.

The Report of the Public Examiner lists the total annual school expenditures by the various government divisions during the years 1941 through 1943 as about $63,000,000. The State government spent about $13,000,000 of which about $11,000,000 was for the University of Minnesota and $1,500,000 for the Teachers Colleges. Offsetting revenues of the State from education facilities have been identified to the extent of about $5,000,000 in each of the years 1941, 1942 and 1943. These accrued largely from the University of Minnesota and Teachers Colleges in the form of tuition fees and receipts from service enterprises operated by the University and the Colleges. School Districts expended about $49,000,000 in each of these three years. (See Exhibit IV-B-1.)

The Constitution of Minnesota states that it is the duty of the legislature to establish a general and uniform system of public schools. State appropriations have included financial aid to the school districts and the financial system includes the sharing of certain taxes for school purposes. These forms of assistance have amounted to such substantial sums as about $17,000,000 yearly. The

determination of a fair basis for, and an equitable distribution of, these aids has presented a perennial but changing problem.

In 1942 Minnesota appeared to have more elementary and secondary public schools per 1,000 population (3.2) than any of the other North Central States except Iowa (4.4). The ratio is about three times as many as are found in Illinois, Michigan, Ohio and Indiana and about 50% more than in Wisconsin.

Minnesota is a State of small schools. Based on the 1940 census the following table indicates the location of 739 graded elementary and 661 high schools (total 1400) with a total enrollment of 353,344 pupils according to population centers of various sizes:

PER CENT OF SCHOOLS AND ENROLLMENT IN GRADED AND HIGH SCHOOLS LOCATED IN CENTERS BY SIZE

		ENROLLMENT			
				HIGH SCHOOL PUPILS	
Population	Schools	Elementary Pupils	Pupils Total	Resident	Non Resident
Under 1,500	72%	28%	30%	23%	53%
1,501 to 2,500	11	6	8	6	14
2,501 to 5,000	7	8	9	8	11
5,001 to 10,000	6	13	12	13	11
Over 10,000	4	45	41	50	11
TOTAL	100%	100%	100%	100%	100%

Source: Report of the Interim Committee on Education, January 1943.

The following analysis presents the situation regarding the ungraded elementary (rural) schools:

		NUMBER EMPLOYING		
Year	Total Number of Schools	One Teacher	Two or More Teachers	Number of Schools Closed
1940	7,500	6,283	501	716
1941	7,484	6,135	493	856

In 1941 the enrollment in these schools varied from one to 250 or more pupils per school. Forty-five per cent of these schools had enrollments of from one to fifteen pupils. Of the schools employing one teacher, 938 or 15% enrolled less than ten pupils. The total Gross Enrollment was 137,395; Net Enrollment, 129,068; Average Daily Enrollment, 125,593; Average Daily Attendance, 113,912. The Average Daily Attendance was 88% of the Total Enrollment

(Net). These schools may be grouped according to the number of pupils as follows:

1940-41 ENROLLMENT IN RURAL SCHOOLS ACCORDING TO NUMBER OF PUPILS

Enrollment	Total Schools		SCHOOLS EMPLOYING				Schools Closed and Transporting	
			One Teacher Only		Two or More Teachers			
	No.	%	No.	%	No.	%	No.	%
1	40	.53	1	.02	-0-	-0-	39	4.56
2	67	.90	5	.08	-0-	-0-	62	7.24
3	96	1.28	18	.29	-0-	-0-	78	9.11
4	123	1.64	35	.57	-0-	-0-	88	10.28
5-9	1,215	16.23	879	14.33	-0-	-0-	336	39.25
10-14	1,840	24.59	1,696	27.65	-0-	-0-	144	16.82
15-19	1,553	20.75	1,486	24.22	7	1.42	60	7.01
20-24	1,035	13.83	1,003	16.35	8	1.62	24	2.81
25-29	599	8.00	561	9.14	23	4.66	15	1.75
30-49	629	8.41	436	7.11	187	37.93	6	.70
50-74	172	2.30	15	.24	154	31.24	3	.35
75-99	73	.98	-0-	-0-	73	14.81	-0-	-0-
100-249	40	.53	-0-	-0-	39	7.91	1	.12
250 ——	2	.03	-0-	-0-	2	.41	-0-	-0-
TOTAL	7,484	100	6,135	81.97	493	6.59	856	11.44

Of these Rural Schools, 1,541 had less than 10 pupils each. Schools with less than 25 pupils each numbered 5,969 or about 80% of the total of 7,484. Only 15 of these schools, in which the number of pupils ranged from 15 through 24, had two or more teachers.

