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North Dakota Oil and Gas Industry

Economic Contribution Analysis

Summary Report

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Preface

This report is the latest biennial assessment of the role of the oil and gas industry in North Dakota.

Data for this study came from industry surveys, state and federal agencies, and other secondary sources,

The definition of the oil and gas industry and methods used to estimate its economic contribution are consistent with studies examining the economic contribution of other industries in the state. As usual, these studies are snapshots in time and economic contributions often vary from year to year with commodity-based industries.

Industry Highlights

The following figures combine several components of the oil and gas industry. All values are based on activity during 2021 and include direct and secondary economic output.

Economic Metrics for the North Dakota Oil and Gas Industry

- ❖ \$42.6 billion gross business volume
 - ❖ \$34.6 billion from production
 - ❖ \$3.3 billion from well development
 - ❖ \$4.6 billion in processing and transportation
 - ❖ \$0.1 billion in capital expenditures
- ❖ 49,385 jobs (direct and secondary)
 - ❖ 31,700 jobs supported by production
 - ❖ 8,500 jobs supported by well development
 - ❖ 8,100 jobs supported by processing and transportation
- ❖ \$3.9 billion in labor income
- ❖ \$26 billion contribution to state gross product
- ❖ \$3.8 billion in local and state government revenues

Share of State Economy

- ❖ 30.8% of the state's gross business volume
- ❖ 8.9% of all employment (wage/salary jobs and sole proprietors/self-employed)
- ❖ 10.5% of labor income
- ❖ 29.0% of state gross state product
- ❖ 37.8% of total state and local government revenues

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Understanding the Numbers

Economic contribution assessments measure the gross size of an industry or economic sector.

Size is estimated by combining *direct* or first-round effects (i.e., sales, spending, and/or employment) with economic modeling to estimate secondary effects of business-to-business transactions (*indirect*) and household spending for goods and services (*induced*).

Economic measures frequently used in economic contribution assessments:

- ❖ **Labor income** – earnings of workers and sole proprietors
- ❖ **Employment** – wage and salary jobs and sole proprietor/self-employed jobs
- ❖ **Gross business volume** – includes direct sales of products and services of the industry being measured, and sum of all business-to-business and household-to-business transactions associated with indirect and induced economic activity
- ❖ **Value-added** – represents share of gross state product

An overview and additional information on study methods, data sources, and economic definitions are appended to the end of this report.

Composition of North Dakota Oil and Gas Industry

Oil and Gas Production: represents the activities associated with extracting crude and natural gas from geologic formations.

Oil Field Services: represents an array of services performed on oil and gas producing infrastructure and services provided to drilling and fracking activities. Included in this segment would be services for moving crude oil, produced water, and natural gas via gathering systems.

Exploration and Well Development: represents all activities associated with locating oil and gas reserves, well pad development, well drilling, and fracking operations.

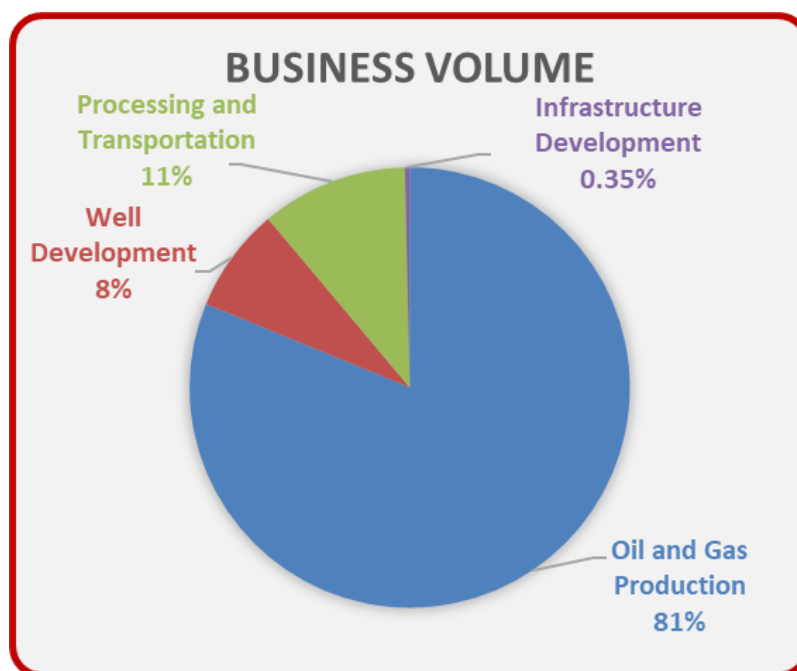
Processing and Transportation: represents transportation of crude oil via truck, rail and pipeline to out-of-state markets, processing of natural gas, and refining crude oil. Pipelines for refined oil products and processed gas are not included.

