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From Research to Results

Itasca County Targeted Industry Cluster Analysis

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INTRODUCTION

Building Bridges to Opportunity

Powerful mega trends in de-carbonization, technology and geo-political policy shifts are redefining markets and behavior. The Federal Government has introduced policies around innovation, revitalizing manufacturing, workforce development, and infrastructure. Itasca County is part of a state that is receptive to technology adoption and has witnessed a recent surge in venture capital activity. IEDC has support from a diverse range of significant actors in the economic ecosystem. All of which aligns with the County's economic base and presents transformative opportunities through sector reconfiguration.

Objectives and Scope

The overarching goal of the Economic Industry Cluster and Business Assistance Targeting Strategy is to guide IEDC in its long-term strategies for efforts in business recruitment and business retention to assist its mandate in advancing the creation and retention of quality jobs working with the regional business community. To support these goals, an analysis of the clusters was completed to understand their dynamics and opportunities and set recommendations on how the County can position itself to capitalize on them.

Methodology

A mix of primary and secondary research determined that forestry, mining, manufacturing, and energy (renewables) were the most likely sectors to spearhead the region's future prosperity. In addition, enabling sectors were identified as construction, professional and technical services, and administrative and support services. The research and analysis were compiled as follows in the technical report:

- Interviews and focus groups with IEDC stakeholders to gather insights on the main study topics
- An economic base analysis and a labor market analysis in relation to Itasca County, the North East Minnesota Planning Region, the State and the Nation
- FDI and trade flows in Minnesota
- External trends analysis in each focus sector
- Itasca County's economic ecosystem in each focus sector

The key findings identified changing and growing clusters, emerging sectors, supply chain gaps, external trends, the impact of Covid on the focus sectors, and transformative technologies.

INDUSTRY and EMPLOYMENT in ITASCA COUNTY

Economic Base Analysis

- **Itasca County's core industries must be evolved into the future** by leveraging technologies and aligning with sector trends**.** Between 2015 and 2019, forestry, mining, utilities and construction saw declining employment and concentration
- **There are nascent sectors in important support sectors and knowledge industries, but the concentration is very low.** Administrative and Support and Waste Management and Remediation Services experienced the strongest growth. Professional and Technical Services, and Information were identified at a fledgling stage that could be a starting point for growth
- **Itasca County is a community of small businesses** 87% of businesses are non-employers (self-employed) or have under 4 employees
- **Small businesses are not concentrated in some focus sectors.** Employment in mining and utilities is dominated by a small number of MNE firms with less than 1% of self-employment and less than 5% in Agriculture, forestry, fishing and hunting, and manufacturing. self-employment is most prevalent in the forestry value chain, with 215 businesses
- **Business formations are not occurring in the core sectors.** The rate of business formations is minuscule or non-existent in the core sectors, with little activity in the support sectors, except construction and professional, scientific and technical services
- **Low economic activity in knowledge industries is a major concern.** There is a low concentration of companies and skills in knowledge industries. IT activities have low representation among the self-employed, often a source of entrepreneurship amounting to just under 1% of self-employment

Labor Market Analysis

- **Itasca County offers a very low-cost, affordable market.** Wage rates are 33-34% below the U.S. and Minnesota averages, across all positions, with projections suggesting this is likely to continue
- **A larger mature workforce** that will continue to age with the combined younger generations Alpha, Z, and Millennials 11% lower than the U.S. and Minnesota averages
- Itasca County's low labor force participation rate is systemic, being well below the Minnesota state and U.S. national averages and in decline over the last five years
- Employment density in Professional, Scientific, & Technical Services and information services is only about half the U.S. average, indicating a thin supply of these skills

RESEARCH & KEY FINDINGS

Trends in the focus sectors align with County's assets and highlight areas for opportunity exploration.

Energy

- **A shift toward renewable energy:** In late 2020, the share of renewables exceeded that of coal in generation for 153 days compared with 39 days in 2019

- **FDI trends:** With FDI into the State between 2015-2020, Industrial Equipment was the leading sector by a number of projects (13). Renewable Energy created ¼ the number of projects as the Industrial Equipment sector; however, it managed to contribute nearly $750M in CapEx, roughly 340% more
- **Increasing demand:** The U.S Energy Information Administration (EIA) forecasts that electricity consumption in the U.S. will increase by 2.2% in 2021 and electricity sales in the industrial sector specifically will grow by 3.3% in 2021; sales to the commercial sector will increase by 1.4% in 2021
- **Policy support:** renewable growth could accelerate in 2021 as the Federal government starts to execute on investing $2 trillion in clean energy, fully decarbonizing the power sector by 2035, and net-zero carbon emissions by 2050

Forestry

- **Demand resurgence:** Paper and Paperboard; Articles of Paper Pulp, Paper or Paperboard saw a resurgence in 2020, leading all exports with 134.9% growth; from $640K in 2019 to $1.5M in 2020
- **Growth in CLT:** Cross Laminated Timber (CLT) global market is projected to reach $982.1 million USD by 2026, from $562.6 million in 2020, at a CAGR of 9.7% during 2021-2026
- **Green building growth:** non-residential green buildings market reached approximately $80 billion in 2020 and is expected to hit $103 billion by 2023
- **Increasing demand for by-products:** The global Biomaterials Market is projected to reach USD 47.5 billion by 2025 from USD 35.5 billion in 2020, at a CAGR of 6.0% during the forecast period

Mining

- **A key export:** Ores, Slag and Ash, is the leading export valued at approximately $266 million and representing half of all exports, which in part, account for almost 90% of all commodities
- **Increasing demand for downstream products:** Demand in the USMCA region is forecast to increase by 7.6% in 2021 to 4.6% in 2022; technology and moves to a green recovery are driving demand for rare earths, copper, lithium and cobalt with battery-grade nickel demand expected to rise 10-to-20-fold by 2030, and possibly a faster recovery of international mining projects investment
- **Mining companies require a $1.7 trillion investment** in the next 15 years to supply enough copper, cobalt, nickel and other metals needed for the shift to a low carbon world
- **Critical need for rare-earths:** The United States does not produce enough to satisfy existing and future demand with domestic concerns over supply

Manufacturing

- **Revitalizing manufacturing and ensuring products are made in America** in the **American Jobs Plan** with have direct and indirect benefits to mining, forestry, and energy sectors
- **Improved productivity and economic growth** expected from basic metals, fabricated metals, precision tools, and special-purpose machinery **Increase in U.S. manufacturing output** of 3.5% for 2021 projected based on the Oxford Economic Model (OEM)
- **Move to 'Glocalization' in supply chains**. There is room to increase domestic sourcing. Peer countries (OECD/Asia) are meeting 80 to 90 percent of domestic demand with regional production, but only 70 percent of US domestic demand is from local production

- **FDI Trends:** In terms of FDI business activities from 2015-2020, Manufacturing accounted for nearly 30% of projects into the state while also producing the highest number of jobs (1,356), more than twice as much as the next leading job creator, i.e. Sales, Marketing & Support (620)

DISRUPTION (COVID & TECHNOLOGY)

The impact of Covid on sectors and the future outlook has a symbiotic relationship with transformative technologies, as such, we combined both topics to provide a perspective in terms of sector disruption. The stakeholder consultations provided the best source for direct impacts of Covid in the County.

Covid Issues

The strongest issues resulting from Covid were primarily a reduction in business, which accounted for nearly a third of all responses from stakeholders. The next leading issues included regulatory at 14% of all responses and essential service/safety at 11%. It's worth noting that just over one-fifth of respondents cited they had no net new issues resulting from Covid. Regulatory issues specific to Covid were centered on regulatory certainty, unnecessary temporary measures and state mandates. Note: regard to essential service/safety included being in an essential industry and workplace safety.

Covid Opportunities

The strongest Covid opportunity lies with technology adoption, which accounted for a quarter of the responses from stakeholders. The next largest opportunity areas included increased business demand, which accounted for one-fifth of the responses, followed by an increased demand/awareness for metals. Lastly, an increased personal adaption and cultural adaption were tied to represent 10%, respectively, of all responses. Increased business demand centered around sales or product/service delivery. Increased demand/awareness for metals included higher steel prices and increased awareness of the need for essential metals. While not leading responses, other noteworthy potential opportunities include: buy local, commercial interest in rural areas, and government & private sector cooperation.

Transformative Technology

Technology can be leveraged to boost operational and cost efficiencies, driving reductions in labor costs, improve data collection, and unlock opportunities.

Energy

- **IoE (Internet of Energy)** provides intelligent distributed control on energy transactions among users
- **Blockchain** seeks to unite all energy stakeholders under a single decentralized network
- **Energy-as-a-Service (EaaS)** is a delivery model that combines hardware, software and services. Enables the transition from selling electricity to selling services such as consumption management, optimizing production, and tracking consumption
- Other transformative technologies include **Energy Storage** and **Distributed Energy Resources** (DERs)

Forestry

- **IoT (Internet of Things) Sensors** enable the monitoring of forests to predict threats in a timely fashion and mitigate the impact of disasters, e.g. soil erosion, pests infestation, forest fires, etc.

- **Artificial Intelligence/Machine Learning & Data Science** supports data analysis and predictions, e.g. Yield prediction; Crop sustainability analytics; detection of tree/crop diseases and pest infestations
- Other transformative technologies include Automation and Robotics as well as Biomass

Mining

- **Artificial Intelligence (AI)** helps mining companies make optimal decisions at the prospecting and exploration stage, aid deposits discovery reducing initial investment costs by increasing strike rates, optimize blasting via projected fragmentation models, ore tracking systems and environmental data
- **Drones** carry out aerial surveying work once undertaken by helicopters. Uses include underground mine scouts searching unfamiliar areas, data collection, and aiding mapping
- **Virtual and simulated reality and digital twins** are used by mining companies to run advanced simulations, enabling enhanced monitoring of equipment and operations
- **Automation** is being blended with AI for autonomous vehicles, drillers and haulage systems resulting in increased productivity gains and safety
- **Mines are looking to reduce emissions** through deploying renewable energy, electrification and use of hydrogen for materials handling and optimizing processing operations

Manufacturing

- **Industry 4.0 technologies** can raise productivity by up to 40 percent and transform scale-based activity into flexible production
- **3D Printing** can temporarily alleviate the strain on supply chains during demand surges and shortages, as with medical equipment
- **IoT (Internet of Things)** revolutionizes machinery to communicate with each other cost-effectively
- **Cobots or collaborative robots** make real-time, complex decisions while working with humans
- **Human-centered AI** understands user needs and values that are reflected in AI designs and models, which will, in turn, improve adoption
- **Digital twinning** is a virtual replica that can be used as predictive testing grounds for monitoring, simulating and optimizing production, quality and operational performance

OPPORTUNITIES & INITIATIVES

Given the forward-looking nature of the recommendations, the sector/subsector opportunities are underpinned by a set of foundational cluster strategic pillars to support the opportunity areas:

- **Business retention and expansion:** Retention Program and Key Account Program
- **Investment attraction:** FDI and Domestic Attraction Plan and Implementation
- **Infrastructure Development:** Infrastructure Analysis –a comprehensive demand analysis
- **Talent Attraction & Development:** Talent Attraction Campaign and Workforce Development
- **Entrepreneurship & Partnerships:** Entrepreneurial Ecosystem Upgrades and Partnership Development
- **Key Partners: Itasca Community College, Northland Foundation, APEX, DEED, Community EDOs**

Sample Initiative – Cluster Activation / Support Opportunity Areas

Sample Initiative – Talent Attraction & Development

Sample Initiative – Entrepreneurship & Partnerships

**** Note, the above foundational cluster development initiatives apply to all sectors***

Forestry

Timber and NextGen Timber will likely grow in popularity and adoption, especially CLT in the Construction/Real Estate industry. Biomass and Biofuels will continue to be of particular interest given increasing energy demands and the global emphasis on renewable/clean. Key themes: **Green Economy**, the **Real Estate Wave**, and **Packaging** and **Tourism**. Sample initiatives to help capture opportunities locally include:

- **Biomass Campaign** – promote biomass opportunity to local companies and facilitate collaboration with regional partners to develop more biomass projects for local use and export
- **CLT Campaign** - promote CLT opportunity to local companies and facilitate collaboration with regional partners to develop Real Estate/Construction projects for local use and export
- **Containerboard Campaign** - promote containerboard/paperboard opportunity to local companies and facilitate collaboration with regional partners to develop projects for export and to assist with local import substitution
- **Key partners: UPM Blandin, IRRRB, NRRI, Nelson Wood Shims, MFI, Great River Energy**

Manufacturing

Manufacturing is ripe for strategic diversification or transformation. Fostering manufacturing culture from the ground up is fundamental to sector development. Sample initiatives to help capture opportunities locally include:

- **Maker/Entrepreneur Culture:** Build from the ground up with children's, youth, family programming; collaborate with local schools. Ensure inclusive access (e.g. Cohasset Manufacturing facility) to encourage the public to take on projects. Validate library equipment provision, e.g. 3D printers
- **Manufacturing Technology Makerspace Incubator:** Develop a focused facility to build knowledge-based skills capacity with a comprehensive range of tools/technologies for product prototyping. Work with manufacturing companies to identify possibilities for in-house makerspaces/prototyping
- **Maker Movement 'Meet your Maker'**: Identify local makers via Etsy and distributed manufacturing platforms such as 3D Hubs, Additively, Maker's Row; create local manufacturing interest groups
- **Distributed Short-run Manufacturing:** Investigate local prototyping and short-run manufacturing capabilities to build manufacturing capacity for product customization
- **Key partners: Lonza, Grand Rapids Chamber, Minnesota Business Finance Corporation, Northland Foundation, Great River Energy**

Sample Initiative – Maker/Entrepreneur Culture

CHILDREN'S PROGRAMMING IN MAKERSPACES

Exposure to manufacturing technology concepts should begin from an early age with family involvement. Provide a combination of children's, youth, family programming in makerspaces to learn the processes of making through hands-on experiences in digital and physical materials. Reinforce this process through collaboration with local schools on makerspace provision.

MAKESHOP®

https://pittsburghkids.org/exhibit/makeshop/

Sample Initiative – Tech Makerspace Incubator

IN-HOUSE MAKERSPACES/ PROTOTYPING FACILITIES

Itasca County is home to several large manufacturers, some of which are IEDC partners, presenting possibilities for in-house makerspaces and prototyping facilities and distributed short-run manufacturing capabilities. This model enables existing employees to harness their creativity and facilitates local manufacturing capacity through skills development and spin-offs.

1B FirstBuild

https://firstbuild.com

Sample Initiative - Partnerships

CO-OPS BEHIND RURAL MAKERSPACES

IDEA CO-OP COWORK • COLLABORATE • CONNECT

IEDC benefits from support from a diverse range of significant actors in the economic ecosystem, including foundations and energy co-ops. Such organizations can have a pivotal role in driving community-driven initiatives, which creates buy-in and enables building a maker/entrepreneur culture from the ground up.

https://idea.coop/

Mining

Opportunities in the mining sector are around the low carbon economy, technology deployment, improved metal materials, process improvements, existing deposits, and supply chain gaps. The Duluth Complex hosts one of the world's largest untouched deposits of copper, nickel, and valuable rare earths critical to de-carbonization and technology. Improved iron ore production processes such as Electric Arc Furnace and 'mustang pellets' improve efficiency and recyclability. Sample initiatives to help capture opportunities locally include:

"45% of the world's economic activity is driven by the mining sector"
CEO Of Anglo American

- **A Transformative Mining Cluster:** build knowledge-based business concentration and employment. Consider a Prospect Mining Studio model that brings together start-ups, entrepreneurs, mining industry experts, funding partners, and academics to define challenges, prototype, and implement pilots at mining sites. Work with regional partners to investigate a mining hub for demonstration projects and improve **advanced technology adoption** with local mining companies such as Mesabi Metallics, and Prairie River Metals, and research institutions and academia
- **Iron Ore Innovation:** Build on U.S. Steel initiatives in mustang pellets to pilot new processing innovations; - hydrogen uses, carbon capture, use and storage (CCUS), bioenergy and direct electrification with local energy partners; utilize results for demonstration projects.
- **Existing Resources:** Maximize potential through working with mining exploration companies to determine the potential of existing deposits; catalog viable opportunities for prospecting/ surveying, exploration; attract prospectors/developers and laboratory services to build the small business base
- **Closing the Loop/Remediation:** Develop specialization through building on Prairie River Metals scram mining demonstration project; investigating bioremediation opportunities in tailings to advance industry sustainability and build innovation capacity
- **Key partners: Hawkinson Construction, Prairie River Metals, Mesabi Metallics, IRRRB, NRRI, DNR**

Sample Initiative – Transforming Mining Cluster

Sample Initiative – Existing Resources

Energy

The majority of the energy opportunities lie in Renewable and clean energy. Opportunities emerged around key themes, including the **Green Economy**, the **Real Estate Wave**, and **Energy Technology**. Suggested initiatives to help capture those opportunities locally include:

- **Biomass Campaign** – promote biomass opportunity to local companies and facilitate collaboration with regional partners to develop more biomass projects for local use and export
- **Energy Efficient Building Support** – Consider making certain levels of energy efficiency a requirement for some new builds and promote the funding and subsidies available for constructing and/or retrofitting buildings to be energy efficient
- **Technology Adoption** – pilot new technologies, e.g. Internet of Energy (IoE), Blockchain, Energy-as-a-Service (EaaS) etc., with local energy providers, and/or partner with research institutions and academia, invite local companies to participate and/or share the results to foster adoption.
- **Key partners: Enbridge, Lake Country Power, Minnesota Power, Great River Energy**

2 Introduction

2.1 Background and Purpose

Powerful demand drivers or megatrends in de-carbonization, technology and geo-political policy shifts are redefining markets. As the technological age unfolds, industries are evolving in a state of disruption. Itasca County's critical natural resource industries are at a pivotal point as they navigate environmental, social and technological challenges. Energy industries are moving through de-carbonization, and advanced technologies are changing manufacturing processes. Combined with the interest in rural communities resulting from Covid combined, these developments offer opportunities for IEDC to harness new and emerging industries through diversification and transformation. The overarching goal of the Economic Industry Cluster and Business Assistance Targeting Strategy is to guide IEDC in long-term strategies for economic development efforts for business recruitment and business retention in Itasca County. It will support its mandate to advance the creation and retention of quality jobs by working with the business community in and around Itasca County.

2.2 Scope

Itasca Economic Development Corporation engaged Hickey Global Economic Development Consulting, in association with Attract Investment Consulting and Location Strategies, to develop an Economic Industry Cluster and Business Assistance Targeting Strategy. The analysis will profile and build a business case for business development targets that leverage Itasca County's current and emerging economic strengths and assets, including its natural resources, value-added diversification, domestic and foreign investment, supply chain gaps and development. This analysis considers existing, new or emerging diversification target sectors and aligns with sustainable growth opportunities and Itasca County's existing and emerging industry clusters.

Accordingly, the report focuses on:

- Identifying cluster and industry indicators with data sources
- Developing a list of emerging industries and business sectors
- Compiling a list of changing industries with identification of growth in targeted sectors
- Identifying supply chain gaps and opportunities
- Analysis of workforce data in the region

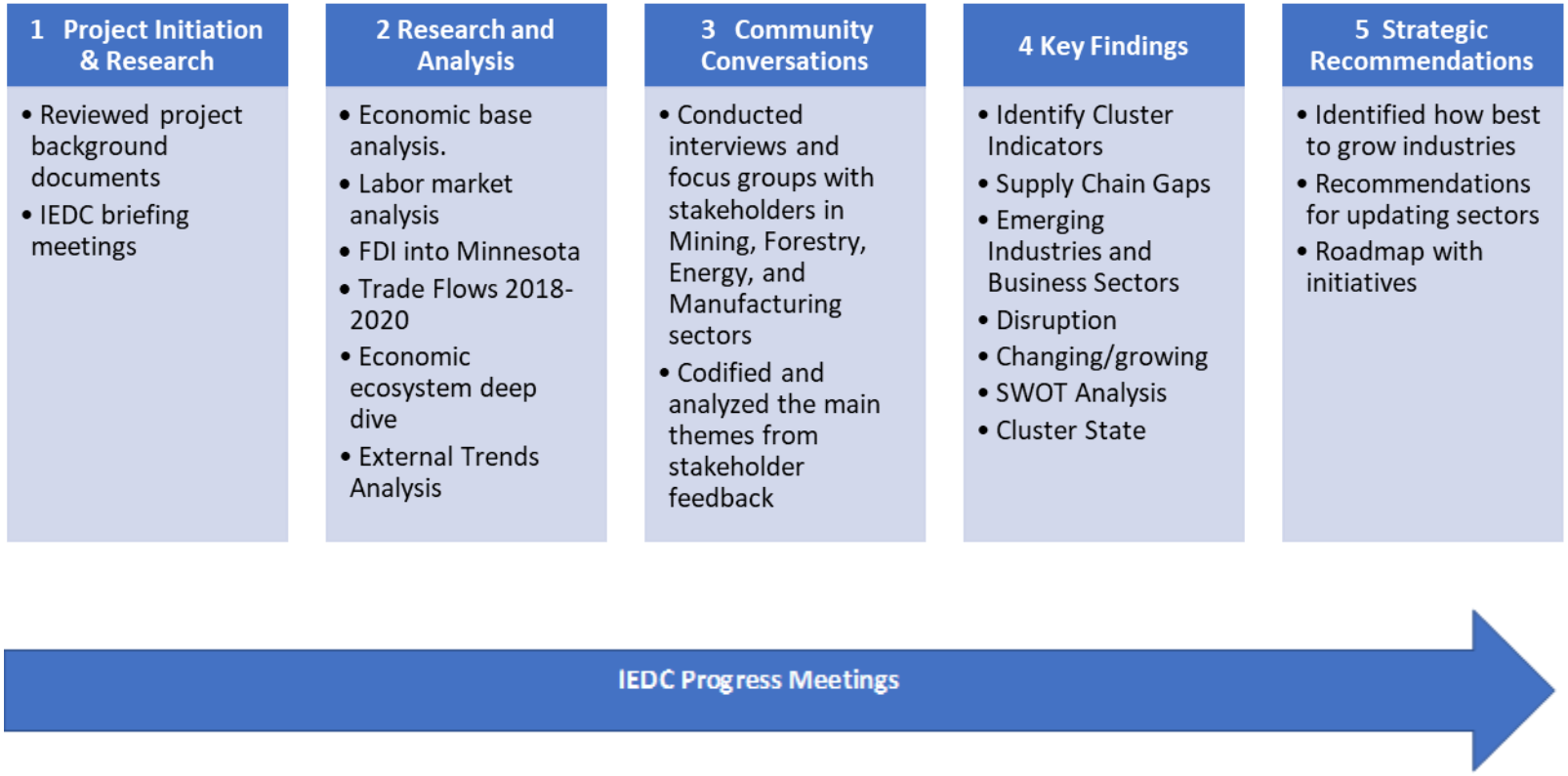
The report concludes with strategic recommendations that the IEDC can implement to support short, medium and long-term strategies for economic development efforts for business recruitment and business retention in Itasca County:

- How to best grow current industries based on the existing sectors and clusters
- Recommendations for updating the key sectors
- Evidence-based indicators used to develop the recommendations

2.3 Approach and Methodology

The strategy was developed through the approach outlined in Figure 1 below:

Figure 1 - Strategy Approach



2.4 Report Structure

The report is organized as follows:

- The Technical Report provides the background research and analysis
- The Findings Report covers the key findings and analysis, with strategic recommendations
- Appendices A through D provide supporting information as referenced in the main body of the report

2.5 Data Sources

Primary and secondary sources were used to gather data and information for the Economic Industry Cluster and Business Assistance Targeting Strategy.