A similar table for earlier years is not available. In order to see the development of this condition reference is made to the almost constantly increasing number of Rural Schools that have been closed and the pupils transported to other schools, during the years 1932-1941, and also during the year 1943, as follows:

RURAL SCHOOLS CLOSED

YEAR	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1943
No.	294	296	276	299	325	375	501	565	716	856	1,239
%*	3.8	3.9	3.6	3.9	4.2	4.9	6.6	7.7	9.5	11.4	16.4

*Per Cent of Total Ungraded Elementary Schools in Minnesota.

In the school year 1942-43 the situation was as follows:

Number of ungraded elementary schools		7,549
Employing one teacher only	5,756	
Employing two or more teachers	554	
Closed and Transporting*	1,239	
Graded Elementary Schools		708
Secondary Schools		660
Junior High Schools	160	
Senior High Schools	137	
Six-Year High Schools	236	
Four Year High Schools	120	
High School Departments	7	
Total		8,917
Junior Colleges located in Public Schools**		13
Total		8,930

*Represents 16.4% of Total Ungraded Elementary Schools.
**Two of these were closed at the end of the year.
Source: Various Reports of the Department of Education.

The number of schools, per se, is not important because their size varies so much. It is important that several School Districts have been consolidated into a smaller number of larger ones with better equipped and better staffed schools. (In 1941-2 there were 440 consolidated schools). When this achievement is combined with State encouragement of better High Schools, the improvement in the whole system, as it benefits the rural boys and girls, becomes state-wide and an indication of its quantitative effect appears in the enrollment figures.

Exhibit V-N-1 based on figures for 21 years, shows the changing gross enrollment; the drop in ungraded elementary enrollment which started even

further back than the beginning of this table; the increase in High School enrollment taking place concurrently; the slight increase in the Graded elementary enrollment until 1928 then its drop corresponding somewhat with the increase in High School figures; all being complicated by the over-all change which was an increase yearly until 1929, followed by a drop the next year, which was more than made up in 1931, the increase continuing through 1933. Since 1933 the total number has decreased from about 562,500 to 526,340 in 1941 and to 501,500 in 1943.

When the High schools and graded elementary schools are combined, they appear to have maintained a relatively constant advance in gross enrollment which started at about 350,000 in 1923 and reached over 394,000 in 1940. Then the enrollment decreased to 369,135 in 1943. During the past two years the drop in total enrollment was nearly 25,000; nearly 13,000 occurred in High, 7,000 in Graded and 5,000 in Ungraded Schools. This is evidently due to the war.

Note: In the foregoing discussion of schools and enrollment there may be minor inaccuracies due to the use of different sources of information which did not always specify whether the figures were gross totals or whether they referred only to schools receiving State aid. Figures for net enrollments, excluding duplications resulting from transfers, start with 1934-35. They have not been used.

The number of pupils enrolled, number of teachers, average salaries of teachers, supervisors and principals and the number of pupils per teacher are shown for the years 1920, 1930 and 1940 in the following tables.

ENROLLMENT AND TEACHING STAFF
PUBLIC ELEMENTARY AND SECONDARY SCHOOLS
MINNESOTA AND SELECTED STATES

	Pupils Enrolled			Number of Teachers		
	1920	1930	1940	1920	1930	1940
North Dakota	168,283	169,277	140,126	8,975	8,856	7,262
South Dakota	146,955	165,624	136,447	7,853	8,943	7,837
Illinois	1,127,560	1,395,907	1,248,827	36,599	47,766	45,955
Minnesota	503,597	551,741	512,224*	19,575	22,169	21,080*
Iowa	514,521	554,655	503,481	27,660	24,585	22,450
Wisconsin	465,243	564,022	535,880	17,094	20,239	20,553
Indiana	588,288	667,379	671,364	17,209	21,847	21,459
Michigan	691,674	970,582	970,188	24,302	34,552	32,716
Ohio	1,020,663	1,277,636	1,213,978	33,751	41,432	43,671

Source: Statistical Abstract of the United States 1942 using figures of Federal Security Agency, Office of Education; Biennial Survey of Education.