Capital Expenditures: represents the share of expenses captured in the North Dakota economy from the development and construction of crude oil pipelines, gathering systems, buildings and facilities, processing plants, and other oil field infrastructure. Expenditures for well head and other well site equipment are contained in exploration and well development.

Industry Output

Direct output of the industry was estimated at nearly \$35 billion. The biggest segment of the industry was oil and gas production, with direct output of \$29.3 billion. Processing and transportation were second with \$3.3 billion in direct output, followed by well development (\$2.2 billion) and infrastructure development (\$96 million).

Secondary economic effects followed a similar pattern as direct output with the largest additional industry output generated by oil and gas production, followed by processing and transportation. Total secondary output was estimated at \$7.6 billion.



Combining all segments of the industry, gross business volume in 2021 was estimated at \$42.6 billion. Oil and gas production was estimated to have a gross business volume of \$34.6 billion, followed by processing and transportation (\$4.6 billion) and well development (\$3.3 billion).

The gross business volume for oil and gas production represented over 80 percent of the industry's total economic output. Processing and transportation represented 11 percent of the industry, followed by well development at 8 percent.

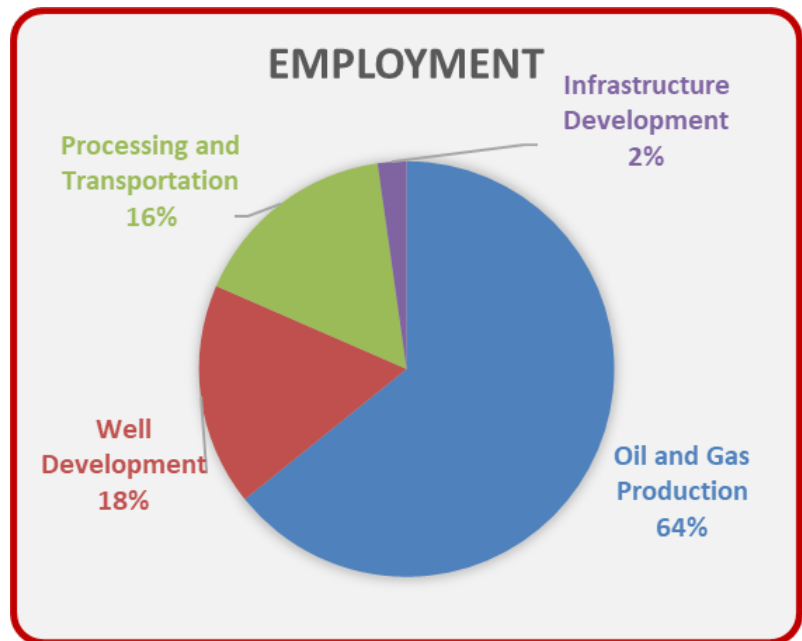
BUSINESS VOLUME, North Dakota Oil and Gas Industry, 2021

Industry Segments	Direct Output	Secondary Business Volume		Gross Business Volume
		Indirect Effects	Induced Effects	
----- millions \$ -----				
Production	29,327.0	4,022.9	1,220.0	34,569.9
Well Development	2,211.2	776.2	285.4	3,272.8
Processing and Transportation	3,310.9	930.2	344.8	4,585.9
Infrastructure Development	95.7	19.9	34.2	149.8
All Segments	34,944.8	5,749.2	1,884.4	42,578.4

Employment

The oil and gas industry had 14,200 direct jobs in 2021. The largest share of direct employment was in oil and gas production with 8,100 jobs. Well development was estimated to have 3,100 direct jobs followed by processing and transportation with nearly 2,200 jobs.

Secondary employment for all industry segments was estimated at 35,200 jobs. Oil and gas production accounted for nearly 23,600 of the 35,200 secondary jobs. Processing and transportation and well development were similar in the generation of secondary employment with 5,900 and 5,400 jobs, respectively.



Combined direct and secondary employment for the entire industry was estimated at 49,400 jobs. Oil and gas production represented 64 percent of all industry-related employment. Following oil and gas production, well development generated 8,500 jobs or 18 percent of all industry employment and processing and transportation generated 8,000 jobs or 16 percent of all industry employment.