Primary Research

Interviews and focus groups were conducted with IEDC stakeholders to gather information on the main topics of the study, including:

- Itasca as a Place to do Business – advantages and disadvantages
- Covid-19 related issues
- Industry Linkages
- Innovation
- Entrepreneurship
- Knowledge Transfer
- Barriers to Growth
- Growth Enablers in the community

The interviews also collected general information about the organization or company.

A total of 16 interviews were completed, including:

- 3 focus groups
- 6 interviews with various stakeholders, including small business advisors, industry interest groups, and government ecosystem actors
- 7 interviews with companies in Forestry, Mining, Tourism/recreation, Manufacturing

Secondary Research

An initial review of documents provided by IEDC was conducted, including recent studies by EDOs and other stakeholders in the region. Data gathering covered sources including MN DEED, DEED, Quarterly Census of Employment and Wages (QCEW), Business Employment Dynamics, the U.S. Census, Bureau of Labor

Statistics, Occupational Employment Statistics, Bureau of Economic Analysis, U.S. Cluster Mapping, fDi markets, IHS Markits – Global Trade Atlas, regional Chambers of Commerce, applicable sector associations and interest groups, thought leaders (e.g. McKinsey Global, Deloitte, Boston Consulting Group)

3 Cluster Identification and Industry Indicators

3.1 Methodology

We collected and analyzed relevant datasets and information, as shown below, to provide a combination of data and qualitative analysis to qualify and identify cluster opportunities for Itasca County:

- Economic base analysis
- Labor market analysis
- FDI into Minnesota
- Trade Flows 2018-2020: Twin Cities, Northeast, Closest Ports (2), & Minnesota
- Stakeholder consultations/Community conversations
- Economic Ecosystem Deep Dive - cataloguing the economic ecosystem actors in each focus sector

The various above-mentioned analyses can be found in the Technical Report, while the Economic Ecosystem Deep Dive can be found in *Appendix A*.

The data and information output underpinned the creation of base cluster indicators covering companies, labor – occupations and skills, and innovation as set out in 2.1.1. below.

3.1.1 List of Cluster Indicators

The initial data analysis findings informed a series of cluster indicators concerning companies, labor – occupations and skills, ad innovation, which are set out below. These indicators are utilized to determine the criteria and key characteristics of the clusters in Itasca County as set out in Developing a Cluster Framework below, which, in turn, will inform the nature of the actions required to grow the clusters.

3.1.1.1 Companies

Cluster Performance	Indicator	Source
Employment	Base employment number Employment growth/decline Shift-share: the difference between actual growth/decline in Itasca County and expected growth/decline at the combined U.S rate and industry rate	DEED, Quarterly Census of Employment and Wages (QCEW)
Establishments	Base number of establishments Growth/decline in number of establishments, % of total establishments	The Census Bureau: 2018 County Business Patterns and 2018 Non-employer Statistics Annual
Domestic and Foreign Direct Investment	Job gains: from expansions, openings **Indicative:** Share of state FDI in clusters/sectors (only available for the state) Wage rates vs M.N., U.S.	DEED, Business Employment Dynamics (BED) FDI markets
Export orientation	Growth/decline in traded clusters: % of total employment **Indicative:** Cluster output present in Top 20 commodity exports by value and % growth $ via Northeast ports/ Minnesota	DEED, Business Employment Dynamics (BED) IHS Markits – Global Trade Atlas
Supply chain gaps	**Indicative:** Cluster related Top 20 commodity imports by value and growth via Northeast ports/Minnesota	IHS Markits – Global Trade Atlas
Entrepreneurship	Growth/decline (-/+) in number in job gains from births Growth/decline (-/+) in number of non-employer businesses Rate of business formations vs. NE MN, MN Growth/decline (-/+) Percentage of non-employer businesses	DEED, Business Employment Dynamics (BED)

3.1.1.2 Occupational and Skills

Cluster Performance	Indicator	Source
Job gain/loss by occupational category	Itasca County rank vs 396 metros Post-COVID impacts Jan 2020-to date	Bureau of Labor Statistics, Occupational Employment Statistics, 2019
Labor market – talent attraction and retention	Inflows –/+ net migration into Itasca County – United States, Foreign Countries Labor market growth/decline Unemployment rate vs U.S., MN Labor force participation rate vs U.S., MN Income & Cost of Living Indicators	Bureau of Labor Statistics, Occupational Employment Statistics, 2019 U.S. Census
Existing and emerging workforce	Growth/decline in proportion of Generations Alpha, Z, and Millennials in population/ workforce Graduate output from local colleges in disciplines applicable to clusters	U.S. Census (Easy Analytic Software, Inc. 2020 edition, Hickey Global Consulting Services)
Educational attainment/quality of talent	% high school graduates, some college (no degree), and Associate, bachelor, master, doctorate, and professional Degrees, % Bachelor's Degree or higher Skill density per 10,000 workers in clusters	U.S. Census (Easy Analytic Software, Inc. 2020 edition, Hickey Global Consulting Services)
Employment Specialization	L.Q. vs. Median Annual Wage	(Easy Analytic Software, Inc. 2020 edition, Hickey Global Consulting Services)
Inclusivity: middle-wage employment opportunities	Occupation location quotient Median annual wage Labor force participation rate Unemployment rate	(Easy Analytic Software, Inc. 2020 edition, Hickey Global Consulting Services)
Productivity	Per capita GDP	Bureau of Economic Analysis

3.1.1.3 Innovation

Cluster Performance	Indicator	Source
Knowledge sector concentration - employment	L.Q. in knowledge sectors: NAICs 51 - Information, 54 – Professional, scientific, & technical services Itasca: vs. N.E. Minnesota (Regional indicator) Itasca: vs. M.N. (State indicator) Itasca vs. U.S. – benchmark (National Indicator)	DEED, Quarterly Census of Employment and Wages (QCEW)
Knowledge sector concentration - skills	Skill density per 10,000 workers in clusters in knowledge sectors: Itasca: vs. N.E. Minnesota (Regional indicator) Itasca: vs. M.N. (State indicator) Itasca vs. U.S. – benchmark (National Indicator)	(Easy Analytic Software, Inc. 2020 edition, Hickey Global Consulting Services)
R&D Institutions	Specialist Research Programs	Value chain
Education Programs	Specialist education programs	Value chain
Indicative – tracks data from over three years ago		
U.S. Cluster Mapping	Number of patents issued – per company by year Patents issued per 10,000 employees	U.S. Cluster Mapping
Indicative – data is only available for Minnesota		
R&D Expenditure	Growth/decline in R&D expenditure in M.N. Growth/decline in state ranking by expenditure and per person	National Science Foundation Annual
Technology utilization by firms	Growth/decline in percentage of firms using vs. United States in robotics, A.I., cloud/specialized software, specialized equipment by cluster	Annual Business Survey: Extent of Technology Use of Employer Firms by 2-digit NAICS for the United States and States

3.2 Developing a Cluster Analysis Framework

3.2.1 Approach to Data Agglomeration

This cluster analysis framework drew on leading key academic and grey literature sources: The Institute for Strategy and Competitiveness, Harvard Business School, The Brookings Institution, Metropolitan Policy Program, and The Institute for Competitiveness & Prosperity. These bodies of work were agglomerated to capture basic structures and processes essential to understanding the current situation and performance of the clusters in Itasca County. Clusters involve

complex cross-sector relationships that extend both vertically and horizontally. The analysis will provide information on the unquantifiable nuances of the cluster in partnerships, knowledge sharing, social capital, and local sources of tacit knowledge that are not reflected through data.

The analysis acknowledges that NAICs codes and SOCs are structured according to conventional industrial categories constrained by rigid and hierarchical groups. As a result, there are shortcomings in their ability to accurately reflect fast-evolving industries, capture new technology sectors and occupations, or account for companies that make products spanning traditional boundaries.

For understanding the complex linkages between firms and sectors, there is no substitute for on-the-ground business intelligence. For example, community consultations with a sample of cluster participants, firms and innovation actors provide rich insights into how clusters operate with a qualitative and quantitative analysis. In addition, data was gathered and catalogued on the value chains to provide a deep dive into the economic ecosystem in the focus sectors.

3.2.2 Cluster Identification - What are Clusters?

Clusters cannot be created from scratch. They should meet three basic criteria: a critical mass of firms that are geographically proximate and economically interdependent:

- **Critical Mass:** A critical mass drives cluster dynamics through a set of related industries. There is no consensus as to how many firms are needed to make a cluster. As a result, cluster initiatives have been built around groups of fewer than ten firms. In Itasca County's case, specialized suppliers should be factored in, as should enabler institutions. Intangible aspects such as the eagerness of firms and cluster actors to work together are also considered[i].
- **Geographical Proximity:** Clusters are enabled by geographical proximity reflecting the specific nature and density of local connections—specifically, interconnected companies, suppliers, service providers, and associated institutions. Proximity leads to more opportunities to share knowledge, form relationships, and develop partnerships, which is pivotal to the development of clusters [ii]
- **Interdependence:** Clusters are shaped by an interplay of collaboration and competition among related activities within a given location with knowledge spillovers and specialized input markets. Dynamic clusters with strong linkages enable firms to draw the full value out of the local assets and capabilities in a location[ii]. In addition, firms benefit from being part of large and dense product and supply chains. The presence of many customers allows suppliers to specialize and become more productive, while many suppliers are efficient for customers.

In sum, clusters foster the creation of new companies, attract and build talent, and draw suppliers and related industries to locate in the same area[iii].
The chart below sets out the factors determining whether or not the focus sectors in question meet these basic criteria. In doing so, they will identify the current state of the cluster or sector and underpin the nature of economic interventions required for development and growth.

Cluster Criteria

Cluster Criteria Description	Criteria	Source
Scale:	Number of companies in the cluster ecosystem >10 Number of establishments employer/non-employer in ecosystem	Ecosystem value chain County Business Patterns, Non-employer
Density: LQ >1	Cluster Location Quotient Itasca: vs. N.E. Minnesota (Regional indicator) Itasca: vs. M.N. (State indicator) Itasca vs. U.S. – benchmark (National Indicator) % share of employment by cluster	DEED, Quarterly Census of Employment and Wages (QCEW)
Proximity	Cluster ecosystem actors present in Itasca County, NE MN, and contiguous counties	Qualitative, non-statistical data Value chain chart, monitor through BR&E activities
Interdependence:		
Product and supply chains	Supply chain characteristics Cross-sector linkages	Qualitative, non-statistical data: Value chain charts, community conversations Monitor through BR&E activities Economic base analysis
Occupations and skills	Complimentary skill sets connected through product chains (i.e., with similar NAICS)	Labor market analysis
Innovation	Linkages between customers, universities, research institutes, government, and other institutions. Innovation indicators above	Qualitative, non-statistical data: Value chain charts, community conversations Innovation indicators above

Scale and geographical proximity are easily established. However, a cluster's interdependencies involve determining linkages around industry product and supply chains, occupations, and technologies. Although some economic outcomes are measurable, there are also difficult-to-quantify elements such as trust, culture, and institutions. that involve a combination of quantitative variables and qualitative insights.

Understanding interdependencies within a cluster is a critical factor in providing a robust foundation for growth strategies in a cluster. However, interdependency between firms in a cluster is complicated, layered, and dynamic. Therefore, the community conversations with Itasca County representatives, the stakeholder consultations and cataloguing of Itasca County's economic assets are important in understanding the interdependencies in the focus sector ecosystems.

3.2.3 Cluster Characteristics

This section provides a deeper dive into the pertinent characteristics of the cluster through the following elements:

- Specialization: what is the strength of the cluster?
- Cluster structure - composition of firms (e.g., one big firm or many small firms)
- Development stage - potential, emerging, developing, established, transformative (or declining)

3.2.3.1 Specialization

Characteristic	Indicator Name	Indicator
Does the cluster have a critical mass of specialization?	Inputs	Availability and quality of raw materials
	Employment	Location quotient
	Occupations	Skill density per 10,000 workers in clusters
	R&D Institutions	Specialist Research Programs
	Education Programs	Specialist education programs
How market expansion/ export-focused is the cluster?	Export orientation	Traded vs. local cluster Growth/decline in traded clusters % of total employment **Indicative:** Cluster output present in Top 20 commodity exports by value and % growth $ via Northeast ports/ Minnesota
	Domestic and Foreign Direct Investment	Job gains from expansions, openings **Indicative:** Cluster/sector share of state FDI (not available at County level). Individual investments into Itasca County should be tracked Wage rates vs M.N., U.S.
What are the capabilities in advanced functions in the economy, such as technology and skills availability	Corporate Innovation	Company examples
	Technology Adoption	**Indicative:** Sector adoption of new technologies in Minnesota
	Labor	% of population with bachelor's degree or higher Density of employment in information services (ICT related) and Professional, Scientific, Technical Services
What specialized funding support resources are available to the sector?	Funding programs	Funding examples

3.2.3.2 Cluster Dynamics - Structure/composition of Firms

Many measures of cluster strength, such as size or specialization, fail to reveal anything about the structure of a cluster, which has considerable influence on how the cluster contributes to regional outcomes. For example, multinational firms and their branch plants have more resources to innovate more than smaller, independent firms and can act as a magnet for attracting suppliers. Moreover, as mergers and acquisitions have concentrated headquarter functions in a few global cities, fewer mid-size American cities can claim to be command and control centers of major multinational companies. As a result, entrepreneurship has been undergoing a long-run national decline. However, that national view disguises how new firm creation is becoming concentrated in large places, allowing them to replenish their economies as smaller cities and rural towns become less dynamic [i].

Characteristic	Indicator Name	Indicator
What is the composition of companies?	Establishments	Base number of establishments Average number of employees per establishment
	Key company H.Q.s	Number, name of companies
	Presence of MNEs	Number, name of companies
	Anchor company	Name of company
What is the nature of entrepreneurship?	Entrepreneurship	Growth/decline (-/+) in number in job gains from births Growth/decline (-/+) in number of non-employer businesses Rate of business formations vs. NE MN, MN Growth/decline (-/+) Percentage or number of non-employer businesses in cluster
What is the extent of diversification by firms?	Diversification	Examples from community conversations and dialogue with IEDC
Presence of community champions	Dedicated core of institutions (often industry groups) to foster and maintain cluster relationships?	Qualitative: Community consultations, dialogue with IEDC

3.2.3.3 Cluster Development Stage

The research and analysis as set out in the Technical Report are synthesized to assess the cluster development stage[iv] in terms of the following characteristics:

Development Stage	Characteristics
Latent	A region has a number of firms and other actors that begin to cooperate around a core activity and realize common opportunities through their linkages. Indicators for a latent cluster will include a small number of firms, low internal awareness and external recognition of cluster activities, and few links among stakeholders.
Emerging	Lead or anchor companies or research institutes are spinning-off new companies new actors in the same or related activities emerge or are attracted to the region there are stronger linkages between companies entrepreneurs may take initial steps to create formal or informal clusters
Developing	As new actors in the same or related activities emerge or are attracted to the region, new linkages develop. Formal or informal institutes for collaboration may appear, as may a 'label' (such as 'Silicon Valley') and common promotional activities for the region. Indicators for a developing cluster will include developing linkages, internal awareness of regional strengths and other actors, and high innovation.
Established	A critical mass is reached. Relations outside of the cluster are strengthened. There is an internal dynamic of new firm creation through start-ups, joint ventures, and spin-offs. Indicators for an established cluster could include a large number of firms (many of which will be 'spin-offs' of other cluster organizations), external recognition of the cluster's advantages, active linkages, and high innovation.
Transforming/ Decline	In order to survive, the firms and organizations within a mature cluster must regularly re-evaluate their operations and re-orientate to their customers to avoid stagnation and decline. The cluster may transform by making changes to products, methods and markets, or it may transform into new clusters focused on other activities. Depending on the state of transformation, indicators may be mixed.

4 State of Clusters in Itasca County

This section sets out the current state of the clusters – mining, forestry, manufacturing and energy - in Itasca County using the indicators in the cluster development analysis framework. These indicators were drawn from a combination of the economic base analysis, labor market study, FDI into Minnesota, and Trade Flows 2018-2020: Twin Cities, Northeast, Closest Ports (2), & Minnesota, the Community Consultations, and the Economic Ecosystem Deep Dive. Unless stated, the growth and percentages data refer to between 2015 and 2019.

This analysis seeks to answer questions and provide insights on the current conditions in Mining, Forestry, Manufacturing, and Energy:

- Are the focus sectors clusters or part of another cluster or value chain?
- Are they sectors that require actions to evolve them into a cluster?
- What are the gaps and weaknesses?
- What are the cluster's unique areas of specialization and key strengths?
- What are the cluster's unique challenges?
- What is the cluster life cycle stage?

There are several steps involved in answering these questions. The first step was to determine whether the focus sector in question fulfills the basic criteria for a cluster in terms of scale, density, proximity and interdependence. In turn, a deeper dive into each cluster is conducted to investigate cluster specialization, firm structure, and stage of development. Finally, the specialization indicators determine the strength of the cluster by shedding light on the following questions:

- Does the cluster have a critical mass of specialization?
- How market expansion/export-focused is the cluster?
- What are the sector's capabilities in advanced functions in the economy?
- What are the specialized funding resources available to the sector?

The analysis then looks at the structure of the cluster, which indicate the composition of established, growing, and new businesses, and entrepreneurs, their needs in developing the cluster and inform the most effective way to engage them:

- What is the composition of companies?
- What is the nature of entrepreneurship?
- What is the extent of diversification by firms?
- Presence of community champions

The aggregation of these information and data components allows the determination of the cluster life cycle stage and shapes the nature of interventions required for cluster development and growth.

4.1 Mining

4.1.1 Cluster Criteria – Mining

Mining Cluster Criteria	Criteria	Description	
Scale:	Number of companies in the cluster ecosystem >10 Number of establishments employer/non-employer	23 companies in economic ecosystem in Itasca County County business patterns, employer/non-employer Mining (8) Cluster supports industries: Professional, Scientific, & Technical Services (394), Construction (516) Administrative Support and Waste Management and Remediation Services (111) Information (38)	
Density: LQ >1	Cluster Location Quotient Itasca: vs. NE Minnesota (Regional indicator) Itasca: vs. MN (State indicator) Itasca vs. U.S. – benchmark (National Indicator)	Natural Resources and Mining (Itasca County) LQ 1.11 4.10 2.69	Mining (NE Minnesota) 3.68 6.79
Proximity	Cluster ecosystem actors present in Itasca County, NE MN, and contiguous counties	Presence in Itasca County, NE Minnesota Key actors in government, academic research & development, specialist education, and companies are located in St. Louis County/Duluth	
Interdependence:			
Product and supply chains	Supply chain characteristics Cross-sector linkages	Horizontal supply chains with linkages to manufacturing (fabricated metal products) and environmental (professional services) Some vertical aspects through specialist service/supply	
Occupations and skills	Complimentary skill sets connected through product chains (i.e., with similar NAICS)	Skill sets in construction/extraction, installation, maintenance & repair, production, management. Limited supply of skills in Architecture & Engineering, ICT skills	
Innovation	Linkages between customers, universities, research institutes, government, and other institutions.	Regional/locally based interest groups and associations include cluster actors throughout the value chain, demonstrating a basis for knowledge	

Mining Cluster Criteria	Criteria	Description
		sharing (e.g. Iron Range Resources Rehabilitation Board, Minnesota Iron Mining Association Cross-sector innovation at Itasca Community College: Fabrication Labs Corporate innovation in Itasca County: Prairie River Minerals Regional innovation at Research Institutes (University of Minnesota, Duluth)

4.1.2 Specialization - Mining

Mining Characteristic	Indicator Name	Indicator	
Does the cluster have a critical mass of specialization?			
Raw materials, inputs	Quality of raw materials	Mesabi Iron Range – the largest mining district in North America, The Archean Superior Province Greenstone Belts - significant Gold Potential) Regional assets: The Duluth Complex - World-Class strategic metals: Copper, Nickel, and Platinum Group Metal Resources The Tamarak Discovery Nickel, Copper, and Platinum Project	
Employment	Location quotient Itasca: vs. NE Minnesota (Regional indicator) Itasca: vs. MN (State indicator) Itasca vs. U.S. – benchmark (National Indicator)	Natural Resources and Mining (Itasca County) LQ 1.11 4.10 2.69	Mining (NE Minnesota) 3.68 6.79
Occupations	Skill density per 10,000 workers	195.4 per 10,000 workers, 10 x state average, 3.42 x national average	
R&D Institutions	Specialist Research Programs	Significant research resources and activities at Natural Resources Research Institute, University of Minnesota, Duluth	
Education Programs	Specialist education/training programs	Comprehensive range of geological, engineering, science, technology programs available in the region through universities and community colleges Diplomas/associate degrees available at Itasca Community College:	

Mining Characteristic	Indicator Name	Indicator
		chemistry; engineering; natural science, geography & GIS, environmental science, supported by availability at community colleges in NE Minnesota Specialist training available in region at Minerals Education Coalition, Iron Mining Association of Minnesota, Minnesota State -Advanced Minnesota Trades apprenticeship programs available at Itasca Community College
How market expansion/export-focused is the cluster?		
Export orientation	Traded vs. local cluster Growth/decline in traded clusters % of total employment **Indicative:** Cluster output present in Top 20 commodity exports by value and % growth $ via Northeast ports/ Minnesota	Traded cluster (U.S. Cluster Mapping) Indicative: Natural Resources & Mining share of total employment declined from 6.1% to 4.6% Ores, Slag And Ash, are the leading export commodities valued at approximately $266 million and representing 30.44% growth and half of all exports out of the NE Ports in 2020. Agglomerated iron ores were the fourth largest commodity export ($440 million) out of Minnesota in 2020
Domestic and Foreign Direct Investment	**Indicative:** Job gains from expansions (2019) Job gains from openings (2019) Share of state FDI 2020 Wage rates in Itasca County vs M.N., U.S.	Natural Resources and Mining 126 9 Agriculture, construction, & mining machinery (3 projects) among the top 20, subsectors $53.76/hour in NE MN, above national/state average
What are the sector's capabilities in advanced functions in the economy?		
Technology Adoption	**Indicative:** Sector adoption of new technologies in Minnesota	Mining has a high propensity to utilize advanced technologies: Artificial Intelligence, robotics, and deploy specialized machinery
Labor Force	% of population with bachelor's degree or higher Density of employment in information services (ICT related) and Professional, Scientific, Technical Services	22.9% Employment density in Professional, Scientific, Technical Services is only about half the U.S. average Employment density in information is less than half the U.S. average
Corporate innovation	**Company examples**	Prairie River Metals: demonstration-scale scram mining and processing facility Regional: Cliffs' Northshore Mining, Nu-Iron Technologies