*These figures differ from figures of Minnesota Dept. of Education Statistical Bureau which are 531,781 and 22,275 respectively.

COMPARISON OF AVERAGE ANNUAL SALARIES AND ENROLLMENT PER TEACHER IN PUBLIC ELEMENTARY AND SECONDARY SCHOOLS MINNESOTA AND SELECTED STATES

	Salaries of Teachers Supervisors and Principals			Average Number of Pupils Per Teacher		
	1920	1930	1940	1920	1930	1940
Minnesota	$882	$1,251	$1,276	25.7	24.9	24.3
Iowa	827	1,094	1,017	18.6	22.6	22.4
Wisconsin	915	1,399	1,379	27.2	27.9	26.1
Indiana	964	1,466	1,433	34.2	30.5	31.3
Michigan	911	1,534	1,576	28.5	28.1	29.7
Ohio	1,088	1,665	1,587	30.2	30.8	27.8
North Dakota	728	900	745	18.8	19.1	19.3
South Dakota	696	956	807	18.7	18.5	17.4
Illinois	1,081	1,630	1,700	30.8	29.2	27.2

Source: Statistical Abstract of the United States 1942 using figures of Federal Security Agency, Office of Education: Biennial Survey of Education.

Such a sampling does not justify extreme refinement in comparisons nor may too definite conclusions be drawn therefrom. However, in comparison with the eight selected states as to average Number of Pupils per Teacher, Minnesota with 25 consistently occupied the position just below the median when the states were arranged in descending order. From the standpoint of adequate or possibly extreme attention to each pupil, this puts Minnesota in the fourth best position. Only the comparatively sparsely populated states of North and South Dakota and the state with more nearly the same population, Iowa, had fewer pupils per teacher. Probably this is partly due to the number of small ungraded schools with too few pupils to justify their continued existence.

In average salary paid, Minnesota consistently occupied the same relative position among these nine states; and the same three states (North Dakota, South Dakota, and Iowa) paid lower salaries.

Although average annual salaries of teachers, supervisors and principals increased in all of the selected states between 1920 and 1930, Minnesota, Michigan and Illinois were the only states showing an increase between 1930 and 1940.

The following table shows, for the years 1936, 1938 and 1940, expenditures per capita of population and per capita of enrollment for Minnesota and the same list of selected states.

EXPENDITURES IN PUBLIC ELEMENTARY AND SECONDARY SCHOOLS

	Per Capita of Total Population			Per Capita of Enrollment					
				Current Expenses			Capital Outlay		
	1936	1938	1940	1936	1938	1940	1936	1938	1940
Minn.	$17.51	$17.74	$19.78	$77.80	$81.19	$92.39	$6.18	$8.10	$15.65
Iowa	15.31	16.20	18.41	67.17	73.84	78.34	5.22	6.09	14.51
Wis.	15.98	17.55	17.05	74.11	82.56	85.35	5.86	8.99	9.31
Ind.	14.42	15.83	17.29	65.10	72.14	78.40	6.86	7.82	9.59
Mich.	16.59	18.98	18.42	78.43	86.70	89.41	3.92	7.56	8.07
Ohio	17.20	18.03	19.82	82.76	86.90	95.94	6.15	9.89	16.14
N. Dak.	15.42	14.54	15.72	65.89	67.65	66.68	4.03	2.82	5.21
S. Dak.	18.41	17.10	18.67	75.49	75.07	79.90	7.68	7.95	7.87
Ill.	15.49	18.37	19.50	82.39	97.96	105.96	8.75	15.01	16.89

Source: Statistical Abstract of the United States 1942 using figures of Federal Security Agency, Office of Education: Biennial Survey of Education.