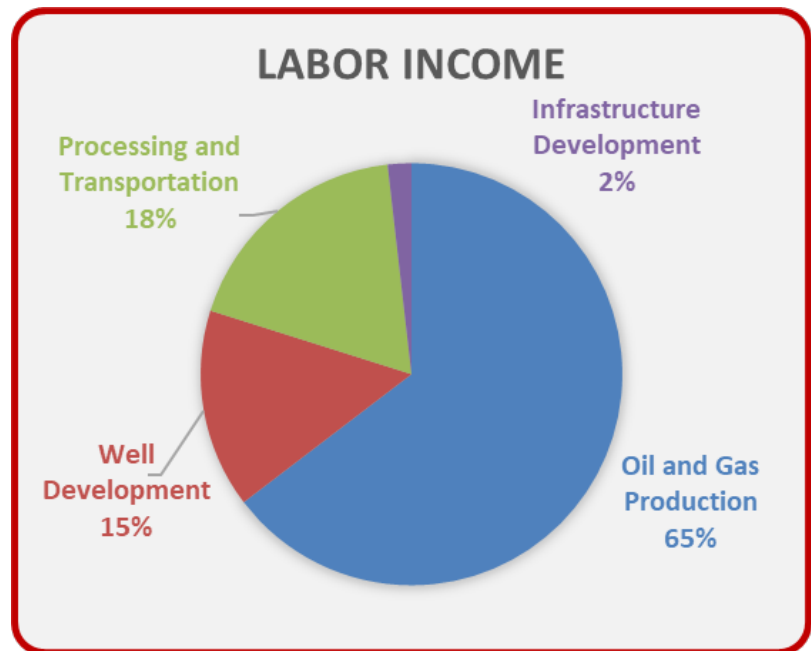
EMPLOYMENT, North Dakota Oil and Gas Industry, 2021

Industry Segments	Direct Employment	Secondary Employment		All Employment
		Indirect Effects	Induced Effects	
		----- jobs -----		
Production	8,100	15,900	7,700	31,700
Well Development	3,100	3,600	1,800	8,500
Processing and Transportation	2,200	3,700	2,200	8,100
Infrastructure Development	800	85	200	1,085
All Segments	14,200	23,285	11,900	49,385

Labor Income

Labor income is the financial compensation for all paid jobs in an industry. The oil and gas industry had \$1.7 billion in direct compensation. The oil and gas industry supported about \$2.3 billion in labor income associated with secondary employment. Combining labor income from both direct and secondary employment was estimated at \$3.9 billion.

Share of labor income among the industry segments was similar to the shares observed with overall employment. Oil and gas production represented 65 percent of the industry's labor income, followed by processing and transportation (18 percent), well development (15 percent), and infrastructure development (2 percent).



LABOR INCOME, North Dakota Oil and Gas Industry, 2021

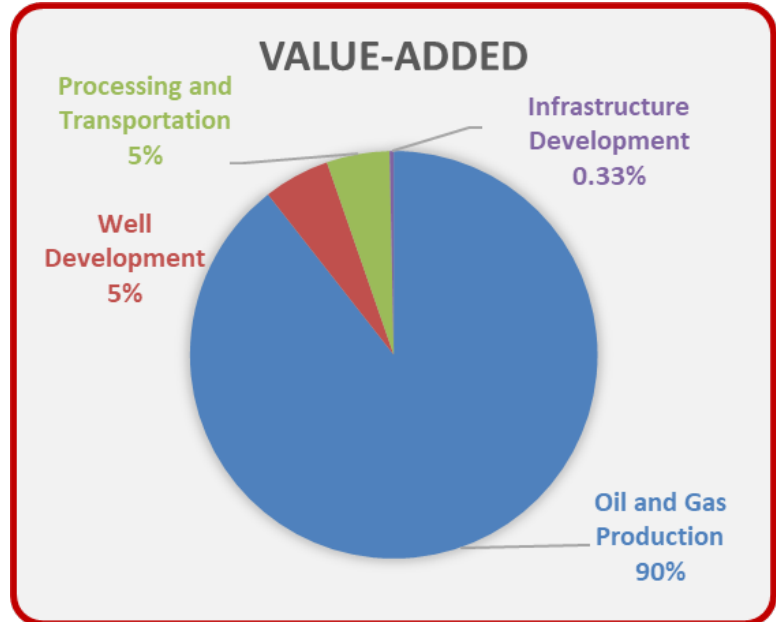
Industry Segments	Direct Labor Income	Secondary Labor Income		All Labor Income
		Indirect Effects	Induced Effects	
----- millions \$ -----				
Production	1,002.1	1,117.9	408.7	2,528.7
Well Development	262.3	238.3	95.6	596.2
Processing and Transportation	334.7	266.3	115.5	716.5
Infrastructure Development	53.2	6.1	11.4	70.7
All Segments	1,652.3	1,628.6	631.2	3,912.1

Value Added

The oil and gas industry's contribution to gross state product (GSP) is represented by estimates of value added (supplemental appendix discusses value-added measures). Direct economic output for oil and gas production contributed over \$20.7 billion to the state's GSP, followed by well development (\$810 million) and processing and transportation (\$630 million). Direct value-added for the industry was estimated to contribute \$22.2 billion to GSP.