Mining Characteristic	Indicator Name	Indicator
What specialized funding resources are available to the sector?		
Funding programs	Funding programs	MN Department of Iron Range Resources & Rehabilitation mining programs

4.1.3 Structure/composition of Firms – Mining

Mining		
Characteristic	**Indicator Name**	**Indicator**
What is the composition of companies?		
Establishments	Base number of employer establishments	3 mine exploration companies, 4 mine operators, 22 active companies in the value chain
Key company H.Q.s	Number, name of companies	Tacora Resources, Prairie River Minerals, Mesabi Metallics
Regional Companies	Number, name of companies	Vermillion Gold (exploration)
MNEs, branch	Number, name of companies	U.S. Steel branch operation
Anchor company	Name of company (ies)	U.S. Steel (operations); AngloGold Ashanti Minnesota, ArcelorMittal (exploration)
What is the nature of entrepreneurship?		
Non-employer businesses	Number of non-employer businesses Percentage of total non-employer businesses	4 0.1%
Business Formations	Growth/decline (-/+) in number of business formations 2015-2019 New non-employer business formations – 2019	Zero business formations in mining in 2015, 2019
What is the extent of diversification by firms?	Diversification Examples	Scram mining – remediation, recycling
Presence of community champions	Dedicated core of institutions to foster and maintain cluster relationships	Iron Range Resources Rehabilitation Board, Minnesota Iron Mining Association, IEDC, to a lesser extent DEED, APEX, Chambers, SBDC, Blandin Foundation

4.2 Manufacturing

4.2.1 Cluster Criteria - Manufacturing

Manufacturing Cluster Criteria	Criteria	Description
Scale:	Number of companies in the cluster ecosystem >10 Number of establishments employer/non-employer	23 companies in economic ecosystem in Itasca County County business patterns, employer/non-employer 126 - Manufacturing 394 - Cluster supports industries: Professional, Scientific, & Technical Services, 111 - Administrative Support and Waste Management and Remediation Services 38 - Information
Density: LQ >1	Cluster Location Quotient Itasca: vs. NE Minnesota (Regional indicator) Itasca: vs. MN (State indicator) Itasca vs. U.S. – benchmark (National Indicator)	 0.85 0.50 0.64
Proximity	Cluster ecosystem actors present in Itasca County, NE MN, and contiguous counties	Business support, specialist education in Itasca County Low LQ in relation to NE Minnesota – higher company concentration in NE Minnesota Key actors in government, academic research & development, associations are located in NE Minnesota
Interdependence:		
Product and supply chains	Supply chain characteristics Cross-sector linkages	Horizontal supply chains Spread thinly across different manufacturing sub-sectors Cross-sector linkages to forestry (wood products) and mining (fabricated metal products), social enterprise, tourism/recreation Upstream linkages to mining and forestry
Occupations and skills	Complimentary skill sets connected through product chains (i.e., with similar NAICS)	Skill sets in installation, maintenance & repair, production, management. Limited supply of skills in professional, scientific, & technical services, ICT

Manufacturing Cluster Criteria	Criteria	Description
Innovation	Linkages between customers, universities, research institutes, government, and other institutions.	Some companies are members of local chambers in Itasca County Regional associations: Arrowhead Manufacturers and Fabricators Association (AMFA)Tri-State Manufacturers' Association include cluster actors. Itasca Community College: Fabrication Labs Regional innovation, commercialization at Research Institutes (University of Minnesota, Duluth)

4.2.2 Specialization – Manufacturing

Manufacturing Characteristic	Indicator Name	Indicator
Does the cluster have a critical mass of specialization?		
Raw materials, inputs	Quality of raw materials	Inputs from forestry products (biomaterials) and mining (metals, technology components)
Employment	Cluster Location Quotient Itasca: vs. NE Minnesota (Regional indicator) Itasca: vs. MN (State indicator) Itasca vs. U.S. – benchmark (National Indicator)	 0.85 0.50 0.64
Occupations	Skill density per 10,000 workers	922.7 per 10,000 workers, 71% of state average, 93% of national average
R&D Institutions	Specialist Research Programs	Research resources and activities at University of Minnesota, Duluth, particularly around materials/metals
Education Programs	Specialist education/training programs	Comprehensive range of engineering, science, technology programs available in the region through universities and community colleges Diplomas/associate degrees available at Itasca Community College: chemistry; engineering; supported by availability at community colleges in NE Minnesota Specialist training available in region Trades apprenticeship programs available at Itasca Community College,

Manufacturing Characteristic	Indicator Name	Indicator
		Northeast Minnesota Office of Job Training, Minnesota Job Skills Partnership, Northforce, Minnesota State -Advanced Minnesota
How market expansion/export-focused is the cluster?		
Export orientation	Traded vs. local cluster Growth/decline in traded clusters % of total employment **Indicative:** Cluster output present in Top 20 commodity exports by value and % growth $ via Northeast ports/ Minnesota	Not a traded cluster according to U.S. Cluster Mapping, but the presence of branch MNEs and the product range markets could suggest export activity Manufacturing's share of total employment declined from 7.17 to 6.5% Of manufacturing exports out of the NE Ports was very small in 2020. The value of Paper And Paperboard; Articles Of Paper Pulp, Paper Or Paperboard exports was small ($1.5 million), declining by -65.57%
Domestic and Foreign Direct Investment	**Indicative:** Job gains from expansions (2019) Job gains from openings (2019) Share of state FDI 2020 Wage rates in Itasca County vs M.N., U.S.	 70 31 Manufacturing has the highest number of projects (20) in the top 20 business activities between 2015-2020 with a 28.2% share $26.17/hour in Itasca County, significantly below the state average of $30.12 and the national average of $29.51
What are the sector's capabilities in advanced functions in the economy?		
Technology Adoption	**Indicative:** Sector adoption of new technologies in Minnesota	Manufacturing has a high propensity to utilize advanced technologies (artificial Intelligence, robotics) and deploy specialized machinery and software
Corporate Innovation	Company examples	A variety of innovative activities by manufacturing companies in Itasca County: Rox Speed FX, A.S.V. patent activity, Northland Machine manufacturing: technology deployment; Midstate Plastics Corporation: recycling; circular economy; Minnesota Diversified Industries (MDI): Social innovation
What are the specialized support resources available to the sector?		
Funding programs	Funding programs	Funding programs for entrepreneurship, tax credits for employment creation

4.2.3 Structure/composition of Firms – Manufacturing

Manufacturing		
Characteristic	**Indicator Name**	**Indicator**
What is the composition of companies?		
Establishments	Base number of employer establishments	23 companies in value chain
Key local company H.Q.s	Number, name of companies	Nelson Wood Shims, MNSTAR Group Highland Holdings (electronics), Rox Speed FX
Regional Companies	Number, name of companies	Plastics: Midstate Plastics Corporation, Minnesota Diversified Industries (MDI)
National Companies	Number, name of companies	Savanna Pallets
MNEs, branch	Number, name of companies	**Branch:** Printing: UPM-Blandin Paper Company, Miscellaneous Manufacturing: Lonza Consumer Health,
Anchor company	Name of company (ies)	Printing: UPM-Blandin Paper Company; Plastics: Midstate Plastics Corporation, Minnesota Diversified Industries (MDI)
What is the nature of entrepreneurship?		
Non-employer businesses	Number of non-employer businesses Percentage of total non-employer businesses	89 Nearly one third in miscellaneous manufacturing 20% in wood products manufacturing 17% in fabricated metal product manufacturing 3%
Business Formations	Growth/decline (-/+) in number of business formations 2015-2019 New non-employer business formations – 2019	Zero 1 new business formed in both 2015 and 2019
What is the extent of diversification by firms?	Diversification Examples	Plastics company started producing face masks - PPE
Presence of community champions	Dedicated core of institutions to foster and maintain cluster relationships	Arrowhead Manufacturers and Fabricators Association IEDC is most mentioned in community conversations DEED, APEX, Chambers, SBDC, Blandin Foundation, Northland Foundation, Arrowhead Development

4.3 Forestry

4.3.1 Cluster Criteria – Forestry

Forestry Cluster Criteria	Criteria	Description
Scale:	Number of companies in the cluster ecosystem >10 Number of establishments employer/non-employer	97 companies in economic ecosystem in Itasca County County business patterns, employer/non-employer 159 - Agriculture, Forestry, Fishing & Hunting Cluster supports industries: 11 - Utilities 394 - Professional, Scientific, & Technical Services 111 - Administrative Support and Waste Management and Remediation Services 38 - Information
Density: LQ >1	Cluster Location Quotient Itasca: vs. NE Minnesota (Regional indicator) Itasca: vs. MN (State indicator) Itasca vs. U.S. – benchmark (National Indicator)	LQ Forestry and Logging Highest of all sectors ranked #1 3.09 35.47 26.94
Proximity	Cluster ecosystem actors present in Itasca County, NE MN, and contiguous counties	Companies, government supports in Itasca County Specialist education programs at Itasca Community College Academic research & development/expertise located in Itasca County and NE Minnesota
Interdependence:		
Product and supply chains	Supply chain characteristics Cross-sector linkages	Specialized vertical regional supply chain Horizontal linkages with energy, manufacturing
Occupations and skills	Complementary skill sets connected through product chains (i.e., with similar NAICS)	Skill sets in installation, maintenance & repair, production, management Limited supply of skills in professional, scientific & technical services, ICT

Forestry Cluster Criteria	Criteria	Description
Innovation	Linkages between customers, universities, research institutes, government, and other institutions.	Regional/locally based interest groups and associations include cluster actors throughout the value chain, demonstrating a basis for knowledge sharing Itasca Community College: specialist forestry education provision and expertise Corporate innovation: Minnesota Power is a focal point Research Institutes: Natural Resources Research Institute, University of Minnesota, Duluth is a critical regional innovation resource with specialist labs and commercialization services

4.3.2 Specialization – Forestry

Forestry Characteristic	Indicator Name	Indicator
Does the cluster have a critical mass of specialization?		
Raw materials, inputs	Quality of raw materials	Nearly 10 million acres of timberland located within 90 miles of Grand Rapids. About 81% (12.75 million) of the estimated 15.75 million total acres of timberland in Minnesota within 120 miles of Grand Rapids
Employment	Cluster Location Quotient Itasca: vs. NE Minnesota (Regional indicator) Itasca: vs. MN (State indicator) Itasca vs. U.S. – benchmark (National Indicator)	LQ Forestry and Logging Highest of all sectors ranked #1 3.09 35.47 26.94
Occupations	Skill density per 10,000 workers	260.7 per 10,000 workers, a third higher than the State average, nearly twice the national average
R&D Institutions	Specialist Research Programs	Local Biomass research/innovation activity at Itasca Community College in Significant research resources and activities at Natural Resources Research Institute, University of Minnesota, Duluth

Forestry Characteristic	Indicator Name	Indicator
Education Programs	Specialist education/training programs	Comprehensive range of forestry programs available at Itasca Community College - Forestry Resources program, and regionally at University of Minnesota: College of Food, Agricultural and Natural Resource Sciences Specialist training in State available at Department of Forest Resources faculty, The Minnesota Logger Education Program (MLEP)
How market expansion/export-focused is the cluster?		
Export orientation	Traded vs. local cluster Growth/decline in traded clusters % of total employment **Indicative:** Cluster output present in Top 20 commodity exports by value and % growth $ via Northeast ports/ Minnesota	Traded cluster (U.S. Cluster Mapping) Forestry and logging share of total employment declined from 1.4% to 1.1% between 2015 and 2019 The value of Paper And Paperboard; Articles Of Paper Pulp, Paper Or Paperboard exports were small in 2020 (1.5 million) but experienced 80% growth
Domestic and Foreign Direct Investment	**Indicative:** Job gains from expansions (2019) Job gains from openings (2019) Share of state FDI 2020 Wage rates in Itasca County vs MN, U.S.	Natural Resources and Mining (Supersector and data suppression but not specific to Forestry) 126 9 Agriculture, construction, & mining machinery (3 projects) among the top 20 subsectors in FDI to Minnesota $21.04/hour in NE MN, slightly below national/state average
What are the sector's capabilities in advanced functions in the economy?		
Technology Adoption	**Indicative:** Sector adoption of new technologies in Minnesota	Minnesota has a higher propensity to utilize advanced technologies and deploy specialized equipment and cloud-based software than the national average. (No state-level statistics were available for Agriculture, Forestry, Fishing & Hunting Sector)
Corporate Innovation	Company examples	Minnesota Power
What are specialized support resources available to the sector?		
Funding programs	Funding programs	Federal and State funding programs available for biomass

4.3.3 Structure/composition of Firms – Forestry

Forestry		
Characteristic	**Indicator Name**	**Indicator**
What is the composition of companies?		
Establishments	Base number of employer establishments	159 Agriculture, Forestry, Fishing & Hunting Value Chain
Key company H.Q.s	Number, name of companies	Rajala Mill Co, Broking's Transport Incorporated, Wille Transport Inc
Regional Companies	Number, name of companies	Minnesota Power
MNEs, branch	Number, name of companies	UPM-Blandin Paper Company, Ponsse North America Inc
Anchor company	Name of company (ies)	UPM-Blandin Paper Company, Minnesota Power
What is the nature of entrepreneurship?		
Non-employer businesses	Number of non-employer businesses Percentage of total non-employer businesses	131 in Agriculture, Forestry, Fishing and Hunting, of which: 81 – over half (61%) involved in forestry and related products 37 – nearly one third (28%) in leisure-related activities fishing and hunting/trapping Agriculture, Forestry, Fishing and Hunting: 4.5% Forestry and Related Products: 2.8%
Business Formations	 Growth/decline (-/+) in number of business formations New non-employer business formations - 2019	Agriculture, Forestry, Fishing and Hunting: 2 businesses gained in 2015 0
What is the extent of diversification by firms?	Diversification Examples	Agricultural products, natural resource-based initiatives
Community Champions	Dedicated core of institutions to foster and maintain cluster relationships	Regional associations IEDC DEED, APEX, Chambers, SBDC, Blandin Foundation, Northland Foundation, Itasca Community College

4.4 Energy

4.4.1 Cluster Criteria – Energy

Energy Cluster Criteria	Criteria	Description
Scale:	Number of companies in the cluster ecosystem >10 Number of establishments employer/non-employer	5 companies in value chain covering renewable energy in economic ecosystem in Itasca County County business patterns, employer/non-employer Utilities - 11 Cluster supports industries: Agriculture, Forestry, Fishing & Hunting (159), Professional, Scientific, & Technical Services (394), Administrative Support and Waste Management and Remediation Services (111) Information (38)
Density: LQ >1	Cluster Location Quotient Itasca: vs. NE Minnesota (Regional indicator) Itasca: vs. MN (State indicator) Itasca vs. U.S. – benchmark (National indicator)	LQ Utilities 2.10 4.96 5.47
Proximity	Cluster ecosystem actors present in Itasca County, NE MN, and contiguous counties	Companies, government supports in Itasca County Specialist education programs at regional community colleges Academic research & development/expertise located in Itasca County and NE Minnesota
Interdependence:		
Product and supply chains	Supply chain characteristics Cross-sector linkages	Specialized vertical regional supply chain Upstream linkages with forestry, food processing - waste management & remediation
Occupations and skills	Complimentary skill sets connected through product chains (i.e., with similar NAICS)	Skill sets in installation, maintenance & repair, production, management Limited supply of skills in professional, scientific & technical services, ICT

Energy Cluster Criteria	Criteria	Description
Innovation	Linkages between customers, universities, research institutes, government, and other institutions.	Locally based interest groups and associations - Itasca-Mantrap Cooperative Electrical Association Corporate innovation: Minnesota Power is a focal point Research Institutes: Natural Resources Research Institute, University of Minnesota, specialist labs and commercialization services

4.4.2 Specialization – Energy

Energy Characteristic	Indicator Name	Indicator
Does the cluster have a critical mass of specialization?		
Raw materials, inputs	Quality of raw materials	Inputs from forestry (biomass) and mining (components for renewable energy) Weakness in renewable energy potential – wind, solar, geothermal
Employment	Cluster Location Quotient Itasca: vs. NE Minnesota (Regional indicator) Itasca: vs. MN (State indicator) Itasca vs. U.S. – benchmark (National Indicator)	LQ Utilities 2.10 4.96 5.47
Occupations	Skill density per 10,000 workers	229.4 per 10,000 workers, three times the state average, 2.7 times the national average
R&D Institutions	Specialist Research Programs	Local Biomass research/innovation activity at Itasca Community College in Significant research resources and activities at Natural Resources Research Institute, University of Minnesota, Duluth
Education Programs	Specialist education/training programs	Comprehensive range of renewable energy programs at regional community colleges Engineering, technology, geology; environmental science; technology programs available in the region through universities and community colleges Relevant trades programs at Itasca Community College University of Minnesota:

Energy Characteristic	Indicator Name	Indicator
		Specialist renewable energy training in State available at regional community colleges
How market expansion/export-focused is the cluster?		
Export orientation	Traded vs. local cluster Growth/decline in traded clusters % of total employment **Indicative:** Cluster output present in Top 20 commodity exports by value and % growth $ via Northeast ports/ Minnesota	Electric Power is a traded cluster (U.S. Cluster Mapping) Utilities share of total employment declined from 2.9% to 2.4% n/a
Domestic and Foreign Direct Investment	**Indicative:** Job gains from expansions (2019) Job gains from openings (2019) Share of state FDI 2020 Wage rates in Itasca County vs M.N., U.S.	Utilities 6 – low in comparison to other sectors None Electricity was 7th (3 projects) the top 20 sectors by activity between 2015 and 2020; 4.2% of total projects Renewable energy is an emerging FDI sector: 5.4% of projects (4) $48.58/hour below national average - $53.57/hour
What are the sector's capabilities in advanced functions in the economy?		
Technology Adoption	**Indicative:** Sector adoption of new technologies in Minnesota	The Utilities sector has a high propensity to utilize specialized equipment and software. Minnesota has a higher propensity to utilize advanced technologies than the national average. No data was available for advanced technologies and robotics.
Corporate Innovation	Company examples	Minnesota Power: Delivering 100% carbon-free energy by 2050
What are specialized support resources available to the sector?		
Funding programs	Funding programs	Federal and State funding programs available for biomass, renewable energies and energy efficiency

4.4.3 Structure/composition of Firms – Energy

Energy Characteristic	Indicator Name	Indicator
What is the composition of companies?		
Establishments	Base number of employer establishments	5 companies in value chain covering renewable energy 11 – Utilities
Key company H.Q.s	Number, name of companies	
Regional Companies	Number, name of companies	Minnesota Power
MNEs, branch	Number, name of companies	UPM-Blandin Paper Company
Anchor company	Name of company (ies)	UPM-Blandin Paper Company, Minnesota Power
What is the nature of entrepreneurship?		
Non-employer businesses	Number of non-employer businesses Percentage of total non-employer businesses	3 - Utilities Utilities – 0.1%
Business Formations	Growth/decline (-/+) in number of business formations New non-employer business formations - 2019	Zero business formations in 2015 and 2019
What is the extent of diversification by firms?	Diversification Examples	
Presence of community champions	Dedicated core of institutions to foster and maintain cluster relationships	Great River Energy IEDC most mentioned in community conversations DEED, APEX, Chambers, SBDC, Blandin Foundation, Northland Foundation, Arrowhead Development

4.5 Cluster Development Stage

Sector	Mining	Manufacturing	Forestry	Energy
Cluster Development Stage	Established -> Decline Transforming	Latent/Emerging/ Developing characteristics	Established -> Decline Transforming	Established -> Transforming
	Need to re-evaluate and re-orientate to take advantage of sector opportunities and avoid decline	Mix of different stage characteristics. Arguably not a cluster but a collection of sub-sectors that are part of other local and regional clusters	Need to re-evaluate and re-orientate to take advantage of sector opportunities and avoid decline	Established cluster that is transforming into a low carbon world
Characteristics				
Cluster Criteria	High concentration. Itasca County is not at 'the center of gravity' - part of a regional mining cluster A critical mass with linkages between cluster actors in government, academia, sector interest groups and companies External recognition of cluster attributes (The Iron Range)	Low concentration, part of a region that has the lowest share of manufacturing in the state Regional EDOs and sector associations for collaboration and active chambers	Very high concentration Regional cluster centralized in Grand Rapids with a critical mass of linkages between cluster actors with links to other sectors External recognition of the cluster's attributes.	High concentration. Specialized vertical regional supply chain with upstream linkages to forestry, food processing - waste management & remediation.
Specialization **Common to all sectors**	Regional specialization across the ecosystem actors: value chain, academia, government, stakeholders, education/ training, workforce, funding, innovation Export-oriented	Spread thinly across different sub-sectors, with linkages to mining and forestry value chain Company innovation activity	Specialization in value chain, academia, R&D, education/ training, government, education/training, workforce, stakeholders, funding, local innovation	Regional specialization: value chain, academia, government, stakeholders, education/ training, workforce, funding, Local innovation initiatives Emerging FDI activity
	Knowledge-based industry skills and company concentration in knowledge industries			
Structure/composition of firms	Concentration among a small number of firms	Small number of firms, anchored by MNE	Anchored by MNE and strong regional flagship	Small number of firms, Large and innovative local flagship

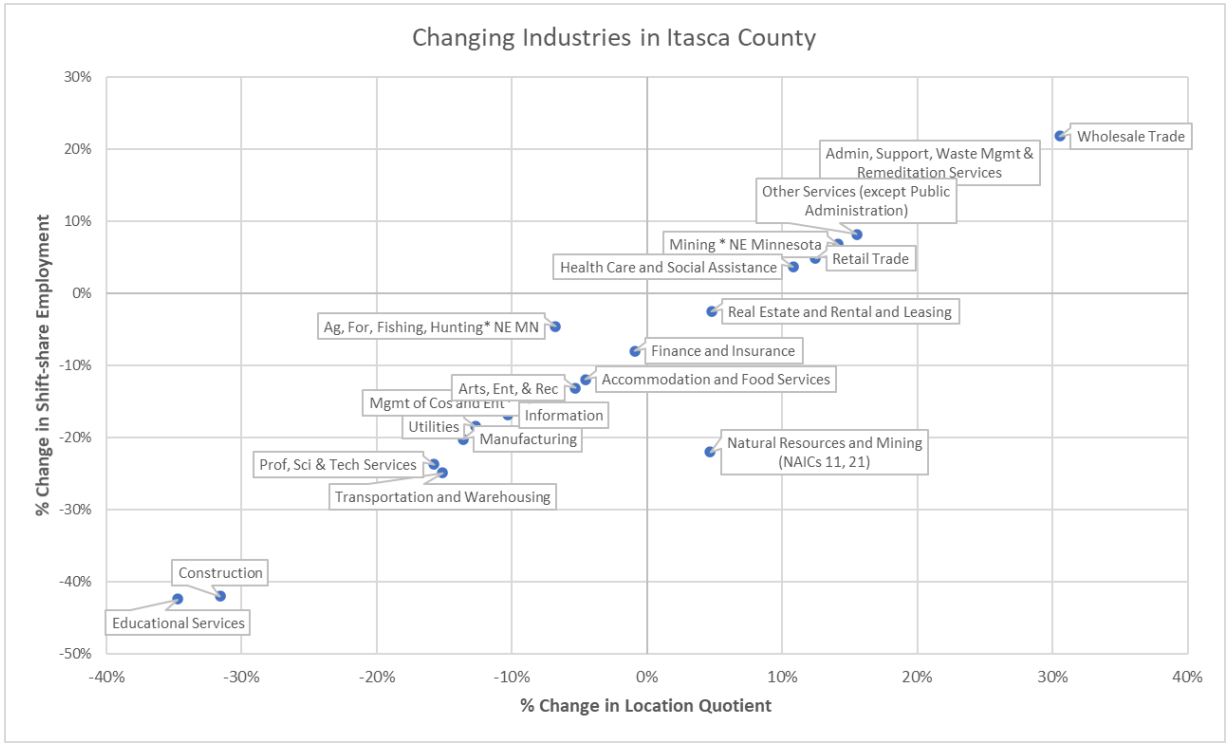
Sector	Mining	Manufacturing	Forestry	Energy
Common to all sectors	Major mining operator, exploration and processing companies with SMEs	branches with local, regional and national companies with entrepreneur (non-employer) businesses	utility. Good base of entrepreneur (non-employer) businesses	company with community-facing energy co-ops
	Weakness in cluster dynamics of new firm creation, start-ups Community champions are common to all sectors			

5 Changing Industries & Growth of Sectors

5.1 Changing Industries

Growing sectors in Itasca County were examined in terms of industry/sub-sector concentration growth and the shift-share analysis between 2015 and 2019. This process shows local conditions in the industry by subtracting the national impact of the economy and the national impact of the industry from the actual employment increase or decline. A positive net difference indicates a competitive advantage, while a decrease shows disadvantages typically attributable to local conditions. In addition, the location quotient shows the extent of cluster density, which is critical in assessing cluster strength. The chart below shows shift-share employment as a percentage of total employment in 2015 to capture the relative change.