These brief and incomplete comparisons indicate that Minnesota has been spending for its public schools more, per capita, than the four neighboring states, North and South Dakota, Iowa and Indiana. It usually exceeded Wisconsin, exceeded Michigan to a lesser degree, and generally was less than Ohio and Illinois. In all of these States the trend from 1936 through 1940 had been generally upward (some drops may have been registered in omitted years). During the same period substantial increases were registered in capital outlay figures by all these States except South Dakota.

When per capita income in 1940 is used as the basis of comparison of these nine states, Minnesota exceeded three of the four it exceeded in per capita public school expenditures i.e. North and South Dakota and Iowa. But its per capita income was less than that of Indiana and all the others.

The organization, through which the public school system in Minnesota is administered, contains a comparatively large number of school districts. In 1940 there were 7,687 of such districts, but these had been reduced to 7,674 in the school year 1941-42. Progress has been made in simplifying the public school system by consolidating school districts, but persons familiar with the situation cite examples which indicate that more opportunities for improvement still exist.

The State Legislature has had under consideration reports and recommendations by various agencies concerning educational problems for the solution of which it is responsible. Detailed financial and other statistics have been

provided in abundance. Much of this information has been broadly publicized throughout the State, one object being to promote public discussion and a crystalization of public opinion. Referring to one of the most important problems, state-aid for schools, The Special Report of the State Department of Education to the Interim Committee on State Administration of the House of Representatives, dated June 1, 1944, confirms the statement in Report of the Interim Committee on Education (January, 1943, page 21).

> "* * * The apportionment of State aids is made on the basis of four types of aids: equalization aid, special aids, general aids, and income tax.
>
> Altogether approximately 37 kinds of aids are distributed. Some of these aid laws were written as far back as 1857. Many of the laws for the distribution of these aids have been changed again and again. * * * As a result at the present time Minnesota has a complicated school aid system which needs simplifying and refining. The local school district finds it very nearly impossible to estimate the amount of money it is to receive from the state, thus making it very difficult to prepare a proper budget. It should be recognized that some of these aids do meet the modern trend of distribution, others are antiquated and in many respects do not distribute money on a plan of equalization based on service which has been accepted as a fair basis for the distribution of public school aids."

Minnesota has ample institutions for higher education. The services of the University of Minnesota to the State have been distinguished and its graduates occupy many top management and important positions in all industries in the State and in other states.

The following tabulation was compiled from the alumni lists of the University schools enumerated, for the Classes of 1921, 1931 and 1938. The lists gave the addresses of the graduates of these classes as of the dates of publication.

GRADUATES OF SELECTED SCHOOLS IN THE UNIVERSITY OF MINNESOTA REMAINING IN THE STATE, COMPARED WITH THOSE LEAVING

School	List Dated	Class	Total	Remaining No.	Remaining %	Leaving No.
Business	June	1921	35	16	45.7%	19
Administration	1939	1931	185	121	65.4	64
		1938	197	150	76.1	47
Forestry	1944	1921	6	—	—	6
		1931	30	11	36.7	19
		1938	86	60	69.8	26
Technology	June	1921	152	58	38.2	94
	1940	1931	274	164	59.9	110
		1938	311	170	54.7	141
Law	1938	1921	63	42	66.7	21
		1931	73	62	84.9	11
		1938	72	62	86.1	10
Medical	March	1921	80	53	66.3	27
	1940	1931	129	69	53.5	60
		1938	128	89	69.5	39
Education	April	1921	122	64	52.5	58
	1941	1931	544	362	66.5	182
		1938	571	411	72.0	160
Dentistry	April	1921	81	65	80.2	16
Graduates	1942	1931	78	44	56.4	34
		1938	87	48	55.2	39
Dental Hygienists		1921	—	—	—	—
		1931	18	12	66.7	6
		1938	27	18	66.7	9
TOTALS		1921	539	298	55.3	241
		1931	1,331	845	63.5	486
		1938	1,479	1,008	68.2	471
GRAND TOTAL			3,349	2,151	64.2%	1,198

It will be observed that nearly two-thirds of the 3,349 graduates in these three classes were in the State at the times of compilation. The number of grad-

uates of the schools of Business Administration, Forestry, Law and Education shows an increasing tendency to stay in Minnesota. Dental graduates show an increasing tendency to leave the State. The tendency of Technological graduates to remain in the State appears to have increased from 1921 to 1931 and then decreased up to 1938. The trend in the case of Medical graduates to remain in the State was downward from 1921 to 1931, then upward to 1939. It should be noted that this analysis is only for three selected years at ten and seven-year intervals and does not include all of the schools, hence is submitted for what it may be worth.