Combining direct and secondary economic output, the oil and gas industry contributed \$26 billion to the state's GSP.

Oil and gas production represented 90 percent of the industry's contribution to the GSP, followed by processing and transportation and well development each with 5 percent.



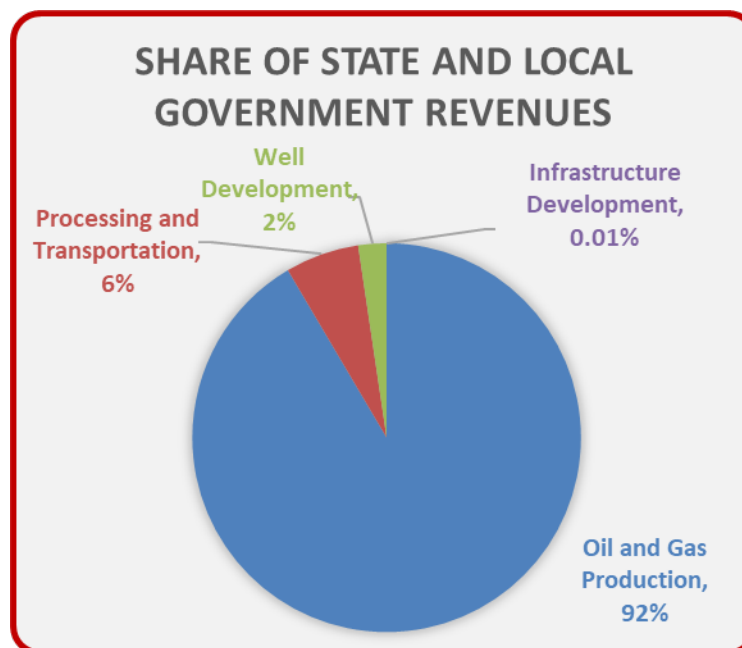
VALUE-ADDED (GSP), North Dakota Oil and Gas Industry, 2021

Industry Segments	Direct Value-added	Secondary Value-added		All Value-added
		Indirect Effects	Induced Effects	
----- millions \$ -----				
Production	20,670.9	2,024.2	673.5	23,368.6
Well Development	810.8	409.5	157.6	1377.9
Processing and Transportation	633.3	482.4	190.4	1306.1
Infrastructure Development	56.1	10.1	18.9	85.1
All Segments	22,171.1	2,926.2	1,040.4	26,137.7

Government Revenues

Government revenues represent payments (e.g., taxes, fees, licenses) made by an industry to local and state government. Some government revenues will have very little annual variation, such as periodic licenses, fees, and other taxes (e.g., fuel tax). However, other taxes, such as personal income and corporate income, will vary more for some industries subject to variable production expenses and commodity prices.

Oil and gas production accounted for 92 percent of the industry's total government revenues. Severance tax payments for the industry represented the dominant form of government revenue accounting for 60 percent all government revenues from the industry.



The oil and gas industry, through direct and secondary economic output, contributed \$3.8 billion in local and state government revenues. The largest component of industry payments to state and local government jurisdictions was severance taxes (\$2.25 billion), followed by sales and use (\$180 million) and property taxes (\$172 million).

STATE AND LOCAL GOVERNMENT REVENUES, North Dakota Oil and Gas Industry, 2021

2021

Government Revenue ^a	Type of Economic Activity		All Government Revenues
	Direct	Secondary	
----- millions \$ -----			
Severance Taxes	2,251.0	na	2,251.0
Lease Bonuses	1.8	na	1.8
Royalties	1,003.1	na	1,003.1
Property	132.2	40.0	172.2
Sales and Use	127.1	53.7	180.8
Corporate and Personal Income	47.2	22.1	69.3
Other Taxes, Permits, Fees, Licenses	82.6	29.7	112.3
All Segments	3,645.0	145.5	3,790.5

^aSeverance taxes include gross production and extraction taxes. Lease bonuses are net federal (which includes tribal leases) and state. Royalties include state, net federal, and tribal.