Figure 2 - Changing Industries in Itasca County



Significant Itasca LQ/Shift Share Decline 2015-2019 vs. U.S. Top 5	Itasca LQ Increase/Shift Share Decline, 2015-2019 vs. U.S.	Significant Itasca LQ/Shift Share Growth 2015-2019 vs. U.S. Top 5	Itasca LQ/Shift Share vs. NE Minnesota
1. **Construction** 2. **Educational Services** 3. **Transportation and Warehousing** 4. **Professional, Scientific & Technical Services** 5. **Manufacturing**	Natural Resources and Mining Real Estate Rental & Leasing	1. Wholesale Trade 2. Administrative and Support and Waste Management and Remediation Services 3. Other Services (except Public Administration) 4. Retail Trade 5. Health Care and Social Assistance	**Growth** Mining Management of Companies and Enterprises **Decline** Agriculture, Forestry, Fishing and Hunting

While the focus sectors are among the top five showing declines, construction is a notoriously cyclical industry. The decline in manufacturing is likely most attributable to the layoff of 150 workers at Blandin Paper Mill in 2017[1], as opposed to a decline throughout the sector as explained in Growth in Targeted Sectors below. Of more concern is the decrease in Professional, Scientific & Technical Services. When considered with Information, which also declined, albeit not to the same extent, there is an overall decline in knowledge-based industries in Itasca County. The gains noted in Growth in Targeted Sectors below were insufficient to offset this situation.

While Natural Resources and Mining (which includes the Forestry focus industry) registered a significant decline in employment, its location quotient improved, suggesting the strength of Forestry and Mining's concentration in Itasca County, where Forestry has the highest location quotient of all industries. Data for NE Minnesota is indicative with Agriculture, Forestry, Fishing and Hunting declining to a small extent and Mining growing.

Wholesale trade demonstrated the most substantial growth. While this sector is important for supply, many of its categories are irrelevant to the target sectors. The economic base analysis revealed no representation in NAICs - 4233 - Lumber and Other Construction Materials Merchant Wholesalers, 4235 Metal and Mineral (except Petroleum) Merchant Wholesalers, and 423810 - Construction and Mining (except Oil Well) Machinery and Equipment Merchant Wholesalers. In addition, the value chain analysis revealed minimal representation. Administrative and Support and Waste Management and Remediation Services experienced the highest growth of the focus sectors, as set out in more detail in Growth of Targeted Sectors below. Retail Trade and Health Care and Social Assistance also grew. These are enabler sectors in providing amenities to the population at large.

5.2 Growth of Targeted Sectors/sub-sectors

Figure 3 Growth of Targeted Sectors/sub-sectors

Industry Code	Description	LQ 2019 (vs. U.S.)	LQ Growth 2015-2019	Shift-share Growth (vs. U.S.) 2015-2019 by Number of Jobs
	ITASCA COUNTY - GROWTH			
56	Administrative and Support and Waste Management and Remediation Services	0.92	21%	99
561	Administrative and Support Services	0.90	28%	130
2383	Building Finishing Contractors	0.32	51%	8
2381	Foundation, Structure, and Building Exterior Contractors	0.34	38%	7
5413	Architectural, Engineering, and Related Services	0.17	23%	3

[1] UPM laying off about 150 workers at Blandin mill in Grand Rapids | Duluth News Tribune, 2017

5419	Other Professional, Scientific, and Technical Services	0.97	40%	17
	ITASCA COUNTY GROWING CONCENTRATION (LQ) vs U.S.			
332	Fabricated Metal Product Manufacturing	0.43	4%	-2
	GROWING CONCENTRATION in NE MINNESOTA (ITASCA COUNTY vs. NE MINNESOTA LQ)			
321	Wood Product Manufacturing	1.74	3%	-37
51	Information	0.88	7%	-24
	REGIONAL NE MINNESOTA GROWTH			
21	Mining	6.79	14%	300
339	Miscellaneous Manufacturing	0.37	90%	23
5415	Computer Systems Design and Related Services	0.36	8%	4

The most significant growth in Itasca County was experienced in Administrative and Support and Waste Management and Remediation Services. This is primarily due to an increase in Administrative and Support Services, which encompasses a range of business services to the target sectors, including business support, employment agencies, and facilities management.

Except for Mining and Wood Products Manufacturing, growth was experienced in sectors/sub-sectors with a low <.50 and lower <1 location quotient. Of particular note are the gains in knowledge-based sub-sectors. Architectural, Engineering and Related Services are showing minor gains, and Other Professional, Scientific and Technical Services are gaining strength, with a net difference of 17 jobs. Furthermore, concentration in Itasca County's information sector is improving in NE Minnesota, which could be a starting point for this sector's growth. Combined with the gains in Administrative and Business Services, it suggests that critical sector supports in Itasca County are increasing in significance. That being said, these improvements were not enough to offset the overall decline in Professional, Scientific and Technical Services as shown in the table, *Changing Industries in Itasca County*.

The gains associated with manufacturing were more to do with concentration than employment. Fabricated Metal Products saw a slight improvement while regional (NE Minnesota) concentration in Wood Products and Miscellaneous Manufacturing, making significant gains albeit from a low base. However, it should be noted that the Manufacturing sector as a whole experienced substantial employment loss between 2015 and 2019, with a 25% decline.

While data was unavailable for mining in Itasca County, this sector's employment concentration and growth were significant in the NE Minnesota region. In Construction, two sub-sectors contrast with the overall significant decline in the sector in Itasca County - Foundation, Structure, and Building Exterior Contractors and Building Finishing Contractors. This may reflect the sector's cyclical nature, as the former is to with the initiation of contracts and the latter with the completion of contracts.

5.3 Targeted Sector Outlook

The table below shows the projections extracted from the external trends analysis for each targeted sector examined. A full version is captured in the technical report. While the economic base and labor data can present a bleak picture of plateauing mature industries, for the most part, each cluster has strong global market growth potential. Powerful demand drivers or mega trends in de-carbonization, technology and geo-political policy shifts are redefining markets and behavior. All of which present future opportunities for Itasca County through sector reconfiguration and realignment.

Mining	Forestry
• Rising global steel prices and demand in the USMCA region forecast to increase by 7.6% in 2021 to 4.6% in 2022 (World Steel Association)[v] • Technology and carbon reduction are powerful drivers for increased demand for rare earths, copper, lithium and cobalt[vi] [vii] • Battery-grade nickel demand expected to rise 10-to-20-fold by 2030[vii] • Mining companies will need to invest nearly $1.7 trillion in the next 15 years to help supply enough copper, cobalt, nickel and other metals needed for the shift to a low carbon world (Wood Mackenzie estimate)[viii] • The United States does not produce enough rare-earth to satisfy existing and future demand[vi]	• Cross Laminated Timber (CLT) global market is projected to reach $982.1 million USD by 2026, from $562.6 million in 2020, at a CAGR of 9.7% during 2021-2026[ix] • Nonresidential green buildings market reached approximately $80 billion in 2020 and is expected to hit $103 billion by 2023[x] • Woodworks reported 1,060 mass timber projects were constructed or were in design in 50 states at the end of 2020[x] • Changes passed for the 2021 code cycle allow mass timber buildings to be constructed eight to 18 stories[x]
Renewable Energy	**Manufacturing**
• In late 2020, the share of renewables exceeded that of coal in generation for 153 days compared with 39 days in 2019[xi] • The U.S Energy Information Administration (EIA) forecasts that electricity consumption in the U.S. will increase by 2.2% in 2021 electricity sales in the industrial sector specifically will grow by 3.3% in 2021; sales to the commercial sector will increase by 1.4% in 2021[xii]. • EIA expects 15.9 GW of new wind capacity to be added in 2021 and 5.2 GW in 2022[xii]. • EIA forecasts that utility-scale solar capacity will add 15.7 GW and 15.9 GW for 2021 and 2022, respectively[xii]	• Basic metals, fabricated metals, precision tools, special-purpose machinery potential to advance productivity and economic growth (McKinsey Global)[xiii] • Deloitte projections based on the Oxford Economic Model (OEM) anticipate an increase in U.S. output of 3.5% for 2021[xiv] • 'Glocalization' and move toward reshoring[xv]

6 Emerging Sectors

We have distilled and identified the emerging sectors from various external and regional analyses available in the Technical Report. The following provides extracts from the analyses and then drills down from an aggregate to a local perspective.

Economic Base Analysis

Sector	Sector/Subsector	Evidence
Professional & Business Services	Professional & Business Services	• 11% LQ growth from 2015-2019 Itasca vs MN • 21.7% LQ growth from 2015-2019 Itasca vs Northeast MN
Professional & Business Services	Architectural, Engineering, and Related Services	• 14.8% LQ growth from 2015-2019 Itasca vs MN • 31.2% LQ growth from 2015-2019 Itasca vs Northeast MN
Construction	Building Finishing Contractors	• 47.2% LQ growth from 2015-2019 Itasca vs MN • 20.97% LQ growth from 2015-2019 Itasca vs Northeast MN
Construction	Foundation, Structure, and Building Exterior Contractors	• 41.49% LQ growth from 2015-2019 Itasca vs MN • 55.7% LQ growth from 2015-2019 Itasca vs Northeast MN
Software & IT	Information	• 0% LQ growth from 2015-2019 Itasca vs MN • 7.45% LQ growth from 2015-2019 Itasca vs Northeast MN
Software & IT	Computer Systems Design and Related Services	• 0% LQ growth from 2015-2019 Itasca vs MN

Sector	Sector/Subsector	Evidence
		• 0% LQ growth from 2015-2019 Itasca vs Northeast MN
Manufacturing	Miscellaneous Manufacturing	• 0% LQ growth from 2015-2019 Itasca vs MN • 0% LQ growth from 2015-2019 Itasca vs Northeast MN • However, LQ of 1.21 vs NE

Trade Analysis (Via Grand Portage & Duluth Ports)

Sector	Export Commodities	Evidence
Manufacturing	Plastics And Articles Thereof	• 22.17% growth from 2019-2020
Manufacturing	Inorganic Chemicals; Organic Or Inorganic Compounds Of Precious Metals, Of Rare-Earth Metals, Of Radioactive Elements Or Of Isotopes	• 24.76% growth from 2019-2020
Manufacturing	Furniture; Bedding, Cushions Etc.; Lamps And Lighting Fittings Nesoi; Illuminated Signs, Nameplates And The Like; Prefabricated Buildings	• 25.39% growth from 2019-2020
Manufacturing	Ships, Boats And Floating Structures	• 16.24% growth from 2019-2020
Manufacturing	Paper And Paperboard; Articles Of Paper Pulp, Paper Or Paperboard	• 79.55% growth from 2019-2020

No commodity in the top 11-20 range averaged 20% growth over the last 2 years; however, there are noteworthy mentions indicated with the *. More specifically Paper And Paperboard; Articles Of Paper Pulp, Paper Or Paperboard saw a strong resurgence in 2020 that awarded it an avg growth of approximately 12% in the last 2 years.

Sector	Traded Commodities	Evidence
Manufacturing	Aircraft, Spacecraft, And Parts Thereof	• 544.99% growth from 2018-2019 • -61.54% growth from 2019-2020 *

Sector	Traded Commodities	Evidence
Manufacturing	Plastics And Articles Thereof	• 58.06% growth from 2019-2020
Manufacturing	Rubber And Articles Thereof	• 20.54% growth from 2019-2020
Manufacturing	Furniture; Bedding, Cushions Etc.; Lamps And Lighting Fittings Nesoi; Illuminated Signs, Nameplates And The Like; Prefabricated Buildings	• 19.61% growth from 2019-2020

Note on methodology: Attempted to use *Harmonized Tariff Schedule of the United States (2021) Basic Revision 2* to convert commodity codes to sectors. However, 2 digit codes could not be matched by this approach and were categorized manually.

FDI Analysis (Minnesota)

Sector	Cluster	Evidence
Manufacturing	Transport Equipment	• 8.45% of projects from 2015-2020
Professional & Business Services	Professional Services	• 5.63% of projects from 2015-2020
Construction	Construction	• 5.63% of projects from 2015-2020
Energy	Environmental Technology	• 5.63% of projects from 2015-2020
Manufacturing	Consumer Goods	• 4.23% of projects from 2015-2020
Transportation & Warehousing	Transportation & Warehousing	• 4.23% of projects from 2015-2020

Sector	Sector	Evidence
Energy	Renewable energy	• 5.63% of projects from 2015-2020
Manufacturing	Biotechnology	• 5.63% of projects from 2015-2020
Transportation & Warehousing	Transportation & Warehousing	• 4.23% of projects from 2015-2020
Construction	Real estate	• 5.63% of projects from 2015-2020
Manufacturing	Rubber	• 2.82% of projects from 2015-2020

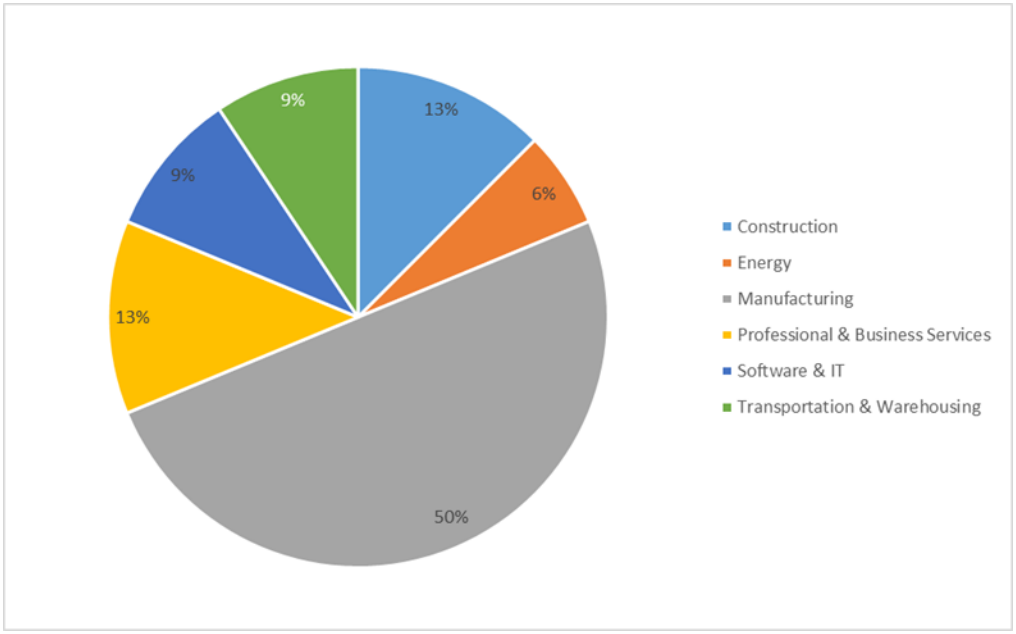
Sector	Subsector	Evidence
Software & IT	Custom computer programming services	• 4.23% of projects from 2015-2020
Transportation & Warehousing	Freight/Distribution Services	• 4.23% of projects from 2015-2020
Manufacturing	Agriculture, construction, & mining machinery *	• 4.23% of projects from 2015-2020

Sector	Subsector	Evidence
		• Did not have at least 2 projects in last 3 years but did have 2 projects in 2019 alone
Professional & Business Services	Professional, scientific & technical services	• 2.82% of projects from 2015-2020
Manufacturing	Ventilation, heating, air conditioning, and commercial refrigeration equipment manufacturing	• 2.82% of projects from 2015-2020

Observations and Conclusions

From a higher level and more inclusive perspective, if we consider state-level data, nearby ports down to Itasca County, we get the following view:

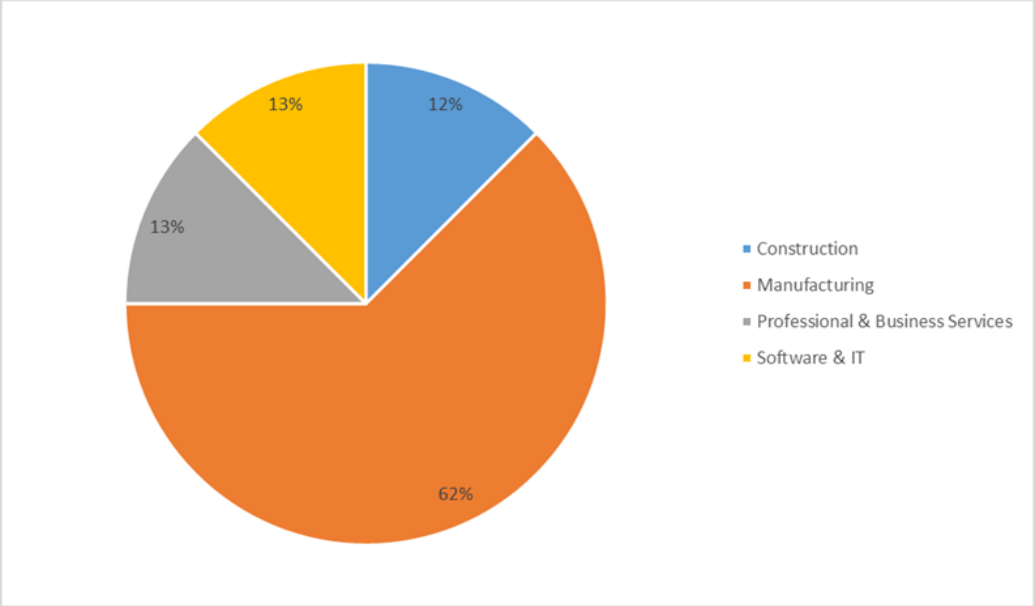
Figure 4 - Itasca County (Economic Base Analysis), Nearest Ports (Trade) and Minnesota (FDI) Emerging Sector Analysis



n = 32

There were 6 emerging sectors identified, with Manufacturing standing out as the most promising, accounting for half of the identified share of emerging sectors. This analysis looked at an Economic Base Analysis in the County, which evaluated Location Quotients (LQ), Trade Analysis from the two nearest ports (Duluth and Grand Portage) and FDI Analysis into the state. Trade Analysis included both Export Commodities as Traded Commodities (combined import and exports). The FDI Analysis included expansion projects by foreign-owned firms. It is important to note that Manufacturing also bleeds into and/or contains other sectors such as Construction with Prefabricated Buildings and Mining with Mining Machinery.

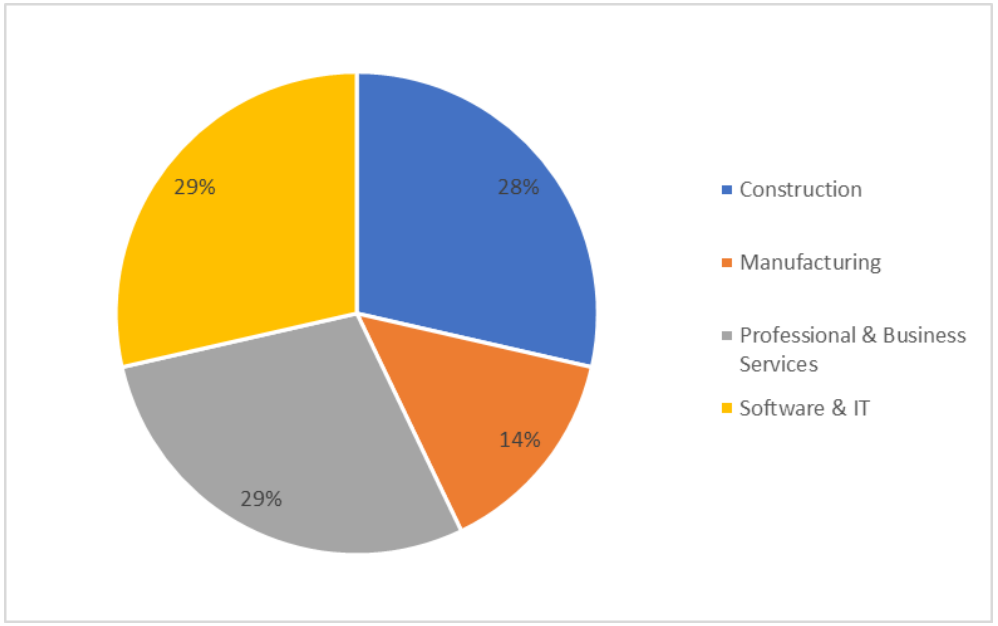
Figure 5 - Itasca County and Nearest Ports Emerging Sector Analysis



n = 16

A deeper drill down into the County and nearest ports further validates the strength of Manufacturing as an emerging sector, now accounting for nearly two-thirds of the share of emerging sectors identified. Again, the Manufacturing sectors often contain other sectors as well because it's also an activity. In this case of Exports, we see a variety of sectors/subsectors in play across the Manufacturing sector, including Plastics, Chemicals, Furniture (Forestry), Prefabricated Buildings (Construction/Forestry) as well as Paper And Paperboard (Forestry). When looking at Traded Commodities as a whole, Plastics, Furniture (Forestry), Prefabricated Buildings again demonstrated noticeable activity. Interestingly, Aircraft, Spacecraft, And Parts Thereof saw approximately 544.99% growth from 2018-2019 and then dropped by roughly -61.54% from 2019-2020. Given the exceptional growth in 2019, combined with the outlier of a year that 2020 was, we opted to include these industries for consideration.