The College of Agriculture is eminent in the services it has rendered and is rendering to the State and nation in all fields of agricultural endeavor. There are other excellent institutions, public and private, in various parts of the State such as the six State Teachers Colleges, the various Catholic colleges, including St. Johns, Concordia, St. Thomas, St. Benedict, St. Catherine, St. Teresa; also other colleges such as Hamline, Gustavus Adolphus, Carleton, Macalester, Augsburg and St. Olaf.

Most of these colleges now are conducting courses in economics, business management and industrial and labor problems, some of them having been recently added to the curricula and indicating an appreciation of the need for instruction along these lines.

(2) Highways

Highway operation, maintenance and capital outlay during 1941 cost the state and local governments about $47,500,000 of which nearly $20,000,000 was current expense and the rest capital outlay. In 1942 the total amount was $49,000,000; current expense being about $22,500,000 and capital outlay $26,600,000, slightly less than the year before. The next year, current expense increased to about $26,200,000 but capital outlay was reduced to slightly less than $9,250,000—the total being about $35,500,000. Of the totals, including capital outlays, the State, in 1941, spent about half, $23,750,000; in 1942, nearly $22,500,000. In 1943, however, the share of the State in the total was about one-third — $11,900,000. In 1941 and 1942 the counties spent nearly one-quarter of the totals, about $13,000,000, and in 1943 approximately $11,000,000. Of the remainder of these total annual expenditures, which ranged from about $11,000,000 in 1941 to $13,000,000 in 1942, decreasing in 1943 to $12,650,000, the cities and villages spent about two-thirds and the towns one-third. These sums are net after inter-division transfers. State-aid (largely from the gasoline tax) ranged from about $8,700,000 in 1941 to $6,100,000 in 1943. Federal grants to the State for highways were about $4,500,000 in the fiscal year ending June 30, 1941, $6,500,000 the next year but decreased to about $2,970,000 in 1943.

The per capita cost of highways, streets and alleys throughout Minnesota

during recent years is indicated in Exhibit IV-B-2. During the five years, 1939 through 1943, per capita expenditures for capital outlays started at about $7.10 in 1939, increased each year to about $9.90 in 1942, but were sharply reduced to about $3.50 in 1943. During the same period, per capita current highway operating and maintenance expenditures were about $9.08 in 1939, decreased to $8.32 in 1940 and to $7.13 in 1941. In 1942 they increased to $8.40 and in 1943 reached $9.80.

In 1940 there were 2,734 highway and street administrative agencies having direct or supervisory responsibilities for construction and maintenance of roads and streets. These agencies included 5 Federal, 5 State, 87 County, 1,884 Township and 753 Municipal. The important systems of highways include Federal-aid System, Trunk Highways, State-aid Roads, County-aid and County Roads, and Township Roads. About 11,000 miles of the total of 120,000 miles of highways, streets and alleys were parts of more than one system. Whole systems may be under the jurisdiction of two or more agencies.

The discussion of Highways with respect to Transportation (Section III-A-2) brought out the general excellence and adequacy of the paved roads of various kinds in Minnesota. Minnesota appears to have more actual mileage of improved roads, outside of urban areas, than any of the neighboring states, Iowa, Kansas, Michigan, Wisconsin, Missouri, Nebraska, North and South Dakota. The higher degree of urbanization in Wisconsin and Michigan is reflected in the larger percentage of surfaced roads that exists in those two states in comparison with Minnesota.

War conditions have caused a reduction in capital outlays for highways in Minnesota. In 1943 the amount was about one-third of that in 1941. On the other hand current expenditures increased more than 31% in the same period, from about $20,000,000 in 1941 to about $26,200,000 in 1943. Again due to war conditions, the quality of maintenance has deteriorated.