Share of State Economy

A key means of placing an industry contribution study into context is showing its share of a broader economy. The oil and gas industry represents a substantial share of the North Dakota's gross state product and total business volume. Oil and gas production represents about 25 percent of the state's gross state production and gross business volume. When the other segments of the industry are combined, the overall industry represents 30 percent of both gross state product and gross business volume. The oil and gas industry represents nearly 38 percent of all state and local government revenues.

The oil and gas industry's share of employment and labor income are around 10 percent of the state economy. Those shares are based on a state total for both wage and salary jobs and sole proprietors/self employed jobs.

ANNUAL SHARE OF STATE TOTALS, North Dakota Oil and Gas Industry

Industry Segment	Labor Income	Value-added (GSP)	Total Output	State and Local Government Revenues
State-level values for 2021	\$37.3 billion	\$77.0 billion	\$142.7 billion	\$9.954 billion
Production	6.8%	24.7%	24.2%	34.8%
Well Development	1.6%	2.2%	2.7%	2.1%
Processing and Transportation	1.9%	2.1%	3.8%	0.9%
Infrastructure Development	0.2%	0.1%	0.1%	0.0%
All Segments	10.5%	29.0%	30.8%	37.8%

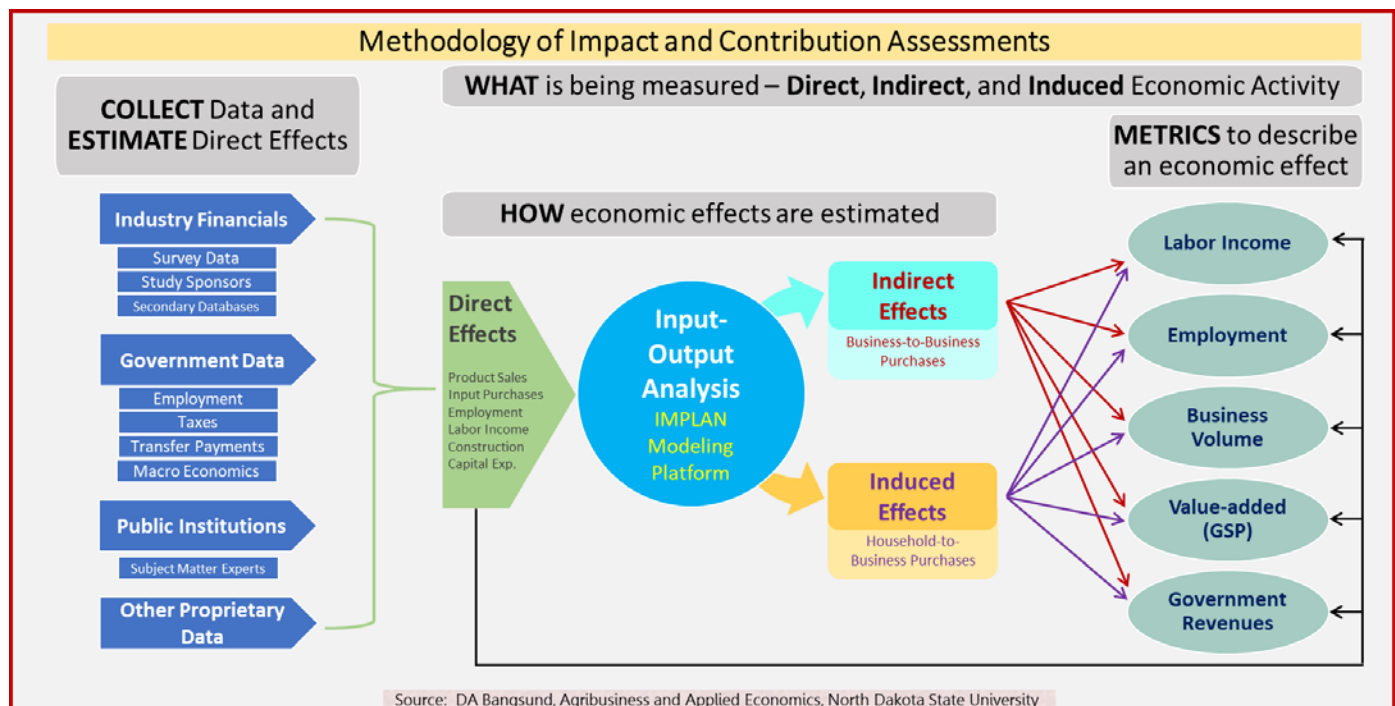
ANNUAL SHARE OF STATE EMPLOYMENT, North Dakota Oil and Gas Industry

Industry Segment	Total Employment	Wage and Salary	Self-employed
State-level values for 2021	557,702	434,811	122,691
Production	5.7%	6.0%	4.6%
Well Development	1.5%	1.6%	1.2%
Processing and Transportation	1.5%	1.5%	1.3%
Infrastructure	0.2%	0.2%	0.2%
All Segments	8.9%	9.28%	7.29%

Supplemental Materials

Economic Contribution Analysis

An economic contribution assessment measures the gross size of some aspect or component of an economy, and is usually measured in conjunction with the overall size of a given economy over a specified period. Size is estimated by combining direct or first-round effects (e.g., industry expenditures, business sales, new employment) with economic modeling to estimate how those first round effects generate business-to-business transactions and household spending on consumer goods and services. Both of those conduits for economic output can be framed using labor income, employment, value-added, gross business volume and government revenues.