Figure 6 - Itasca County Emerging Sector Analysis



n = 7

While the nearest ports would likely represent where the majority of products are being exported from, as confirmed by the Department of Employment and Economic Development (DEED), we further isolated our analysis to strictly look at known and observable characteristics or trends directly in Itasca County via an Economic Base Analysis which identified LQs across sectors. In this case, there was more balance across fewer emerging sectors. While the % share of Manufacturing ostensibly declined in this particular analysis, the portion attributed to Construction, which included Building Finishing Contractors and Foundation, Structure, and Building Exterior Contractors, could also be included in Manufacturing. However, the Construction sector is separated to highlight it and because it often ties into the Forestry sector when considering lumber and mass timber. This drill-down also showed the relative strength of white-collar jobs, notably, Professional & Business Services and Software & IT. These sectors are particularly interesting because they are industries in themselves and support infrastructure across the other sectors.

In conclusion, the following are the emerging sectors in order of observable activity or growth:

Emerging Sector (Mid-Strong)	Emerging Sector (Low/Developing)
1. Manufacturing 2. Construction 3. Professional & Business Services 4. Software & IT	5. Transportation & Warehousing 6. Energy

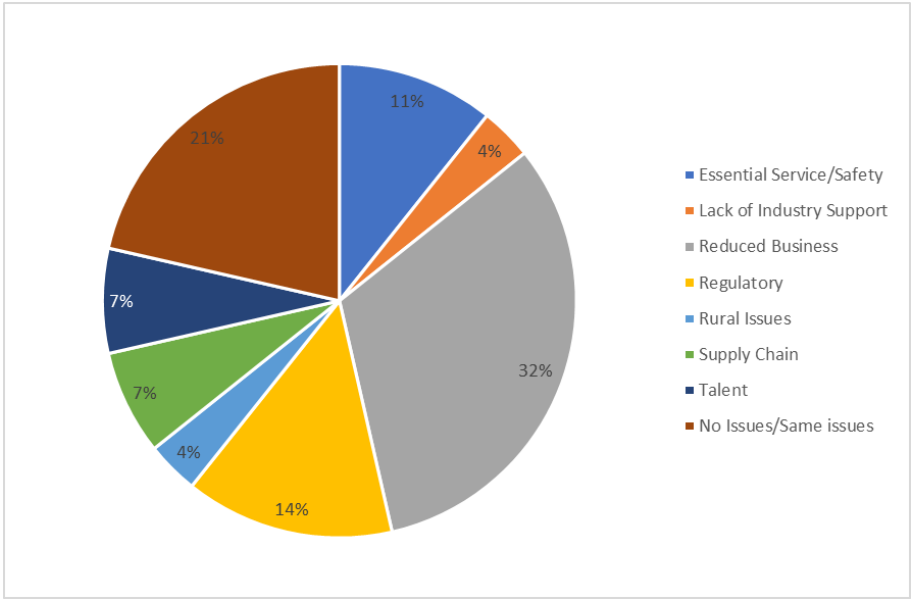
7 Sector Disruption

The impact of Covid on sectors and the future outlook has a symbiotic relationship with transformative technologies. As such, both topics are combined to provide a perspective in terms of disruption to the sector and an emphasis on opportunities.

7.1 Post-Covid Impact

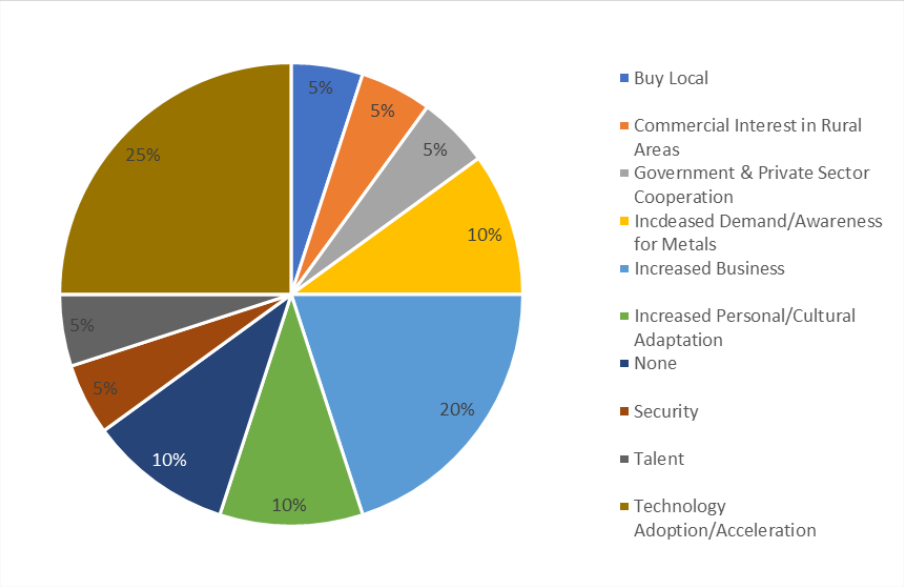
The stakeholder consultations provided the best source for direct impacts of Covid in Itasca County and indicate what post-Covid impacts might result. We have recategorized responses to fit groupings to show alignment/trends between similar issues or opportunities. This was further supplemented and validated by an external trend analysis in the target clusters/sectors. First, we must look at the existing issues and opportunities identified, and then based on trends, consider a post-Covid outlook and what issues and opportunities would likely still apply.

Figure 7 - Covid Issues Grouped by Main Categories



n = 28

Figure 8 - Covid Opportunities Grouped by Main Categories



n = 20

Post-Covid Impact Breakdown

Based on the analysis shown in the Covid Issues chart above and a comparison against industry trends, the strongest issues resulting from Covid were primarily a reduction in business, which accounted for nearly a third of all responses from stakeholders. The next leading issues included regulatory at 14% of all responses and essential service/safety at 11% of responses. Finally, it's worth noting that just over one-fifth of respondents cited they had no net new issues resulting from Covid.

Regulatory issues specific to Covid and the problems cited were centered on regulatory certainty, unnecessary temporary measures and state mandates. With regard to essential service/safety, this grouping included being in an essential industry and workplace safety.

Although they were not among the leading responses, the following opportunities are unique and deserving of inclusion for potential impacts post-Covid: rural issues and supply chain issues, representing 4% and 7% respectively of all responses.

Based on the analysis shown in the chart, Covid Opportunities above, as well as a comparison against industry trends, the strongest Covid opportunity lies with technology adoption, which accounted for a quarter of the responses from stakeholders. The next largest opportunity areas included increased business demand, which accounted for one-fifth of the responses from stakeholders, followed by an increased demand/awareness for metals. Lastly, an increased personal adaption and cultural adaption were tied to represent 10%, respectively, of all responses.

Increased business demand centered around sales or product/service delivery. Increased demand/awareness for metals included higher steel prices and increased awareness of the need for essential metals, while increased personal/cultural adaption referred to responses that included increased empathy and resilience.

It is also worth noting that technology adoption included virtual/online sales, which in some cases may have been more than simply a shift from in-person to virtual, but also contributed to an increase in overall demand/sales.

Although they are not among the leading responses, the following opportunities are unique in nature and deserving of inclusion for potential impacts post-Covid: buy local, commercial interest in rural areas, as well as government & private sector cooperation.

That being said, not all of these Covid issues and opportunities will continue in a post-Covid world. However, some will persist while others may or may not continue to play a role in their lingering impact.

Issue/Opportunity	Category	Post-Covid Impact
Issue	Reduced business	Evidently, some businesses had a direct reduction or loss of clients or revenues as a result of Covid. Consequently, there is potential for that lost business to return to some or full capacity. However, in some cases, customers may have found alternatives and given the length of the pandemic, those alternatives may have become engrained or at the very least become a perpetual option.
Issue	Regulatory	In general terms, many of the Covid protocols, especially temporary measures, will cease to be an issue post-Covid; however, there will be some that survive, as well as potentially need regulations adapted for a post-Covid environment to help prevent future outbreaks of Covid or other potential threats.
Issue	Essential service/safety	Businesses deemed as an essential service will cease to operate as an essential service in terms of being the sole types of companies allowed

Issue/Opportunity	Category	Post-Covid Impact
		to be open an operate, but given the demands placed on them during Covid, this will have a lingering effect, not to mention they may need to continue to prepare themselves for a pandemic so they can continue to operate. Safety will continue to be a concern in the workplace, and many companies will likely continue to implement at least a fraction of Covid measures as a precaution.
Issue	Technology adoption/acceleration	Serval technologies were rapidly adopted or had their development accelerated as a result of the pandemic. While the adoption may slow because they have achieved critical mass, many will likely continue as they have become commonplace and provide strategic advantages. In terms of accelerating the development and release of new technologies, only time will tell; however, both producers and consumers have observed how quickly technology can be developed and deployed, which may incite further efforts.
Issue	Rural	Rural communities have always had unique issues, and this is exacerbated with Covid. Some of those issues will likely continue given the nature of rural regions, e.g., lack of technological infrastructure such as broadband which makes activities such as virtual sales via Zoom meetings more challenging.
Issue	Supply chain	Some supply chains were severed or disrupted as a result of Covid, and in finding alternatives, many of those supply chains will remain severed and/or disrupted. On the flip side, there are many cases where supply chains will return to normal due to economies of scale and/or contracts setup with suppliers etc. Consequently, the threat of future supply chain disruptions due to pandemics or world issues will be a perennial issue., As such, we can expect to see more adaption to supply chains and the building of secondary/alternative supply chains, especially those that are more localized.
Opportunity	Increased business	It can be argued that some businesses that observed an increase in demand/revenues can expect to see that demand drop as post-Covid opens up competition and alternatives etc. On the flip side, however, companies that observed an uptick in business gained deep penetration and intelligence on existing customers and increased client acquisition and intelligence on new customers and the market. As such, companies

Issue/Opportunity	Category	Post-Covid Impact
		may be in a position to capitalize on increased demand turning it into pipelines and targets for future sales etc.
Opportunity	Increased demand/awareness for metals	This demand and awareness may continue as there is a recognition of the finite resources available and the fact that certain industries/products are looking to increase production and therefore their demand for certain metals, e.g., semiconductors in smartphones and transportation vehicles construction.
Opportunity	Increased personal/cultural adaption	While some were forced to adapt and others chose to adapt, the adaption happened, and the ability to employ it will likely be reserved. It is possible that in future scenarios, these adaptions may be employed to work more effectively or support businesses etc.
Opportunity	Buy local	The buy-local movement was already picking up steam pre-Covid and then gained much more adoption during the pandemic due to supply chain disruptions. Post-Covid, this will definitely continue as investments were made to produce locally, consumers became accustomed to consuming locally and supporting, and the ethos behind buy local has gained extra PR in addition to the fact that it supports other global initiatives/trends, i.e. reducing carbon footprint/fighting climate change which includes governments, businesses and consumers a well as more health/environmentally conscious consumers.
Opportunity	Commercial interest in rural areas	As we observed an increase in virtual workers, a decreased need for commercial space in downtown metros, and residents opting to relocate to more natural environments in rural areas with lowers costs, the benefits of all of this have been exposed arguable more than ever. As such, it will likely continue to be an option or area of interest. In fact, many companies are already committing to continue allowing employees to work virtually. Furthermore, rural areas can typically offer industrial and commercial sites for cheaper than in metros, along with talent available to work at the factories and fulfilment centers etc. which for the Amazons of the world is a major factor.
Opportunity	Government & private sector cooperation	Public and private sectors have cooperated long before Covid, but the pandemic brought about increased collaboration with joint problem-solving. This created relationships between private companies and governments that can potentially be maintained. As well, the efficiency

Issue/Opportunity	Category	Post-Covid Impact
		of this collaboration during Covid, including the removal of barriers to foster cooperation, has provided business cases that might encourage proactive collaboration.

An overarching initiative that is also supplemental to some of the target clusters/sectors is the American Jobs Plan, which presents the following potential opportunities for Itasca County:

Issue/Opportunity	Category	Post-Covid Impact
Opportunity	Rebuild clean drinking water infrastructure, a renewed electric grid, and high-speed broadband to all Americans	Improved broadband infrastructure and improving the electrical grid can provide increased innovation capacity. This would have a direct impact on the Energy, Construction, and Mining, e.g. environmental remediation - capping abandoned mines, technology deployment in operations, smart communities
Opportunity	Modernize homes, commercial buildings, schools, and federal buildings	Increased demand for products and processes enabling energy efficient and resilient buildings. This will require inputs from the Forestry sector for green buildings, as well as the construction/manufacturing sector to erect the buildings.
Opportunity	Revitalize manufacturing, ensure products are made in America, and invest in innovation	Reshoring has already commenced and may continue due to increased demand from steel customers in PA, OH, IL. Increased manufacturing activity will have direct/indirect benefits to Mining, Forestry, and Energy sectors which play a critical role in the supply chain.
Opportunity	Create good-paying union jobs and train Americans for jobs of the future	Workforce development initiatives and increased technology capacity of workers. This could facilitate talent attraction and retention. [xvi]

7.2 Transformative Technologies

Many technologies observed in the global trends were around pre-Covid and either gained extra traction during Covid or are likely on deck to receive investment/attention post-Covid due to evolving demands and opportunities. Below is a list of those transformative technologies broken down by target cluster/sector:

Sector/Cluster	Technology	Description
Manufacturing	Platform Economy *	Enables micro-manufacturers and small-scale prototyping to reach global markets through Etsy and distributed manufacturing Platforms such as Fictiv, 3D Hubs, Additively, Maker's Row [xvii]
	Sustainable Manufacturing Processes *	Through non-polluting, energy and natural resources conserving, and economically sound and safe processes. These solutions are moving toward the creation of a closed-loop, multiple product life-cycle system as the basis for sustainable manufacturing[xviii]
	Industry 4.0	Can raise productivity by up to 40 percent and transform some scale-based activity into flexible production (McKinsey). Digital technologies have emerged as a powerful tool for helping manufacturers maintain continuity in the face of major challenges such as pandemics[xix]
	IoT	Is revolutionizing machinery to communicate with each other cost-effectively. Market size is expected to grow from USD 77.3 billion in 2020 to USD 110.6 billion by 2025, at a CAGR of 7.4% during the forecast period. Manufacturing continues to hold the largest share of the IoT industry[xx]
	Cobots	Cobots or collaborative robots make real-time, complex decisions while working on tasks with humans. Computing power must shift to the "edge," or closer to where the data is created, to reduce latency and boost processing. This protects workforce safety and security while helping manufacture goods in an agile, efficient manner[xxi]
	Human-centered AI	Understanding user needs and values that are reflected in AI designs and models, which will, in turn, improve adoption[xxii]
	Digital twinning	A virtual replica of any physical product, equipment or asset, or the supply chain that can be used as testing grounds for monitoring, simulating and optimizing production, quality and operational

Sector/Cluster	Technology	Description
		performance [xxiii]. They make it possible to predict, test and develop new ways of working and new products for rollout without trade-offs and additional costs[xxiv]
Mining	AI	Offers key advantages by helping mining companies organize, understand and make optimal decisions on the vast amounts of data they collect. Precision is key at the prospecting and exploration stage, when digging in the wrong location can be a very costly mistake. AI can help companies accurately discover deposits and reduce initial investment costs by increasing their strike rates. Blasting can be optimized through projected fragmentation models, ore tracking systems and environmental data
	Drones	Can carry out the same aerial surveying work that was once undertaken by a helicopter. Underground drones can be used as mine scouts in unfamiliar areas flying through mines to search caves, collect data, and aid in the mapping process. Artificial intelligence-enabled drones allow a better understanding of the environment and terrain, helping companies make better decisions on where exploration should be targeted
	Virtual and simulated reality and digital twins	Are being used by mining companies to run advanced simulations, enable enhanced monitoring of equipment and operations and increase precision in mining operations. VR/AR (virtual reality/augmented reality) can be used to provide immersive training for employees, allowing them to prepare for difficult events in a safe environment. It also offers great potential for forensics and incident investigations. Using a simulated mine, trainees can practice placing, setting, and detonating explosives in a safe environment. Any mistakes they make are highlighted and revisited as a learning opportunity without causing damage to people or mines
	Automation	Is being blended with AI improvements for autonomous vehicles, drillers and haulage systems. Self-driving trucks navigate through narrow tunnels without a human driver. Autonomous haulage systems (AHS) can safely move and transport more materials than a human workforce could, resulting in increased productivity gains and safety[xxv]

Sector/Cluster	Technology	Description
	Renewable Energy/Electrification	Through deploying renewable energy, electrification and use of hydrogen for materials handling, and optimizing processing operations. For example, Newmont Goldcorp officially opened an all-electric mine in Canada in 2019 and Gold Fields in Australia now meets over half its energy needs through renewable sources after backing up its hybrid power microgrid with a lithium-ion battery energy storage system (BESS) in 2020
Forestry	IoT (Internet of Things) Sensors	Enables the monitoring of forests to predict threats in a timely fashion and mitigate the impact of disasters, e.g. soil erosion, pests infestation, forest fires, etc. This provides better visibility of forests, data and insights that allows for better time and resource management, ultimately reducing costs, increasing profits and efficiency
	AI/ML & Data Science	Supports data analysis and predictions, e.g. Yield prediction; Crop sustainability analytics; Types of plants, crops, trees recognition; Detection of tree or crop diseases and pest infestations; Waste reduction
	Automation and Robotics	Increases efficiency and eases workload on human resources, potential applications include precision in planting and harvesting; Vehicles with driverless control; Computer vision for precise sprinkling and seeding; The use of tree-planting drones in remote areas; Forests monitoring with drones.[xxvi]
	Biomass	As adoption continues, there are many opinions about the climate neutrality of biomass for energy purposes, and an ongoing debate about biomass combustion and whether the CO2 emissions have the same global warming effect as CO2 released from the combustion of fossil fuels[xxvii]
Energy	Renewable Energy	Aimed at preserving the environment with minimal to zero harmful emissions, extracting from a constant source in the environment
	IoE (Internet of Energy)	Provides intelligent distributed control on energy transactions between its users; this new energy generation paradigm develops a smart grid and also improves coordination and optimization in the macro-energy system.
	Energy Storage	Helps to ensure stable pricing by proactively managing demand and provides the opportunity to purchase energy for future use. This

Sector/Cluster	Technology	Description
		accumulated energy later helps in reducing the grid loads during peak times, while prosumers earn more as buying energy becomes expensive.
	Blockchain	Seeks to unite all energy stakeholders under a single decentralized network. Electricity producers, distribution network operators, metering operators, providers of financial services, and traders potentially benefit from utilizing smart contracts. The technology also has the potential for producing some degree of equality between energy producers and consumers by making electricity affordable for more people.[xxviii]
	Energy-as-a-Service (EaaS)	Delivery model that combines hardware, software and services. [xxix] Enables the transition from selling electricity to selling services such as consumption management, optimizing production, and tracking consumption.[xxx]
	Distributed Energy Resources (DERs)	Enables electricity generation or heat at the site of its consumption. The absence of a network eliminates the loss and cost of energy transmission. Consumers who produce energy for their own needs can direct their surplus to the common network[xxxi]

8 Supply Chain Gaps & Opportunities

8.1 Gap Analysis

8.1.1 Stakeholder Consultation Analysis

When asked what types of suppliers or services would be better for businesses if they had a local presence in the region? The following responses were received from organizations and companies.

Sector	Sector/Subsector	Evidence
Forestry	Biofuels, BioChemicals	• 60% of organizations that responded said yes or maybe to a local demand for services
Construction	Construction	• 60% of organizations that responded said yes or maybe to a local demand for services
Manufacturing	Manufacturing	• 60% of organizations that responded said yes or maybe to a local demand for services
Retail	Outfitters for winter activities	• 60% of organizations that responded said yes or maybe to a local demand for services
Retail	Restaurants	• 60% of organizations that responded said yes or maybe to a local demand for services
Manufacturing	Steel	• 44% of companies that responded said yes or maybe to if it would be better for business if suppliers had a local presence in the region
Forestry	Trees and water	• 44% of companies that responded said yes or maybe to if it would be better for business if suppliers had a local presence in the region

8.1.2 Trade Analysis

With regard to gaps in the local market, we looked strictly at 2020 imports into the region via the two closest ports. While 2020 exports dropped by 27%, imports increased in 2020 by 41%. Below is a breakdown of the top 20 imports.