(3) Public Welfare

Total net expenditures for "public welfare" or "charities" decreased from $39,000,000 in 1941 to less than $33,000,000 in 1943. The counties spent more than three-quarters of these amounts, such sums decreasing from about $30,200,000 in 1941 to $27,200,000 in 1943. State-aid amounted to about two-thirds of these latter sums ($19,000,000 to $20,000,000) of which the State, in turn, received more than one-half from the Federal government. The State spent about $2,500,000 yearly, the cities and villages, $3,000,000 to about $6,000,000; and the towns from $150,000 to $250,000. The largest single item was Old Age Assistance. These expenditures for "Charities" do not include those expended for "Hospitals", which during these three years, 1941 through

1943 ranged from about $8,800,000 to $9,650,000 — about half of the burden being carried by the State.

The Department of Social Security, composed of the Division of Social Welfare, the Division of Employment and Security, and the Division of Public Institutions, is charged with the administration of the laws relating to care of and assistance to the indigent, unemployed, and physically and mentally handicapped. These Divisions have divided the State into varying numbers of districts, the number depending on their activities and the number and locations of the local units they supervise or through which they function. Various Bureaus in the Division of Social Welfare supervise the County Welfare Boards in their administration of the assistance laws.

(4) General Government

General government costs in 1941 amounted to about $13,370,000, decreased to $12,764,000 in 1942 and then increased to $13,884,000 in 1943. These sums represent from about $4.50 to $5.00 per capita. The counties spent nearly one-half, the cities and villages slightly more than one-quarter, the State less than one-quarter, and the towns the remainder.

2. Number of Local Government Units

When Minnesota is compared with such other states in the North Central Region as Iowa, Wisconsin, Indiana, Michigan, Ohio, Illinois, and North and South Dakota and with the average of the 48 states in the Union, its organization into minor local government units — counties, incorporated places, townships, school and other special districts — outnumbers in total units every other state except Illinois. In total number of such units Minnesota, with 10,409 in 1941, had more than three times as many as the average for the 48 states. The number of school districts in Minnesota also was more than in each of these other states except Illinois; and it outnumbered the average of all states three to one.

The following table brings out these relationships and others as they existed in 1941:

NUMBER AND TYPES OF LOCAL GOVERNMENTAL UNITS
MINNESOTA AND SELECTED STATES — 1941

	Total Units of Government	Counties	Incorporated Places	Townships	School Districts	Other Special Districts
Minnesota	10,409	87	751	1,883	7,687	1
Iowa	7,585	99	933	1,609	4,869	75
Wisconsin	9,514	71	513	1,289	7,394	247
Indiana	3,032	92	536	1,016	1,183	205
Michigan	8,295	83	476	1,266	6,466	4
Ohio	4,216	88	884	1,341	1,673	230
North Dakota	4,118	53	332	1,405	2,272	56
South Dakota	4,919	64	302	1,124	3,429	—
Illinois	15,629	102	1,138	1,436	12,129	824
Average of Selected States other than Minn.	7,164	82	639	1,311	4,927	205
Average of 48 States in Union	3,437	63	339	396	2,465	175

Source: The Book of the States 1943-1944, Page 94. Published by the Council of State Governments, Chicago, Ill.

In comparison with all the states in the Union, in total number of such local units Minnesota is exceeded only by Kansas (11,206), and Missouri (10,992), in addition to Illinois. In Minnesota the school districts cover the whole area of the State as do the counties. The total area of each of the other classes of units is less than the area of the State. However, in Illinois there is a dual system of school districts, so that their total area is more than the area of the state. Comparative records of the expenditures of these administrative units in all of these states do not exist.

3. Per Capita Government Expenditures, State and Minor Civil Divisions, 1939 through 1943

Exhibit IV-B-2 presents the results of computing, on a per capita basis, the data published by the Public Examiner of Minnesota, the estimates of population being those of the Bureau of the Census. The per capita cost of net current expense of operating the State and local government activities, in 1939 amounted to about $65.20, decreased to $63.40 in 1940, and to about $63.00 in 1941. Then they increased to $65.30 in 1942 and to $66.20 in 1943. Capital

outlays, in 1939, amounted to about $13.40 and they increased, in 1940, to $16.19. Then there was a decrease to $13.91 in 1941, a further decrease to $13.04 the next year and a sharp reduction to $5.15 in 1943. When these sums are added to the current expenses, the high point in the combined costs was $79.59 in 1940 and the low point $71.34 in 1943. The addition of interest payments brought these totals to a low of $74.77 in 1943 and a high of $83.42 in 1940. This per capita cost of such government operations — current expenses, capital outlays and interest payments in 1940 — was nearly 16% of the per capita income of $526.