Key Terms and Concepts

Direct Effects: First-round of payments for services, labor, and materials and/or sales of an industry's products.

Indirect Effects: Economic activity created through purchases of goods and services by businesses.

Induced Effects: Economic activity created through purchases of goods and services by households.

Industry Output and Gross Business Volume: Industry output is the value of all goods and services produced and supported by an industry. In most industries, output is largely synonymous with sales; however, for some sectors output also includes changes in product inventory. For oil and gas production, direct output includes both sales and inventory adjustments.

When output from business-to-business transactions (*indirect*) and households-to-businesses (*induced*) are measured, they also are described as the *sum of gross receipts* as annual adjustments to inventories are largely unquantified and not distinguished from sales. *Gross business volume* (GBV) therefore includes direct output/sales and includes secondary sales from indirect and induced economic activity.

Value-added: Value-added is synonymous with measures of gross domestic product (GDP) and gross state product (GSP), are some of the most commonly used economic measures to indicate the economic size and change in economic output. However, official government estimates of GDP and GSP do not include secondary economic effects generated by any industry. For oil and gas industry, official government estimates are primarily limited to oil and gas production, oil field services and well development. Economic contribution assessments include secondary economic effects, and include GSP from those effects, thereby providing a more realistic and representative portrait of an industry.

Key components of value-added include labor income, consumption of fixed capital, profits, business current transfer payments (net), income derived from dividends, royalties, and interest. In nontechnical terms, value-added is equal to product value minus production inputs. For example, value-added from oil and gas production would be the value of oil and gas produced less the value of the inputs consumed in producing the oil and gas. Depreciation charged to durable assets (e.g., buildings, pipelines, processing equipment) are not included in value-added measures.

Employment Compensation: Wages, salaries, and benefits earned by an employee.

Proprietor Income: Payments received by self-employed individuals and unincorporated business owner/operators.

Labor Income: Wages, salaries, and benefits for employees and compensation for self-employed individuals.

Input-output Analysis (I-O): Mathematical application of the interdependence among producing and consuming sectors in an economy.

I-O Matrix: Depiction of an economy using a grid of rows and columns that represents consumption and production for each economic sector in an economy.

Intermediate Inputs: Goods and services consumed in one year to produce another good or service. Intermediate inputs do not include expenditures for capital inputs used for multiple production seasons (e.g., machinery, buildings).

Capital Inputs: Represent the use of inputs to produce another good or service that are not consumed in one production season and are subject to depreciation. *Capital expenditures* represent the purchase of those depreciable assets.

Industry Balance Sheet: Dividing an industry or economic sector into various components for use in estimating the economic effects using input-output analysis. Components of the balance sheet include measures of output, wage and salary employment, self-employment, payroll and proprietor income, other property type income, taxes on production and imports, and intermediate inputs.