Sector	Commodity	Evidence
Energy	Nuclear Reactors, Boilers, Machinery And Mechanical Appliances; Parts Thereof	• #1 of Top 20 imports of 2020
Manufacturing	Electrical Machinery And Equipment And Parts Thereof; Sound Recorders And Reproducers, Television Recorders And Reproducers, Parts And Accessories	• #2 of Top 20 imports of 2020
Mining	Mineral Fuels, Mineral Oils And Products Of Their Distillation; Bituminous Substances; Mineral Waxes	• #3 of Top 20 imports of 2020
Forestry	Paper And Paperboard; Articles Of Paper Pulp, Paper Or Paperboard	• #4 of Top 20 imports of 2020
Mining	Salt; Sulfur; Earths And Stone; Plastering Materials, Lime And Cement	• #5 of Top 20 imports of 2020
Manufacturing	Articles Of Iron Or Steel	• #6 of Top 20 imports of 2020
Forestry	Pulp Of Wood Or Other Fibrous Cellulosic Material; Recovered (Waste And Scrap) Paper And Paperboard	• #7 of Top 20 imports of 2020
Other	Special Classification Provisions, Nesoi	• #8 of Top 20 imports of 2020
Forestry	Wood And Articles Of Wood; Wood Charcoal	• #9 of Top 20 imports of 2020
Transportation & Warehousing	Vehicles, Other Than Railway Or Tramway Rolling Stock, And Parts And Accessories Thereof	• #10 of Top 20 imports of 2020

Sector	Commodity	Evidence
Manufacturing	Aircraft, Spacecraft, And Parts Thereof	• #11 of Top 20 imports of 2020
Mining	Natural Or Cultured Pearls, Precious Or Semiprecious Stones, Precious Metals; Precious Metal Clad Metals, Articles Thereof; Imitation Jewelry; Coin	• #12 of Top 20 imports of 2020
Manufacturing	Plastics And Articles Thereof	• #13 of Top 20 imports of 2020
Manufacturing	Tanning Or Dyeing Extracts; Tannins And Derivatives; Dyes, Pigments And Other Coloring Matter; Paints And Varnishes; Putty And Other Mastics; Inks	• #14 of Top 20 imports of 2020
Manufacturing	Ships, Boats And Floating Structures	• #15 of Top 20 imports of 2020
Manufacturing	Optical, Photographic, Cinematographic, Measuring, Checking, Precision, Medical Or Surgical Instruments And Apparatus; Parts And Accessories Thereof	• #16 of Top 20 imports of 2020
Manufacturing	Rubber And Articles Thereof	• #17 of Top 20 imports of 2020
Manufacturing	Furniture; Bedding, Cushions Etc.; Lamps And Lighting Fittings Nesoi; Illuminated Signs, Nameplates And The Like; Prefabricated Buildings	• #18 of Top 20 imports of 2020
Manufacturing	Inorganic Chemicals; Organic Or Inorganic Compounds Of Precious Metals, Of Rare-Earth Metals, Of Radioactive Elements Or Of Isotopes	• #19 of Top 20 imports of 2020
Manufacturing	Aluminum And Articles Thereof	• #20 of Top 20 imports of 2020

8.1.3 FDI Analysis

We analyzed FDI flows into the State of Minnesota from 2019 to 2020 with an emphasis on 2020.

Sector	Sector/Subsector	Evidence
Manufacturing	Industrial equipment	• No projects in 2020
Manufacturing	Plastics	• No projects in 2020 • No projects in 2019
Energy	Renewable energy	• No projects in 2020
Manufacturing	Biotechnology	• No projects in 2020
Transportation & Warehousing	Transportation & Warehousing	• No projects in 2020
Construction	Real estate	• No projects in 2020 • No projects in 2019
Manufacturing	Semiconductors	• No projects in 2020 • No projects in 2019
Forestry	Paper, printing & packaging	• No projects in 2020 • No projects in 2019
Manufacturing	Business machines & equipment	• No projects in 2020
Manufacturing	Engines & turbines	• No projects in 2019
Manufacturing	Ceramics & glass	• No projects in 2020
Software & IT	Communications	• No projects in 2020
Manufacturing	Consumer products	• No projects in 2019
Manufacturing	Aerospace	• No projects in 2020 • No projects in 2019

8.1.4 Value Chain Analysis

We examined the value chains of the focus sectors/clusters to identify areas of no representation to low representation of companies in the region.

Sector	Sector/Subsector	Evidence
Mining	Site - Construction	• No representation in Itasca County and low representation in St. Louis County, stakeholder consultations
Mining	Logistics - Bulk Haulage	• No representation in Itasca County and low representation in St. Louis County
Mining	Fuel Handling & Storage	• No representation in Itasca County and low representation in St. Louis County
Mining	Process Control	• No representation in Itasca County and low representation in St. Louis County
Mining	Manufacturing - Specialist Machinery/supplies	• No representation in Itasca County and low representation in St. Louis County
Mining	Bulk Products	• No representation in Itasca County and low representation in St. Louis County
Mining	Maintenance & Repair, Components & Parts	• No representation in Itasca County and low representation in St. Louis County, Stakeholder Consultations
Mining	Equipment Hire	• No representation in Itasca County and low representation in St. Louis County
Mining	ICT support (all types)	• Low LQs in all ICT related products/services
Professional & Business Services	Stakeholder Consultation Services	• No companies in Itasca County/St. Louis County, low LQ (Prof/tech services)
Professional & Business Services	Testing/Analytical Supplies & Services	• No representation in Itasca County and low representation in St. Louis County
Manufacturing	Manufacturing - parts distribution	• Supported by low representation in mining value chain
Manufacturing	Manufacturing servicing/repair	• Supported by low representation in mining value chain
Manufacturing	Specialist Technical & Professional Services to manufacturing	• Small number of companies, Low LQ
Manufacturing	Specialist technology services such as 3D printing, robotics, software etc.	• No companies, Low LQ

Sector	Sector/Subsector	Evidence
Manufacturing	Logistics and Warehousing: Logistics - truckers, shipping companies, storage	• Regional Suppliers, local storage could be required
Manufacturing	Recycling	• Small number of companies, Sub-sector growing sub-sector, specialization (U.S. Cluster Mapping)
Energy	Food waste	• Only one company - under represented in relation to potential
Energy	By-products e.g. bioplastics, storage	• Small number of companies
Energy	Energy Efficient Buildings, Clean Energy	• Small number of companies
Energy	Distributors	• Small number of companies
Energy	Manufacturing Support - Equipment and machinery – heavy equipment (installations, maintenance and repair), technical equipment (generators, systems, processes and technology)	• Small number of companies

8.1.5 Economic Base Analysis

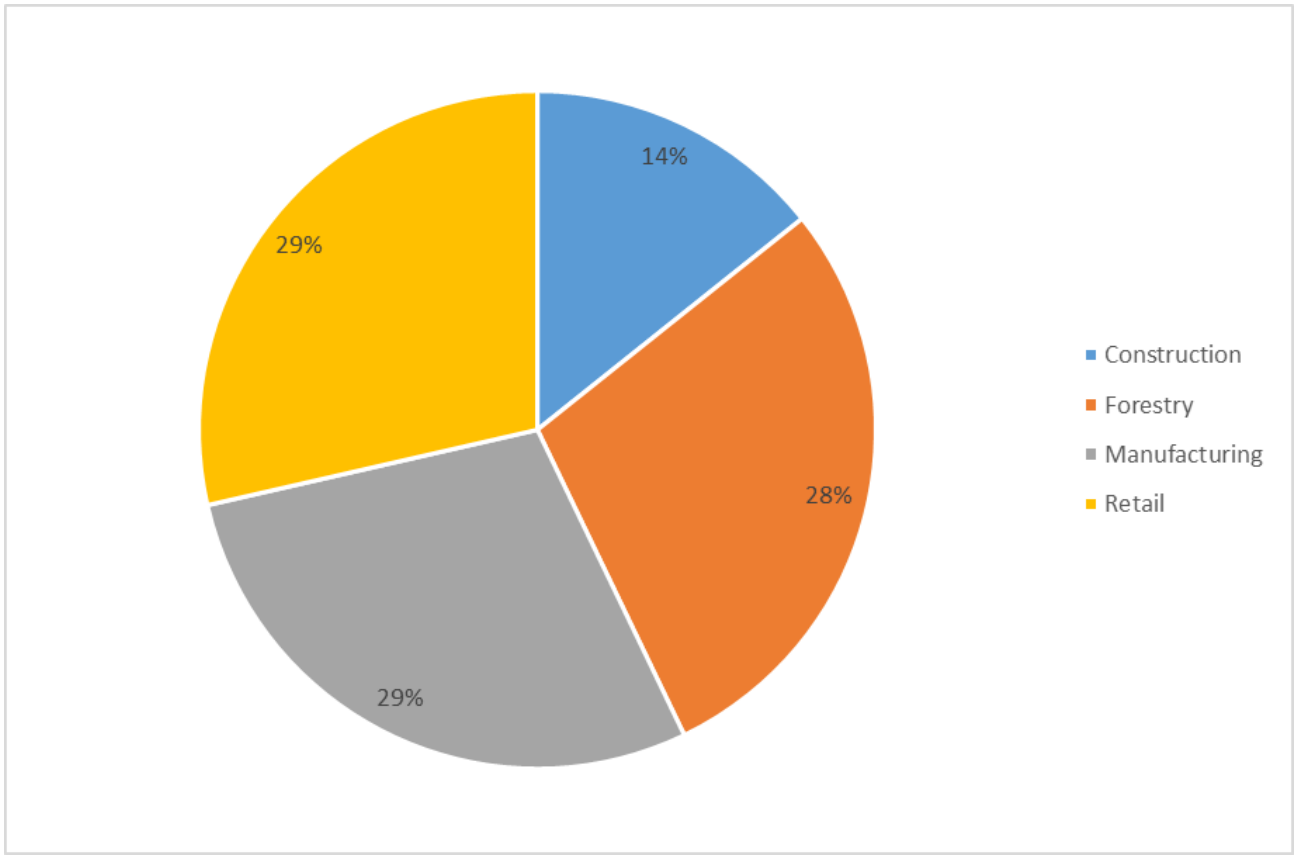
From the Economic Base Analysis, we extracted the Location Quotients (LQ) of the clusters/sectors in Itasca County as well as Northeast Minnesota to determine if there was under-representation based on employment. Note that Northeast Minnesota was used as a proxy in scenarios where data was not captured and/or suppressed.

Sector	Sector/Subsector	Evidence
Forestry	Fishing, Hunting and Trapping	• Low representation
Mining	Support Activities for Mining	• Supported by value chain data
Construction	Non-residential Building Construction	• QCEW - zero employment
Construction	Other Heavy and Civil Engineering Construction	• QCEW - zero employment, stakeholder consultations
Construction	Utility System Construction	• Low representation

Sector	Sector/Subsector	Evidence
Manufacturing	Fabricated Metal Product Manufacturing	• Room for growth in this sector due to compliment to mining, mall number of companies in Mining,
Manufacturing	Machinery Manufacturing	• Supported by mining value chain
Energy	Geothermal Electric Power Generation	• QCEW - zero employment, no companies
Software & IT	Data processing, hosting, and related services	• All aspects are underrepresented in each value chain, low LQ
Software & IT	Software publishers	• All aspects are underrepresented in each value chain, low LQ
Professional & Business Services	Architectural, Engineering, and Related Services	• Low representation
Professional & Business Services	Testing Laboratories	• No representation in Itasca County and low representation in St. Louis County
Professional & Business Services	Industrial Design Services	• QCEW - zero employment, no companies
Professional & Business Services	Specialized Design Services	• QCEW - zero employment, no companies
Professional & Business Services	Computer Systems Design and Related Services	• very few companies, low LQ
Professional & Business Services	Scientific Research and Development Services	• QCEW - zero employment, no companies
Professional & Business Services	Other Scientific and Technical Consulting Services	• QCEW - zero employment, no companies

The following is a percentage share representation of the above to highlight which sectors demonstrated the most gaps.

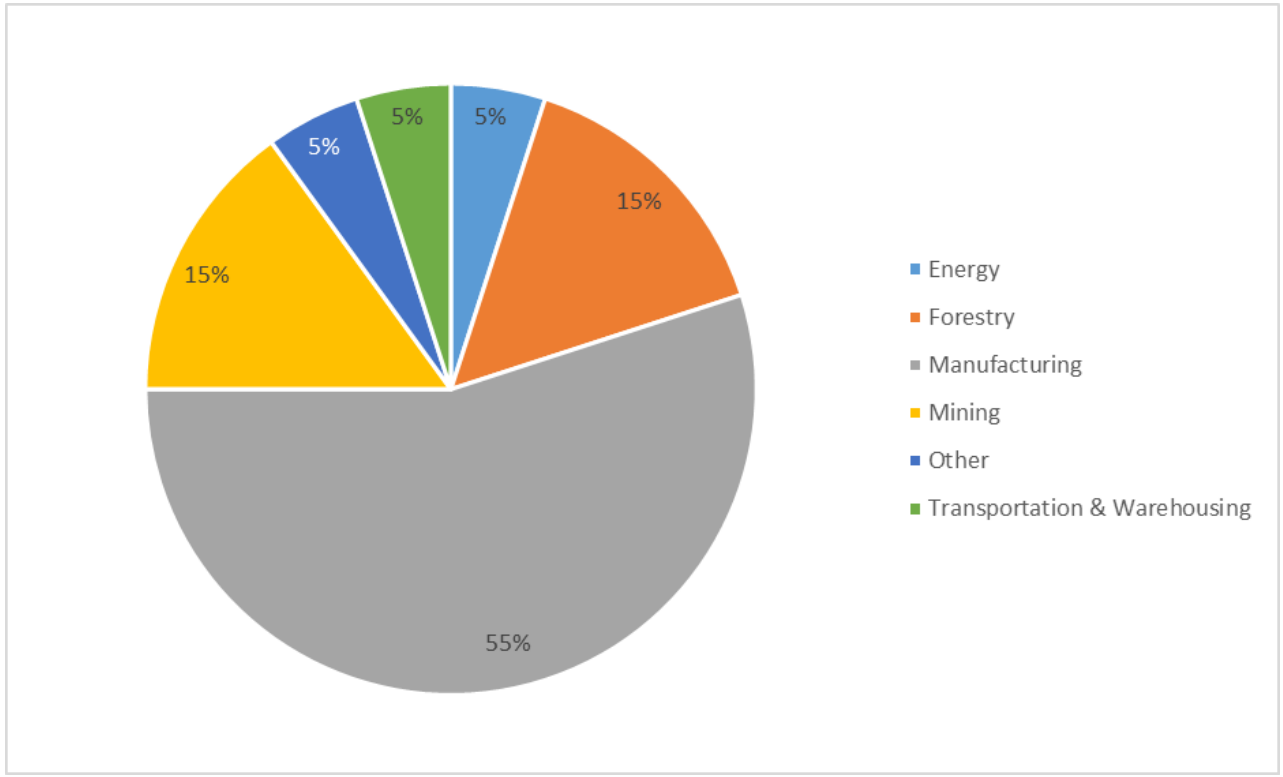
Figure 9 - Stakeholder Consultation Gap Analysis % Share of Gaps by Sector



n = 7

There was a relatively even spread in terms of gaps; however, it is important to note that Construction can often be a subsector of Forestry and Manufacturing, furthermore Retail is not a focus sector.

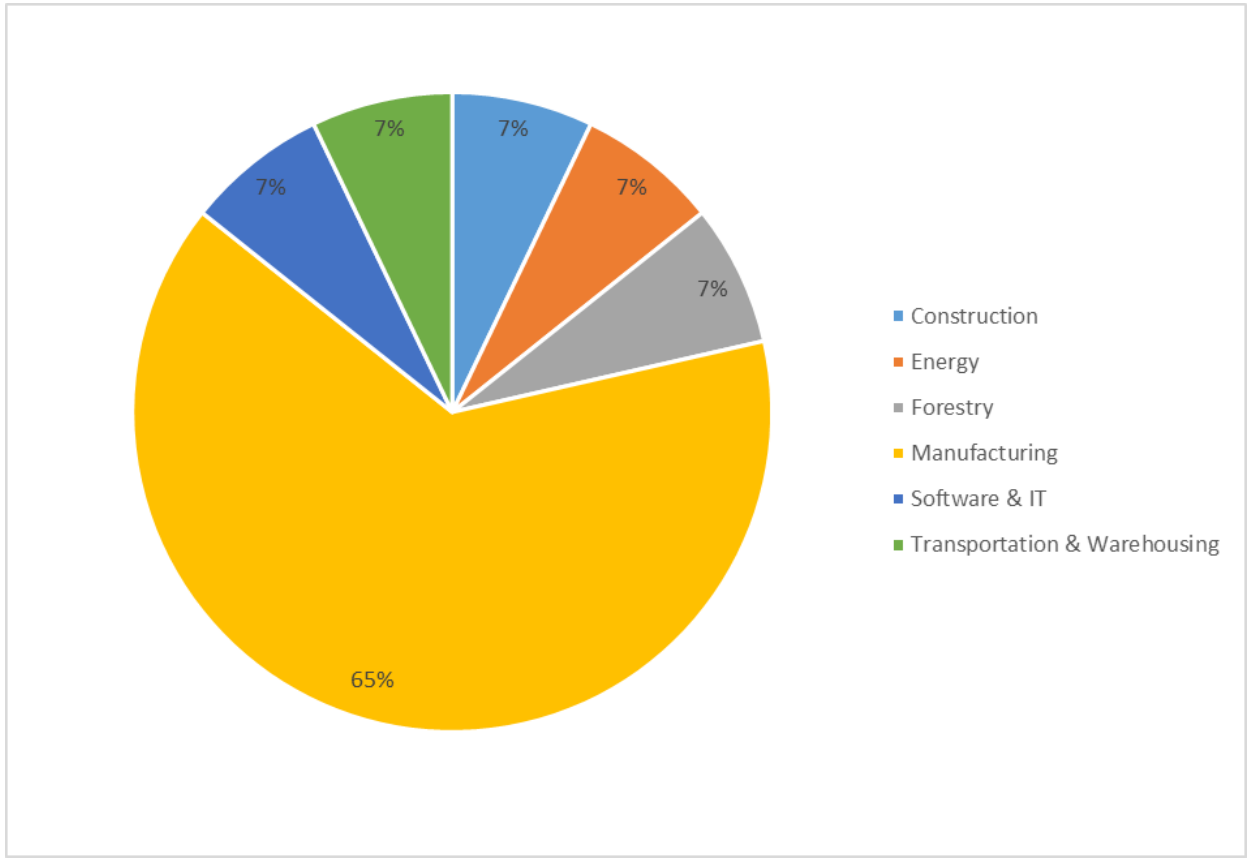
Figure 10 - Trade Gap Analysis % Share of Gaps by Sector



n = 20

The trade analysis, which focused on the top imports of 2020, illustrates a clear dominance by Manufacturing, which accounted for over half of the top 20 imports while Forestry and Mining combined to represent 30% of the top 20 imports.

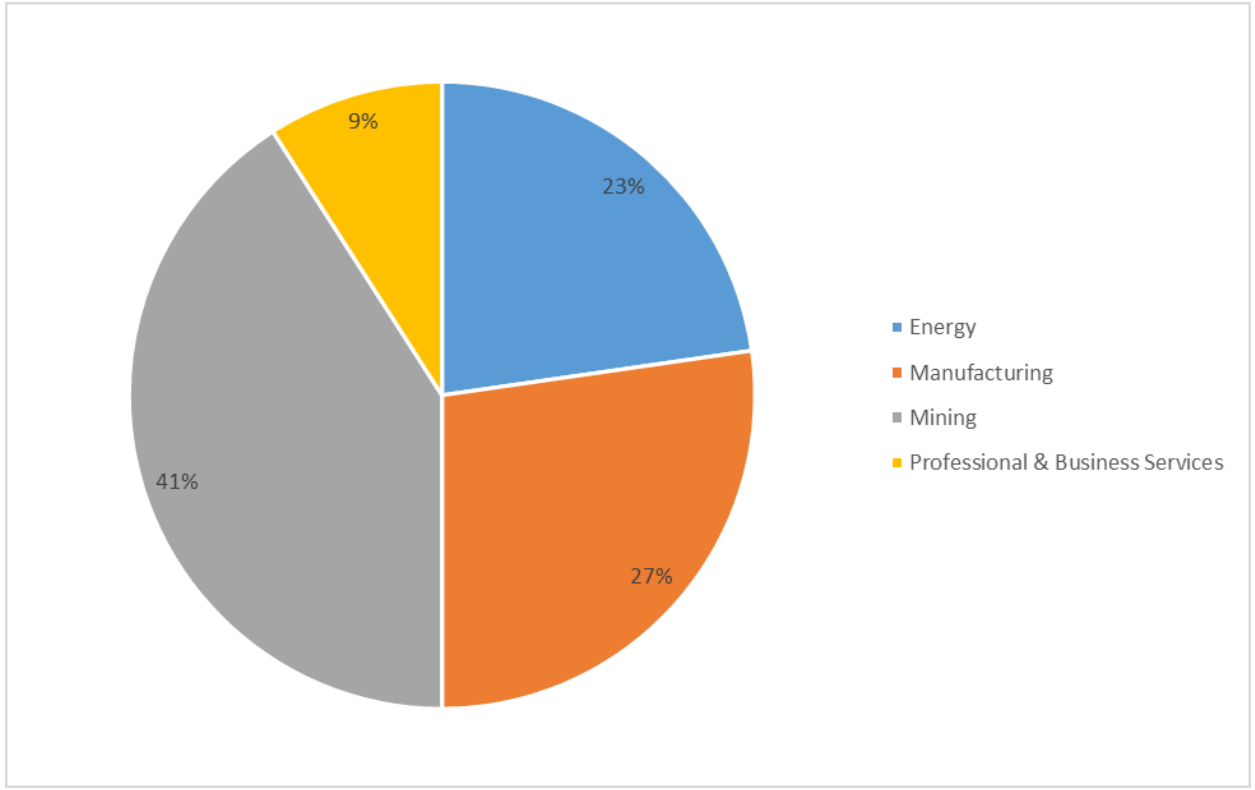
Figure 11 - FDI Gap Analysis % Share of Gaps by Sector



n = 14

The FDI analysis into the State of Minnesota revealed that the concentration of investment and likely gaps were most prevalent in the Manufacturing sector, accounting for roughly two-thirds of known FDI.

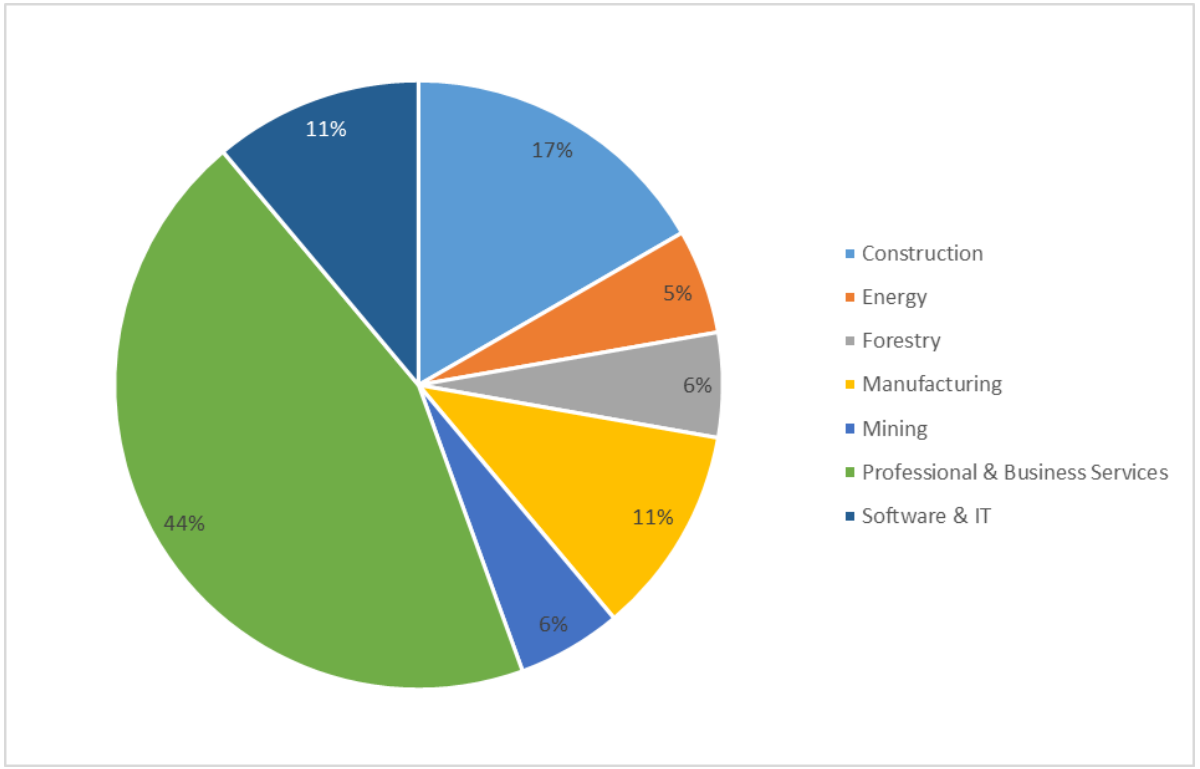
Figure 12 - Value Chain Analysis % Share of Gaps by Sector



n = 22

The value chain analysis revealed that despite the presence of mining companies, there were significant gaps within the sector which turned out to be the leading sector in terms of percentage share of gaps, followed by Manufacturing which was closely followed by the Energy sector.