4. Per Capita State Cost Payments, Minnesota Compared with Other States, 1937 through 1942.

In this category are the payments administered by the State government and grants made by the State to aid minor civil divisions, including expenditures for operation of the functional departments of the State government, for capital outlays and for interest. Expenditures made by local units are not included, except as grants to such divisions by the State government are embraced as State expenditures. In Exhibit IV-B-3 Minnesota has been compared with the neighboring states, North and South Dakota, Kansas, Iowa, Indiana, Wisconsin, and Michigan, and with the average for the 48 states. Although these per capita expenditures, ranging from $38.85 in 1937 to $44.07 in 1942 in the case of Minnesota, were uniformly higher than those of the other states excepting Michigan, they progressively decreased from $43.46 in 1938 to $40.09 in 1941. In 1942, at $44.07 they were slightly higher than they were in 1938 — $43.46. During these years, this maximum of $44.07 in 1942 compares with the maximum average of the 48 states of $37.51 the same year. Year by year, Minnesota exceeded the average for all the states by about $12 in 1937 and 1938; $7 in 1939; $5 in 1940; $3 in 1941 and $6 in 1942. The low point for the 48 states was $26.99 in 1937. Percentagewise, these differences range from about 7.5% to 30%.

In Exhibit IV-B-4 there are listed those states whose per capita cost payments during the years 1937 through 1942 exceeded Minnesota. Such sparsely populated states as Nevada, Wyoming, Arizona, New Mexico, Idaho (in 1941) and Utah exceeded Minnesota, as did Colorado, Washington and California. All of the last three have had certain expenditures considerably higher than those corresponding in Minnesota, some owing to special circumstances and some owing to the fact that these states are less fully developed. Although New York and Ohio were much lower in the earlier years, their expenditures gradually increased until, in 1941, they slightly exceeded those of Minnesota. Delaware consistently exceeded Minnesota. The record of Michigan has been

irregular and higher in three years, 1939, 1941 and 1942, apparently because of the problems of its industrialized areas.

In 1940, with "per capita income payments to individuals" of $526, Minnesota spent $40.32 for these functionalized State government cost payments compared with $40.17 spent by New York, whose per capita income was $814; and compared with $37.12 spent by Ohio whose per capita income was $644. These two latter states are highly industrialized and their population density in 1940 was 281.2 and 168.0 respectively, compared with 34.9 in Minnesota. Because of lower population density and comparatively larger expenditures, Minnesota, in that year spent 7.7% of its "per capita income payments to individuals" compared with 4.9% for New York and 5.8% for Ohio.

5. State Cost Payments Made Directly, Compared with those Diverted to Minor Civil Divisions

The part of State cost payments made directly by the State itself may be compared with the portion diverted to aid minor civil units, both in the form of grants to such agencies and taxes shared with them. The states have various and varying policies in their distribution of their expenditures. In the same state, proportions expended for various functions may differ widely. Policy may change from year to year. Exhibit IV-B-5 compares the divisions of functionalized expenditures by selected states for fiscal years ending June 30, 1942, as published in "State Finances" issued by the Federal Bureau of the Census. This record illustrates the wide variation among the states for that year in the three government functions requiring the largest amounts, and in the totals, including the other functions.

6. Per Capita Cost Payments for Principal Government Functions

In order to provide a more detailed comparison of State government expenditures, Exhibit IV-B-6 shows, for Minnesota, seven neighboring states and the average of the 48 states, per capita cost payments separated to indicate the amounts devoted to the principal government functions. The comparison includes the six years 1937 through 1942.

As the scale used in this graph is the same as that in Exhibit IV-B-2, a comparison of the two Minnesota charts brings out the substantial amounts (not including utility expenditures and debt retirements) expended by the minor units which they provide themselves.