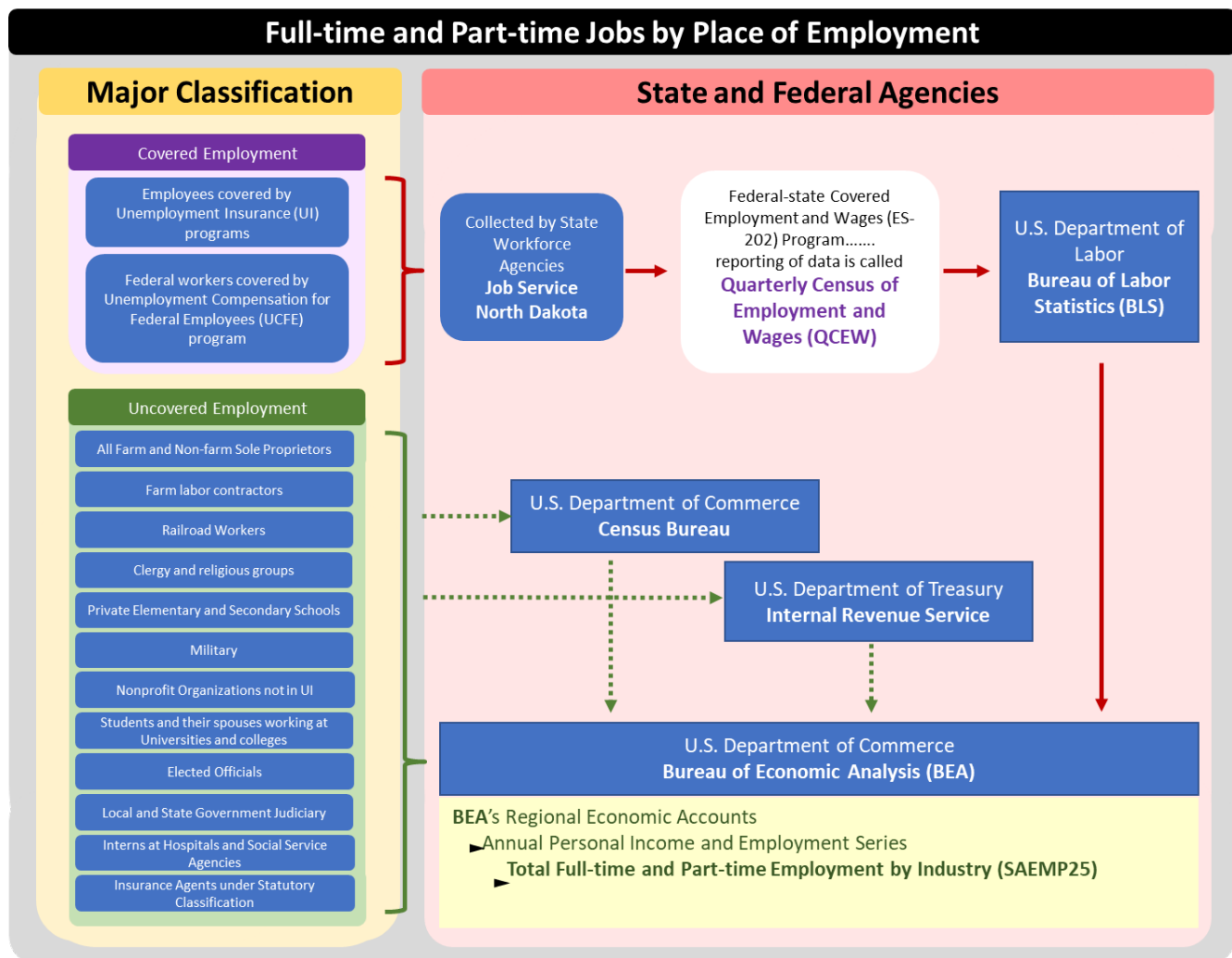
Institutions: Represent governments and other non-private entities consuming goods and services in an economy.

Households: Represent one or more individuals in a specific living arrangement for which income from all sources is used to purchase goods and services.

North American Industry Classification System (NAICS): Government classification system for all goods and services produced in the economy.

Employment Sources and Measures

Employment is broadly measured in two distinct categories: covered and uncovered. Covered workers are those that are employed by a business, institution, or government agency, receive a wage or salary, and are subject to unemployment insurance (UI). Jobs that fall under an UI program are called 'covered' employment. Quarterly Census of Employment and Wages (QCEW) employment reported by Job Service North Dakota is 'covered' employment. QCEW data are collected for each state and reported by the U.S. Bureau of Labor Statistics (BLS). Therefore, employment statistics for self-employed individual cannot be derived from QCEW data.