Figure 13 - Economic Base Analysis/NAICS % Share of Gaps by Sector

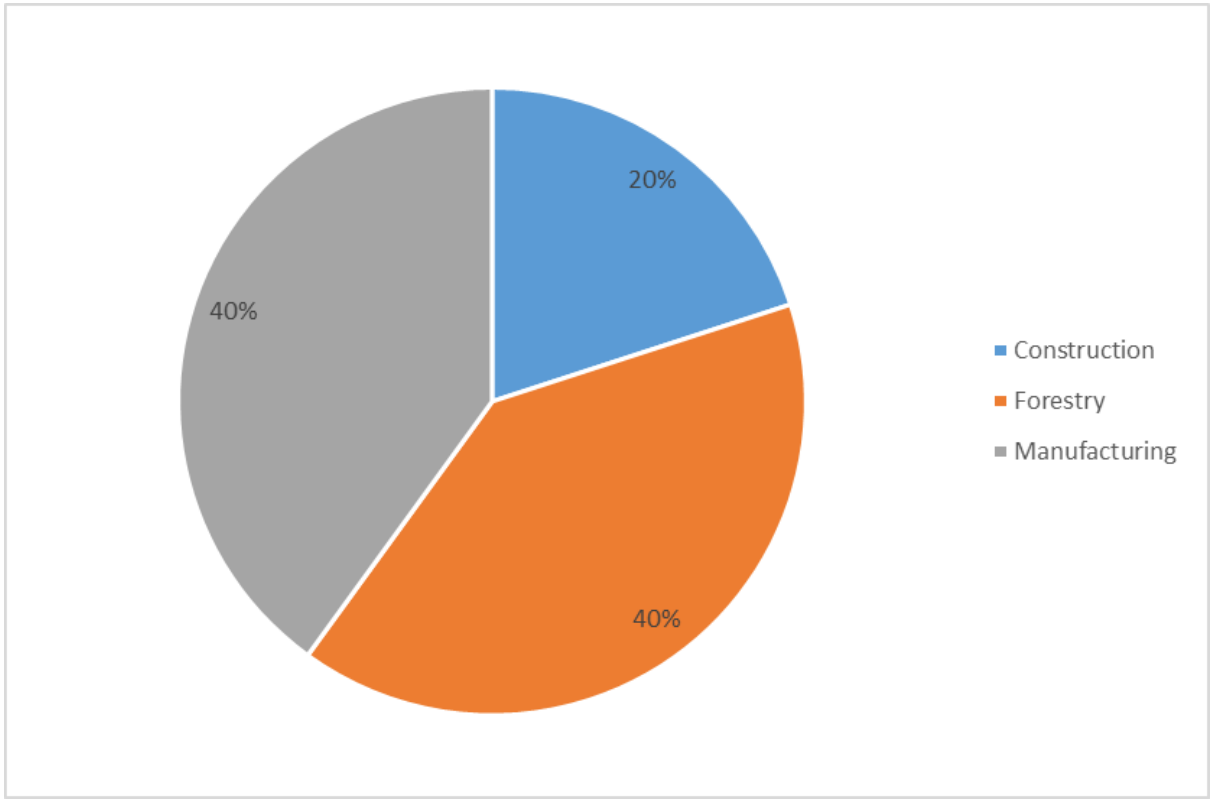


n = 18

The Economic Base Analysis highlighted that the Professional & Business Services sector had the most gaps due to a lack of companies or employment. The second leading sector in terms of gaps was the Construction sector, followed by Manufacturing and Mining, which were tied for third place.

8.2 Deeper Dive

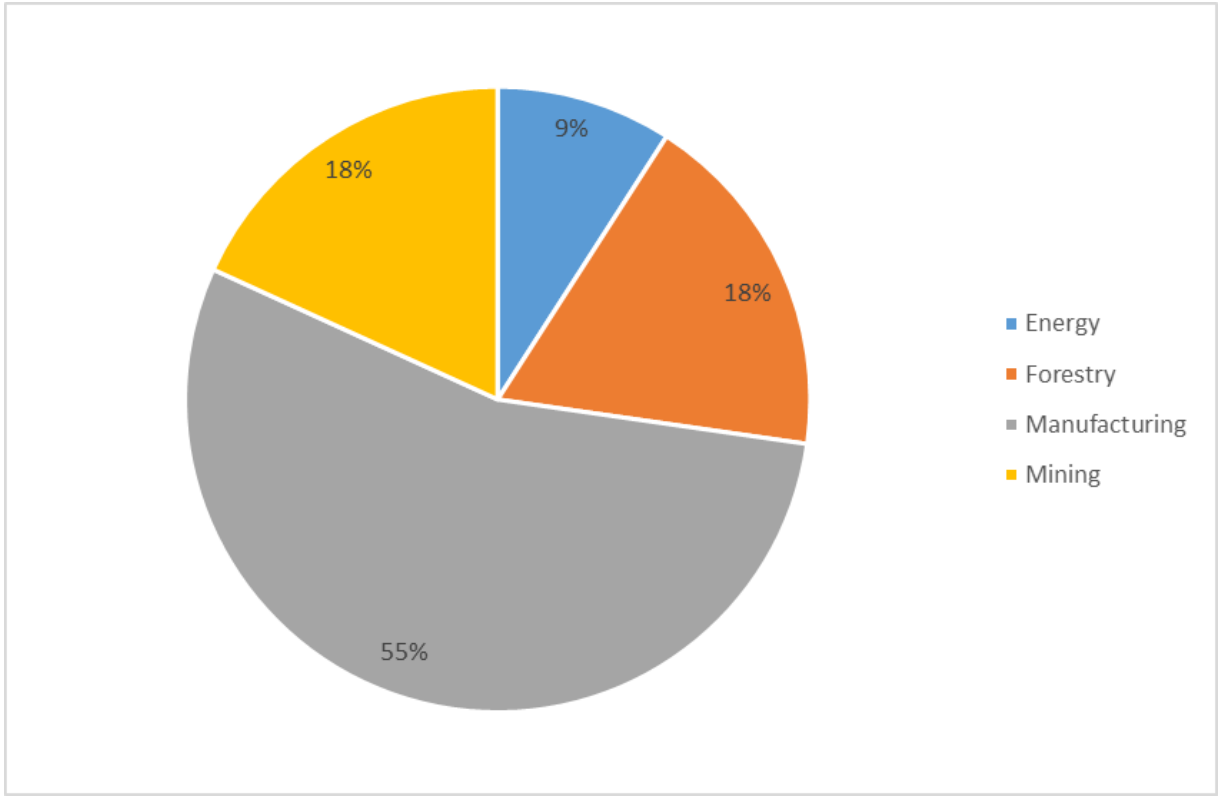
Figure 14 - Stakeholder Consultation Gap Analysis % Share of Gaps by Sector without Retail



n = 5

Given that the Retail was not a focus sector, we opted to remove it and create a view that would highlight the key sectors and their respective percentage share of gaps based on the Stakeholder Consultations. Manufacturing and Forestry were tied as the sectors with the most gaps.

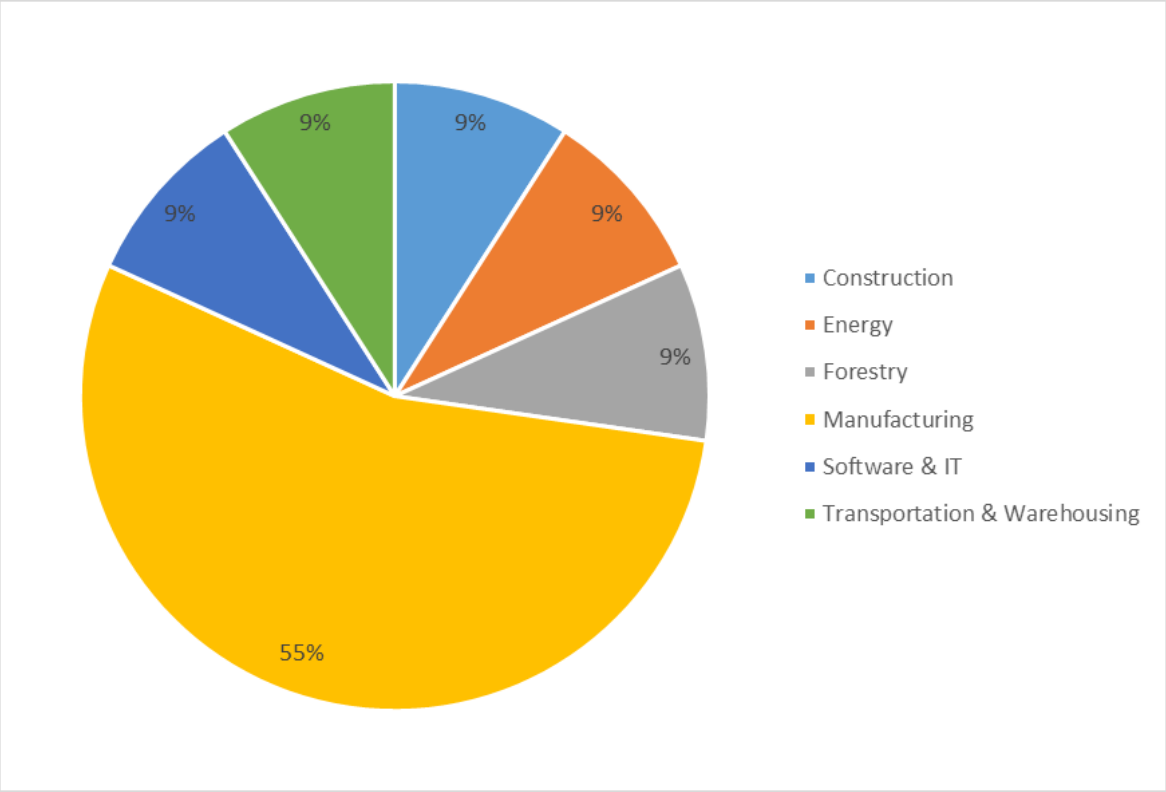
Figure 15 - Trade Gap Analysis % Share of Gaps by Sector - Growing/Minimal Decline Imports Only



n = 11

In terms of Trade, specifically imports, we focused strictly on those commodities (and their respective sectors) that experienced growth by $ value in 2020. However, we also included a few commodities/sectors that had either no growth or minimal decline, given that 2020 was a unique year that disrupted businesses and supply chains. If an import managed to see a minimal decline or simply no growth or decline, we categorized this as a sign of resilience and believe it may also indicate a gap being filled via imports.

Figure 16 - FDI Analysis % Share of Gaps by Sector - Sectors without Projects in 2020

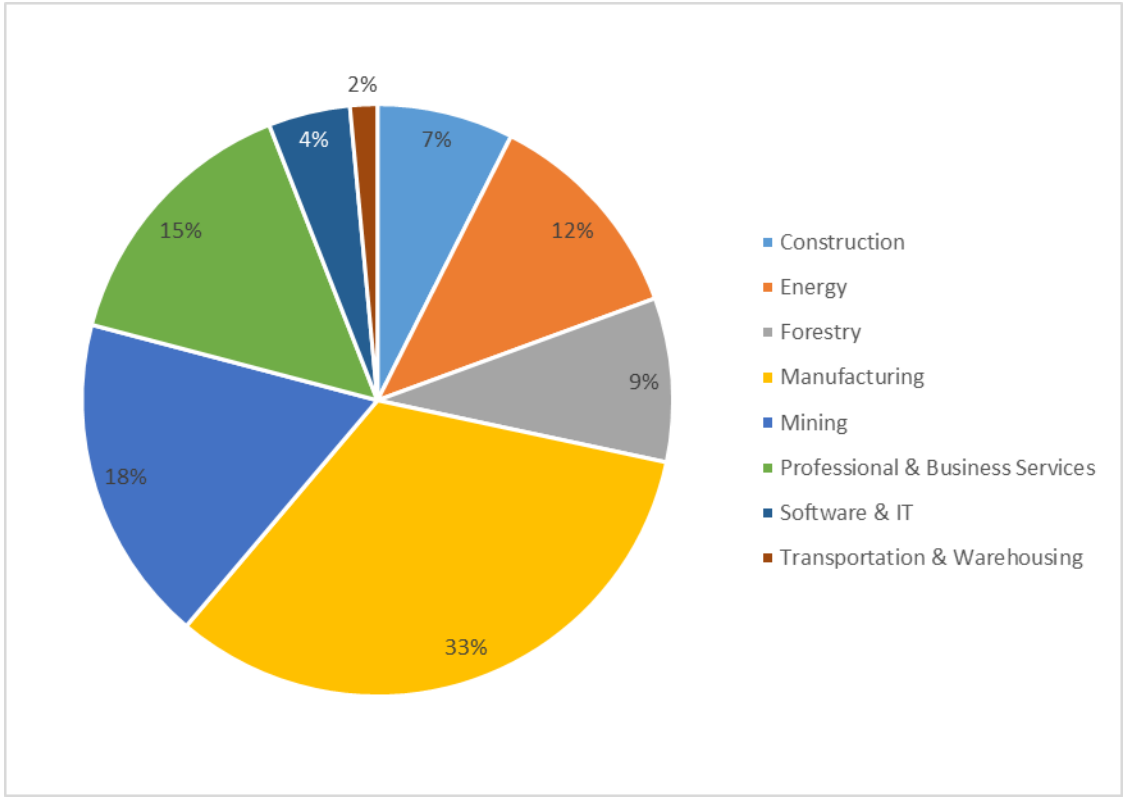


n = 11

With regards to the FDI Analysis, we removed sectors that simply observed no investments in 2019 and focused on those sectors that received no FDI in 2020. The Manufacturing sector observed the largest gaps with over half of the share of sectors without FDI. The remaining sectors were equally tied, making up the remaining 45% of the share of FDI gaps. Sectors with noteworthy gaps, i.e., no FDI, in both 2020 and 2019 included Manufacturing (Plastics, Semiconductors, and Aerospace), Forestry (Paper, printing & packaging) and Construction (Real Estate). It is worth noting that the Semiconductor industry is dependent on the Mining sector.

8.3 Combined Analysis & Opportunity Identification

Figure 17 - Combined Gap Analysis % Share Gaps by Sector by Stakeholder Consultations, Trade, FDI, Value Chain and Economic Base Analysis



n = 67

When we combine the previous analyses, it is apparent that the Manufacturing sector possesses the most gaps, accounting for a third of the supply chain gaps. As such, it offers the most potential opportunities. This is especially the case because Manufacturing also crosses over into the Construction and Mining sector. If we were to combine these three interdependent sectors into one more encompassing Manufacturing sector, it would account for 58% of the supply chain gaps.

If we were to include Forestry, which is also fairly Manufacturing intensive depending on subsector or activities included, into a more encompassing Manufacturing sector, this sector would account for 67% or roughly two-thirds of all gaps. That being said, regardless of the sector prioritized, Manufacturing will have a key role to play in the development of development clusters in Itasca County.

Combined Subsectors by Stakeholder Consultations, Trade, FDI, Value Chain and Economic Base Analysis

The following is a breakdown of the subsectors that demonstrated gaps from the combined analysis.

Construction
Construction
Nonresidential Building Construction
Other Heavy and Civil Engineering Construction
Real estate
Utility System Construction
Energy
By-products e.g. bioplastics, storage
Distributors
Food waste
Geothermal Electric Power Generation
Manufacturing Support - Equipment and machinery – heavy equipment (installations, maintenance and repair), technical equipment (generators, systems, processes and technology)
Nuclear Reactors, Boilers, Machinery And Mechanical Appliances; Parts Thereof
Renewable energy
Energy Efficient Buildings, Clean Energy
Forestry
Biofuels, BioChemicals
Fishing, Hunting and Trapping
Paper And Paperboard; Articles Of Paper Pulp, Paper Or Paperboard
Paper, printing & packaging
Trees and water
Wood And Articles Of Wood; Wood Charcoal

Manufacturing

Aerospace
Articles Of Iron Or Steel
Biotechnology
Business machines & equipment
Ceramics & glass
Electrical Machinery And Equipment And Parts Thereof; Sound Recorders And Reproducers, Television Recorders And Reproducers, Parts And Accessories
Fabricated Metal Product Manufacturing
Industrial equipment
Logistics and Warehousing: Logistics - truckers, shipping companies, storage
Machinery Manufacturing
Manufacturing
Manufacturing - parts distribution
Manufacturing servicing/repair
Plastics
Plastics And Articles Thereof
Recycling
Rubber And Articles Thereof
Ships, Boats And Floating Structures
Specialist Technical & Professional Services to manufacturing
Specialist technology services such as 3D printing, robotics, software etc.
Steel
Tanning Or Dyeing Extracts; Tannins And Derivatives; Dyes, Pigments And Other Coloring Matter; Paints And Varnishes; Putty And Other Mastics; Inks

Mining
Bulk Products
Equipment Hire
Fuel Handling & Storage
ICT support (all types)
Logistics - Bulk Haulage
Manufacturing - Specialist Machinery/supplies
Mineral Fuels, Mineral Oils And Products Of Their Distillation; Bituminous Substances; Mineral Waxes

Mining
Process Control
Salt; Sulfur; Earths And Stone; Plastering Materials, Lime And Cement
Site - Construction
Support Activities for Mining
Maintenance & Repair, Components & Parts
Professional & Business Services
Architectural, Engineering, and Related Services
Computer Systems Design and Related Services
Industrial Design Services
Other Scientific and Technical Consulting Services
Scientific Research and Development Services
Specialized Design Services
Stakeholder Consultation Services
Testing Laboratories
Testing/Analytical Supplies & Services
Software & IT
Communications
Data processing, hosting, and related services
Software publishers
Transportation & Warehousing
Transportation & Warehousing

The sectors with the strongest opportunities are as follows:

1. Manufacturing with 33% of the supply chain gaps
2. Mining with 18% of the supply chain gaps
3. Professional & Business Services with 15% of the supply chain gaps
4. Energy with 12% of the supply chain gaps
5. Forestry with 9% of the supply chain gaps *

Consequently, the subsectors with the strongest opportunities are as follows:

Manufacturing
Aerospace
Articles Of Iron Or Steel
Biotechnology
Business machines & equipment
Ceramics & glass
Electrical Machinery And Equipment And Parts Thereof; Sound Recorders And Reproducers, Television Recorders And Reproducers, Parts And Accessories
Fabricated Metal Product Manufacturing
Industrial equipment
Logistics and Warehousing: Logistics - truckers, shipping companies, storage
Machinery Manufacturing
Manufacturing - parts distribution
Manufacturing servicing/repair
Plastics
Plastics And Articles Thereof
Recycling
Rubber And Articles Thereof
Ships, Boats And Floating Structures
Specialist Technical & Professional Services to manufacturing
Specialist technology services such as 3D printing, robotics, software etc.
Steel
Tanning Or Dyeing Extracts; Tannins And Derivatives; Dyes, Pigments And Other Coloring Matter; Paints And Varnishes; Putty And Other Mastics; Inks

Mining
Bulk Products
Equipment Hire
Fuel Handling & Storage
ICT support (all types)
Logistics - Bulk Haulage
Manufacturing - Specialist Machinery/supplies
Mineral Fuels, Mineral Oils And Products Of Their Distillation; Bituminous Substances; Mineral Waxes
Process Control
Salt; Sulfur; Earths And Stone; Plastering Materials, Lime And Cement
Site - Construction
Support Activities for Mining
Maintenance & Repair, Components & Parts

Professional & Scientific, and Business Services
Architectural, Engineering, and Related Services
Computer Systems Design and Related Services
Industrial Design Services
Other Scientific and Technical Consulting Services
Scientific Research and Development Services
Specialized Design Services
Stakeholder Consultation Services
Testing Laboratories
Testing/Analytical Supplies & Services

Energy
By-products e.g. bioplastics, storage
Distributors
Food waste
Geothermal Electric Power Generation

Manufacturing Support - Equipment and machinery – heavy equipment (installations, maintenance and repair), technical equipment (generators, systems, processes and technology)
Nuclear Reactors, Boilers, Machinery And Mechanical Appliances; Parts Thereof
Renewable energy
Energy Efficient Buildings, Clean Energy

Forestry
Biofuels, BioChemicals
Fishing, Hunting and Trapping
Paper And Paperboard; Articles Of Paper Pulp, Paper Or Paperboard
Paper, printing & packaging
Trees and water
Wood And Articles Of Wood; Wood Charcoal

8.4 Opportunity Overview & Commentary

8.4.1 Manufacturing

Potential manufacturing opportunities cover a wide range of sectors. In determining viable sectors, they should complement, rather than duplicate, the activities of the existing manufacturing base or have grounds for a strategic diversification or transformation. For example, the biotechnology manufacturing cluster in Minneapolis St. Paul is internationally renowned. Since competitive advantages were not identified in Itasca County, there is no basis for pursuing this sector. Similarly, aerospace is an emerging cluster in the Duluth area and is highly competitive on the international stage. While seaplanes and boats complement tourism activity in NE Minnesota, this is probably insufficient to justify pursuing manufacturing in these areas. However, if Itasca County's manufacturing sector deploys more advanced materials in future, this may warrant a revisit in the form of a diversification opportunity for existing companies.