Exhibit IV-B-6 is incomplete in that it includes only the direct expenditures by the State government and its contributions to the local civil divisions. Money raised and spent by the counties, cities, towns and villages, and school

and other districts is not indicated. In comparing Minnesota with Iowa, it should be noted that school expenditures by the latter are comparatively small; also that there are grants by the State to minor civil divisions for various unspecified purposes. Some of these grants have been made to compensate for exemption of homesteads from local taxes. Such payments probably were used by the local units not only for schools but for all the purposes that would have been supported by taxes on homesteads.

There are other inequalities in policies among the states which render detailed comparisons inadvisable without full explanations. Although as a whole, the Minnesota expenditures included in this analysis exceeded the average for the 48 states, the averages spent by the 48 states for General Control and Employment Security were larger than the corresponding figures for Minnesota.

7. Debt and Debt Service

Since 1928 the Constitution of Minnesota has provided ample safeguards against excessive and, to a large degree, against unwise incurrence of debt by the State itself. Among the safeguards are definite detailed provisions as to amount and term, with provision of tax revenue for the debt service which is not subject to repeal, postponement or diminution during the life of the bonds. There are also requirements concerning the necessary majority and methods of voting by legislators, which appear in Article IX, Sections 5 and 6. Section 8 limits the use of the proceeds of any debt to the object specified in the Act authorizing it.

Numerous Legislative Acts limit the powers of the minor civil divisions to incur debt and prescribe the standards to which they shall conform. The policy of limiting debt to a relatively small proportion of total assessed valuation has tended to keep such valuations high in those civil units in which the outstanding debt is at or near the maximum allowed.

The Constitution makes it possible for one civil unit in the State to invest any available funds in certain obligations of other units. Naturally, many of the Constitutional provisions had not been applicable to debts outstanding at the time these provisions, which were in the form of Constitutional amendments, became effective.

In the Report of the Highway Planning Survey, considerable space is devoted to highway debt. It appears that there have been certain towns that have defaulted on debts incurred many years ago. In the same report there is a description of the use of "Warrant Financing" by counties and local units and certain minor irregularities are mentioned.

The proportion of Gross Debt Burden carried by each type of unit in 1932, 1933, 1941 and 1942 is shown below. The actual amounts involved, in 1942, in millions of dollars, appear in the last column.

PROPORTION OF GROSS DEBT BURDEN
ON CIVIL UNITS — SELECTED YEARS

Unit	Proportions				Amount
	1932 %	1933 %	1941 %	1942 %	1942 (Million $)
State	32.9	33.6	34.8	34.7	103.9
Counties	14.2	14.1	9.4	8.7	26.0
Cities and Villages	31.9	31.3	39.2	40.3	121.1
Towns	.5	.6	.7	.8	2.2
School Districts	20.5	20.4	15.9	15.5	46.4
Total Bonded Debt	100.0	100.0	100.0	100.0	299.6
Unfunded Debt					6.1
TOTAL GROSS DEBT					305.7

On the assumption that on July 1, 1942 the population of the State was 2,664,000 this Gross Debt amounted to nearly $115 per capita. There has been a steady reduction since 1938, the amount of decrease in the bonded debt being about $44,000,000 and in the total $50,000,000.

The Report of the Examiner appears not to contain any complete schedule of debt maturities during the life of current obligations. From other sources —the Report of the Highway Survey and of the Auditor (1941-2)—Highway bonds and State obligations apparently will become due in constantly decreasing amounts through 1953 with one or two series not maturing until 1977.

During the years 1940 through 1943 yearly retirements exceeded annual new issues of State Bonds for "Charities." The gross amounts outstanding decreased from about $23,354,000 to $13,832,000. Continuing retirements are scheduled through 1953.

V. CONCLUSION

The purpose of this Volume II has been to present the statistical data gathered by the staff of The J. G. White Engineering Corporation during their study of the fundamental conditions which influence the economic problems of the State of Minnesota. This volume of data together with the exhibits (which have been separately bound) is to be regarded as a reference book for the Report. The data is essential to the findings and conclusions presented in Volume I and to the recommendations in Volume III.