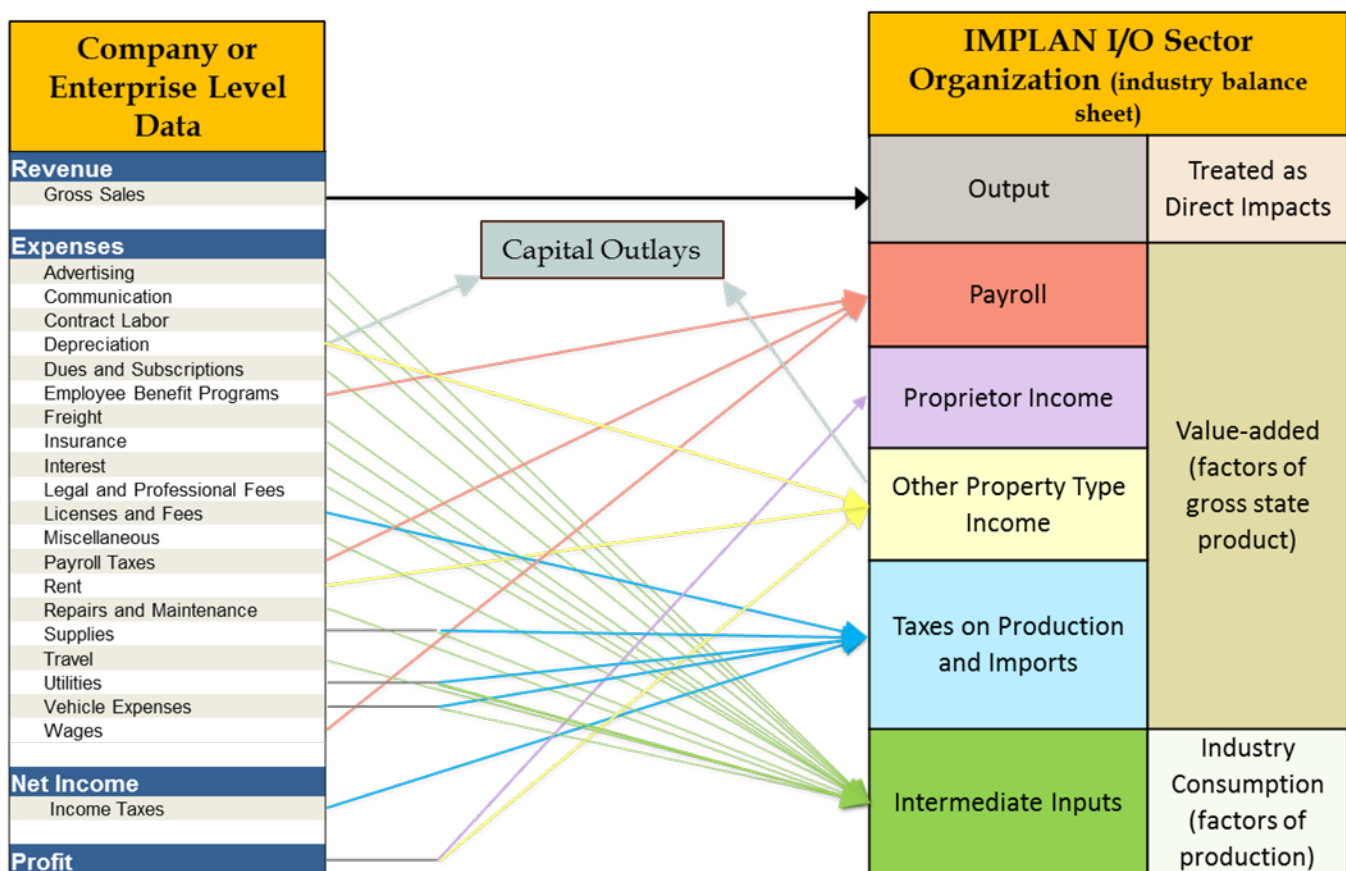


Developing Economic Sector Profiles

An industry balance sheet or economic profile is one of the most important elements in economic contribution studies. Nearly all key economic metrics have their origin within an industry's economic profile/sector. Information and data to create economic sector profiles were collected from surveys of industry firms and government agencies.

While the IMPLAN modeling platform provides baseline economic profiles generated from proprietary estimation techniques applied to government data, this study relied on state-sourced data and industry input to create a customized IO matrix. The process of developing study-specific economic profiles and then modifying an IO matrix is time consuming and requires considerable empirical analysis, but the results from those efforts produce a credible and transparent evaluation of an industry's role in an economy.

A combination of government agency and general public information was used to estimate capital expenditures for various pipeline and processing facilities under construction in 2021. Those economic activities relied on default construction sector values. However, adjustments to capital expenditures were conducted to ensure only expenditures captured in North Dakota and expenditures made in calendar 2021 were modeled.



General Transposition of Financial Information into IMPLAN Economic Sector Profiles

Source: DA Bangsund, Department of Agribusiness and Applied Economics, NDSU

Treatment of Traditional Economic Sectors Supporting Oil and Gas Production

This summary omits specific details of how the secondary economic effects are distributed among the state's numerous sectors and sub-sectors. Several economic sectors support the oil and gas industry by providing inputs and services to various segments of the industry. Examples include oil field services, financial institutions, legal representation, business services, among others. Under some definitions, those activities and sectors are presented as "direct" segments of the industry, much like oil field services often are considered a stand-alone component of the industry. However, from the perspective of how this study's input-output analysis was structured, those sectors represent "indirect" economic output of the industry, meaning those sectors are supported and sustained from purchases relating to oil and gas industry, processing, transportation and well development.

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