Fabricated metal product manufacturing, precision tools, and special-purpose machinery (Industrial equipment, machinery manufacturing) are identified (Mc. Kinsey Global) as having the potential to advance productivity and economic growth, jobs and incomes for workers and communities. With growing concerns around equitable opportunities, these manufacturing activities can provide middle-wage jobs, fill identified supply chain gaps, and compliment mining and energy, where gaps were also identified. Basic metals were also identified as an opportunity in this vein. However, steel was imported from overseas in 2020;

with current policies to encourage domestic sourcing, this commodity is served regionally and may be grounds for company expansions as demand is forecast to increase in 2020. Gaps in the complementary areas of distribution, servicing and repair were indicated from multiple sources. These are critical supports to mining and forestry, both of which have ongoing requirements.

Several subsectors were identified that are critical for cluster development across all sectors. Moves toward a circular economy drive growth in recycling and related activities in remediation. Steel, a key commodity in the region, is one of the most recycled materials. Initiatives to grow this sector will help address Itasca County's recent declines in employment and concentration. Specialist technical support and technology services are also critical to promote future growth and innovation. Advanced manufacturing technologies are driving the sector and quality job creation. Gaps in these areas were not only identified in manufacturing but also in mining.

8.4.2 Mining

The future of mining is at a pivotal stage, as the sector underpins a low carbon economy and technological advancement. As remarked by the CEO of Anglo American: "45% of the world's economic activity is driven by the mining sector[2]". New technologies in iron ore production around Electric Arc Furnace production for recycling scrap materials and the production of high-grade materials offer value-added opportunities through a longer life cycle and better recyclability. Improved processes such as 'mustang pellets' to improve the efficiency of blast furnaces are indicative of further opportunities as well as carbon capture, use and storage (CCUS), bioenergy and direct electrification.

Itasca County is part of a region that is home to the Duluth Complex, one of the world's largest untouched deposits of copper, nickel and valuable rare earths. Essential to the green economy, they are used for components of smart energy devices, solar photovoltaics, batteries, electric vehicle (EV) motors, wind turbines, and fuel cells, along with a range of technology devices used for everyday life. While recent announcements to import such metals could limit the extent of this opportunity, there is potential in the supply chain in areas such as processing.

A number of subsector opportunities exist in mining services and support that St. Louis County does not serve. For example, equipment hire, process control equipment, maintenance and repair, fuel handling and storage, mineral fuels, and heavy construction, bulk haulage will help build the mining value chain. Bearing in mind the potential of the regional mineral deposits, this is critical in positioning for future opportunities.

8.4.3 Professional & Business Services

Professional, scientific & business Services cross-cuts all sectors, adding value and providing essential support. While there are some promising signs in part, overall, the sector has a low location quotient (< 0.5) in relation to NE Minnesota, the state and the United States. Furthermore, the density of workers in this sector is only half that of the nation. As a result, gaps are present across various disciplines in industrial design, laboratory testing, scientific research and

[2] Anglo American CEO: "45% of the world's economic activity is driven by the mining sector" - MINING.COM

development, professional fields, and stakeholder consultation services. This structural weakness in Itasca County's economic base must be addressed to capitalize on future sector opportunities. The environmental challenges around mining rare-earths will require highly skilled consultation services to mediate between the diverse stakeholders involved. Industrial design and scientific research and development underpin innovation, and in turn, drive cluster growth.

8.4.4 Energy

The majority of the energy opportunities lie in the Renewable Energy and clean energy space. This is born from a variety of factors, including the local gaps as well as where the direction the industry is going, global trends, and the Federal initiatives/investment in the clean/renewable energy space. The key theme is around smarter and cleaner energy consumption. Furthermore, the clean energy space has cross-pollination into other sectors, including Manufacturing and Construction i.e. manufacturing that can potentially be carried out with cleaner energy and clean energy integration into construction such as with the use of timber and the development of energy-efficient buildings, smart grids etc. In terms of energy generation itself, Forestry also offers opportunities in terms of biomass and distributed energy. While clean energy generation is the goal, the backbone that enables it is the equipment. There may be specific opportunities to build equipment or parts thereof locally.

8.4.5 Forestry

While Forestry has the least opportunities uncovered, some of them are particularly strong and/or unique. Timber and NextGen Timber will likely grow in popularity and adoption, especially CLT etc. Biomass and Biofuels will continue to be an are of particular interest given increasing energy demands and the emphasis on renewable/clean energy and achieving climate change targets. Although there was only a single mention articulated, Fishing, Hunting and Trapping is a unique opportunity that takes advantage of the natural landscape, can promote tourism which has a direct benefit to the industry as well as the overall local economy. Paper and Paperboard has generally been on the decline for the last few decades; however, in approximately the last 10 years, it has seen a slight increase linked to growth in electronic retail sales and associated demand for containerboard products. As such, we would likely see a continued demand for containerboard products. Paper, printing & packaging will likely see some increased demand for packaging and labels. While the local opportunity may be small, the value of imports was relatively unchanged but therefore stable, and exports from the two nearest ports for Paper and Paperboard; Articles Of Paper Pulp, Paper Or Paperboard did increase by 80% from 2019-2020. Wood and Articles of Wood have only observed a slight decrease in imports despite the pandemic. For a region with a strong Forestry sector and manufacturing capabilities, it is plausible that there would be opportunities to produce some products locally.

9 SWOT & Barriers to Growth

9.1 Forestry - SWOT & Barriers to Growth

Strength	Weakness

• Grand Rapids, most centrally located for wood supply
• The Grand Rapids market has the highest total area of timberland, over 4.7 million acres. With nearly 10 million acres of timberland located within 90 miles of Grand Rapids.
• Grand Rapids has the most biomass.
• Grand Rapids is Minnesota's forestry center, with research and administration offices for the U of M, USFS, DNR, etc.
• Strong policy support for value-added renewable energy projects
• Large surplus of sustainable forest resource, with northern hardwoods demonstrating the greatest surplus
• Historically, private land ownership has been a stable and dependable source of timber
• Home to flagship companies such UPM Blandin Paper Mill, MN Power (Biomass)
• Natural Resources Research Institute
• University of Minnesota, Duluth Materials and Bioeconomy Platform
• The Minnesota Forest Resources Council (MFRC)
• Itasca Community College - Forestry Resources program
• MN Business First Stop
• Critical mass of specialization: LQ Forestry and Logging highest of all sectors ranked #1
• State-level funding/programs for sector
• Specialized vertical regional supply chain
• Horizontal linkages with energy, manufacturing
• Good base of entrepreneur (non-employer) businesses
• Stakeholder top strengths as a place to do business:
	• Trade Analysis
	  ○ Some top 20 imports for 2020 included Paper And Paperboard; Articles Of Paper Pulp, Paper Or Paperboard; Pulp Of Wood Or Other Fibrous Cellulosic Material; Recovered (Waste And Scrap) Paper And Paperboard; and Wood And Articles Of Wood; Wood Charcoal
	  ○ Exports of Pulp Of Wood Or Other Fibrous Cellulosic Material; Recovered (Waste And Scrap) Paper And Paperboard exports dropped by 39%, and Wood And Articles Of Wood; Wood Charcoal decreased by 47% from 2019-2020
	• FDI Analysis:
	  ○ No FDI for Paper, printing & packaging into Minnesota in 2019 and 2020
	  ○ No FDI for Construction/Real Estate into Minnesota in 2019 and 2020
	• Stakeholder top weaknesses as a place to do business:
	  ○ Infrastructure (Transportation and/or ICT) #1 and Regulations/Policies/Permitting
	  ○ Housing
	  ○ Labour
	• Economic Base Analysis:
	  ○ Low representation of companies in Fishing, Hunting and Trapping
	  ○ LQ in Wood Product Manufacturing dropped 21.9% from 2015-2019

Strength	Weakness
○ Natural resources ○ Quality of Life ○ Outdoor recreation ○ Workforce	• Lack of cluster dynamism - rate of business formations, start-ups
Opportunity	**Threat**
• Forestry is largely untapped in terms of leveraging biomass and forest residues to create pellets, biofuels as well as other potential bioproducts and biomaterials • CLT to support US/North American Construction sector • Support demand for inputs for Real Estate/Construction sectors such as timber and other wood products • Fishing, Hunting and Trapping, can promote tourism and overall exposure to local Forest sector and overall economy • Paperboard, which is linked to growth in electronic retail sales and associated demand for containerboard products; more can potentially be produced locally; import substitution • Wood and Articles of Wood, more can potentially be produced locally; import substitution • American Jobs Plan - Modernize homes, commercial buildings, schools, and federal buildings; green buildings leveraging Forestry inputs	• Cluster dynamism in rate of business formations, start-ups • Professional, technical, & scientific services, IT skills/company base • Stakeholder consultations top barriers to growth: ○ Attracting/retaining skilled labor #1 ○ Business licenses/permits ○ Land and property ○ Incentives/access to finance • With some exceptions, less demand for paper as consumers shift to digital • Stagnation or decline: many new technologies entering the Forestry market, those that do not adopt and adapt will be left behind • Softwood lumber mills in the U.S. have been concerned over Canadian policies on timber pricing, as Canada represents roughly 93% of all softwood lumber volume imported into the U.S. from 2000 to 2019 (USITC 2020). • Stumpage paid by private firms in Canada is comparatively less than the U.S. due to the provincial government's subsidization of timberlands, leading to a lost domestic market share for U.S. producers. (Hoover and Fergusson 2017) • Expanding influence by Canadian lumber companies in the U.S. through the acquisition of U.S.-based sawmills and other primary wood processors • UPM Blandin: anchor company is a branch location of MNE • Systemic decline in parts of the value chain (i.e., printing/paper)

9.2 Energy – SWOT & Barriers to Growth

Strength	Weakness

• Large and innovative local flagship company in MN Power
• Community facing energy co-ops: Great River Energy, North Itasca Electric Cooperative
• Strong foundation of education/training in the state as well as solid options directly in Itasca County, providing for both a pipeline of talent as well as R&D opportunities
• Specialized vertical regional supply chain
• Upstream linkages with forestry, food processing - waste management & remediation
• Northland Small Business Development Center Small Business Development Center (SBDC)
• Natural Resources Research Institute
• University of Minnesota, Duluth
• State-level support for funding and programs
• Itasca Community College: Engineering program and the Power Generation program Biomass Project
• Stakeholder top strengths as a place to do business:
  ○ Natural resources
  ○ Quality of Life
  ○ Outdoor recreation
  ○ Workforce
	• Cluster dynamism in rate of business formations, start-ups
	• Professional, technical, & scientific services, IT skills/company base
	• Low availability/favourability for geothermal energy [xxxii]
	• Solar radiation in the County for PV electricity generation is fair to poor with some of the least advantages levels as compared to other regions of Minnesota [xxxiii]
	• Solar radiation in Itasca County annually is 4.44 kWh / m2 / day [xxxiv]
	• Low wind (class 3) levels[xxxv]
	• FDI Analysis:
	  ○ No FDI for Energy into Minnesota in 2020
	• Electric Power Generation, Transmission and Distribution LQ Itasca vs Minnesota observed a decrease of 10.39% from 2015-2019
	• Several plans by MN Power remain unapproved or pending implementation, as such opportunities cannot yet be accessed
	• Stakeholder top weaknesses as a place to do business:
	  ○ Infrastructure (Transportation and/or ICT) and Regulations/Policies/Permitting #1
	  ○ Housing
	  ○ Labour

Opportunity	**Threat**

• Leverage biomass and forest residues to create pellets, biofuels
• Leverage new technologies, e.g., Internet of Energy (IoE), Blockchain, Energy-as-a-Service (EaaS) etc.
• Energy-efficient buildings
• Smart grids
	• Stakeholder consultations top barriers to growth:
	  ○ Attracting/retaining skilled labor #1
	  ○ Business licenses/permits
	  ○ Land and property
	  ○ Incentives/access to finance

• The U.S Energy Information Administration (EIA) forecasts that electricity consumption in the U.S. will increase by 2.2% in 2021[xxxvi] • Renewable growth may accelerate in 2021 as the new administration starts to execute on a platform that includes rejoining the Paris Climate Accord, investing $2 trillion in clean energy, and fully decarbonizing the power sector by 2035[xxxvii] • Federal and State funding programs available for biomass, renewable energies and energy efficiency • Renewable energy is an emerging FDI sector	• Small number of companies available to bring to support/materialize opportunities in Energy Efficient Buildings • Limited options in terms of Renewable Energy due to low levels of energy generation ability for geothermal, wind and solar in the County • Energy projects are often CapEx heavy, especially in the initial stages • Due to increasing energy demands and initiatives by Federal government, there may be competition from players outside the County and/or State

9.3 Manufacturing – SWOT & Barriers to Growth

Strength	Weakness

• Diverse range of manufacturing subsectors
• Innovation by companies
• Entrepreneur base (non-employer businesses)
• Cross-sector linkages to forestry (wood products) and mining (fabricated metal products), social enterprise, tourism/recreation
• Upstream linkages/inputs to Mining and Forestry in close proximity
• Platform for local knowledge sharing/social capital: Some companies are members of local chambers in Itasca County
• Regional associations: Arrowhead Manufacturers and Fabricators Association (AMFA)Tri-State Manufacturers' Association include cluster actors.
• Key actors in government, academic research & development, associations are located in outside Itasca County
• Regional research capacity in materials/metals
	• Cluster dynamism - rate of business formations, start-ups
	• Professional, technical, & scientific services, IT skills/company base
	• Trade Analysis:
	  ○ Heavy import dependency on Electrical Machinery And Equipment And Parts Thereof etc. #2 leading import in 2020, valued at roughly $74M
	  ○ Heavy import dependency on Articles Of Iron Or Steel, #6 leading import valued at roughly $28.5M
	• FDI Analysis:
	  ○ No FDI for Industrial equipment into Minnesota for 2020
	  ○ No FDI for Plastics into Minnesota for 2019 and 2020
	  ○ No FDI for Aerospace into Minnesota for 2019 and 2020
	  ○ No FDI for Construction into Minnesota for 2019 and 2020
	• Value chain analysis:

Strength	Weakness

• Comprehensive range of engineering, science, technology programs available in the region through universities and community colleges
• Diplomas/associate degrees available at Itasca Community College: chemistry; engineering; supported by availability at community colleges in NE Minnesota
• Specialist training available in region
• Trades apprenticeship programs available at Itasca Community College
• Stakeholder top strengths as a place to do business:
  ○ Natural resources
  ○ Quality of Life
  ○ Outdoor recreation
  ○ Workforce
• Competitive wage rates: $26.17/hour in Itasca County, significantly below the state average $30.12 and national average $29.51
• Skills availability – highest number of residents employed in sector
	○ Supply chain gaps for Manufacturing - parts distribution;
	○ Manufacturing servicing/repair
	○ Logistics and Warehousing
	○ Recycling
	• Economic base analysis:
	○ Supply chain gap Fabricated Metal Product Manufacturing
	○ Machinery Manufacturing
	○ Nonresidential Building Construction
	○ Other Heavy and Civil Engineering Construction
	○ Utility System Construction
	• Funding programs for sector development are limited

Opportunity	**Threat**
• Advanced manufacturing technologies: Industry 4.0, AI, IoT, 3D printing, robotics, digital twinning • Fabricated metal product manufacturing, precision tools, and special-purpose machinery (Industrial equipment, machinery manufacturing) • Steel, as well as complimentary areas of distribution, servicing and repair were indicated gaps from multiple sources • Manufacturing - parts distribution • Manufacturing servicing/repair • Logistics and Warehousing • Recycling • Fabricated Metal Product Manufacturing	• Stakeholder consultations top barriers to growth: ○ Attracting/retaining skilled labor #1 ○ Business licenses/permits ○ Land and property ○ Incentives/access to finance • Declining sector concentration: LQ for Itasca vs Minnesota is both low at .50 and in decline, dropping 13.7% from 2015-2019 • Declining export orientation - Exports in 2020 were on the decline, decreasing by 27% from 2019-2020 • Branch economy with MNE anchor firms • Stagnation or decline: technology adoption must keep up with advancements in manufacturing

Strength	Weakness
• Machinery Manufacturing • Nonresidential Building Construction • Other Heavy and Civil Engineering Construction • Supply Chains 'Glocalization' in the wake of Covid-19 companies will focus on balancing localized and globalized options to stay competitive deploying technology solutions that improves resiliency and efficiency of critical supply chains in localized regions[xxxviii] • America Jobs Plan - Revitalize manufacturing, ensure products are made in America	

9.4 Mining – SWOT & Barriers to Growth

Strength	Weakness

• Horizontal supply chains with linkages to manufacturing (fabricated metal products) and environmental (professional services)
• Stakeholder top strengths as a place to do business:
  ○ Natural resources
  ○ Quality of Life
  ○ Outdoor recreation
  ○ Workforce
• Regional/locally based interest groups and associations include cluster actors throughout the value chain, demonstrating a basis for knowledge sharing (e.g., Iron Range Resources Rehabilitation Board, Minnesota Iron Mining Association)
• Cross-sector innovation at Itasca Community College
• Fabrication Labs Corporate innovation in Itasca County
• Prairie River Minerals
• Regional innovation at Research Institutes (University of Minnesota, Duluth
	• 'Centre of gravity' is not in Itasca County
	• Cluster dynamism in rate of business formations, start-ups, spin-offs, small number of non-employer businesses
	• Professional, technical, & scientific services, IT skills/company base
	• Trade Analysis:
	  ○ Heavy import dependency on Electrical Machinery And Equipment And Parts Thereof etc. #2 leading import in 2020, valued at roughly $74M
	  ○ Heavy import dependency on Articles Of Iron Or Steel, #6 leading import valued at roughly $28.5M
	  ○ Aluminum And Articles Thereof
	  ○ Mineral Fuels, Mineral Oils And Products Of Their Distillation; Bituminous Substances; Mineral Waxes #3 leading import in 2020, valued at roughly $44.5M
	  ○ Salt; Sulfur; Earths And Stone; Plastering Materials, Lime And Cement #5 leading import valued at roughly $34M

Strength	Weakness

• Skill sets in support sectors: construction, installation, maintenance & repair, production, management
• Innovation by Prairie River Metals, U.S. Steel
	• FDI Analysis:
	  ○ No FDI for Industrial equipment (which includes Mining) into Minnesota for 2020
	• Value chain analysis:
	  ○ Supply chain gaps for Site – Construction
	  ○ Logistics - Bulk Haulage
	  ○ Process Control
	  ○ Manufacturing - Specialist Machinery/supplies
	  ○ Bulk Products
	  ○ Maintenance & Repair, Components & Parts
	  ○ Equipment Hire
	  ○ ICT support (all types)
	• Economic base analysis:
	  ○ Supply chain gap for Support Activities for Mining
	• Social capital - industry funds Minnesota schools

Opportunity	**Threat**

• Mining technologies: autonomous vehicles, AI, drones, digital twinning, automation,
• Emission reduction
• Steel - global steel prices are rising as demand in the USMCA region is forecast to increase by 7.6% in 2021[xxxix]
• Cobalt, copper, lithium, cadmium, and rare earth elements are essential components for clean energy solutions. These include smart energy devices, solar photovoltaics, batteries, electric vehicle (EV) motors, wind turbines, fuel cells, and nuclear reactors[xl]
• Rare earth elements are also critical components in smartphones, digital cameras, computer hard disks, fluorescent and light-emitting-diode (LED) lights, TV, computer, and electronic displays, as well as defense technologies[xlixlii]
• Proximity to Canada - rare earth mineral supply
• PolyMet mining project approval
	• Stakeholder consultations top barriers to growth:
	  ○ Attracting/retaining skilled labor #1
	  ○ Business licenses/permits
	  ○ Land and property
	  ○ Incentives/access to finance
	• Mining permits take 3x as long in U.S. than Canada or Australia
	• Exports in 2020 were on the decline, decreasing by 27% from 2019-2020
	• Environmental issues/climate impact from operations and extraction
	• Stagnation or decline: cluster must position itself for mining of the future

Strength	Weakness
• Bioremediation and remediation • New processes for carbon reduction in iron ore processing Recycling of mining tailings, e.g., scram mining • Mustang pellets • Bulk haulage • Process control equipment • Maintenance and repair • Fuel handling and storage • Mineral fuels • Heavy construction • Equipment hire	

10 Recommendations

The strategic recommendations are designed to align with the research and analysis findings, stakeholder feedback, the IEDC's mandate, and the project's scope to ensure each supports cluster development in Itasca County.

Given the fundamental and forward-looking nature of some recommendations, the sector/subsector opportunities are underpinned by a set of strategic pillars for foundational cluster areas. The recommendations are grouped under key themes with supporting evidence from the research and analysis.

10.1 Forestry

10.1.1 Forestry – Foundational Cluster Development

Strategic Pillars – Foundational Cluster Development			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
BR&E	• 50 Job Gains from Expansions and 7 Job Gains from Openings in 2019, with 60 Job Losses from Contractions and 13 Job Losses from Closings in 2019 (Employer) • Extremely high LQ of 35.47 in 2019	• **Increase Retention Program** – proactively surveying and meeting with businesses to understand concerns in advance and collaborate towards creating solutions • **Key Account Program** – provided dedicated Economic Development staff resources to businesses with most economic impact or potential to facilitate anchoring them and attracting partners, clients and/or talent	Short term / Ongoing Medium term / Ongoing
Investment Attraction	• No FDI in County (note: there were 6 unspecified destination FDI projects from 2015-2019, which may include the County) • 2 business formation in 2015	• **FDI Attraction Plan** – build an FDI Plan and proactively target foreign investors in the target sectors • **Domestic Attraction Plan** – build a Domestic Plan and	Short term / Medium term / Ongoing

Strategic Pillars – Foundational Cluster Development			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
		proactively target US based investors outside of the State in the sector • **Implement Investment Attraction Plans –** action plans, monitor progress, measure ROI, make necessary adjustments and return to the market with adjusted approach	Short term / Medium term / Ongoing Medium term / Ongoing
Infrastructure Development	• Stakeholder consultations revealed Infrastructure (Transportation and/or ICT) as #1 weakness to do business	• **Infrastructure Analysis** – conduct a comprehensive demand analysis to pinpoint needs and plan infrastructure investments needed to support current and anticipated economic growth	Medium term / Ongoing
Talent Attraction & Development	• Stakeholder consultations revealed Attracting / retaining skilled labor as #1 barrier to growth • LQ for Itasca vs Minnesota declined by 4.53% from 2015 – 2019 • 9 job gains from openings	• **Talent Attraction Campaign** – develop and marketing plan to entice talent to the region, leveraging rural advantage • **Workforce Development** – work with local businesses, regional partners, and academia to provide training/education and funding to satisfy future needs pipeline • **Diaspora Campaign Itasca** – Host a 2-day homecoming to encourage those who now live outside the area to use their success to inspire others.	Short term / Ongoing

Strategic Pillars – Foundational Cluster Development			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
Entrepreneurship & Partnerships	• 81 non-employer businesses; 2 new non-employer business formations in 2015 (2019 unknown); Local associations, education institutions and corporate	• **Entrepreneurial Ecosystem Upgrading** – working with entrepreneurs in & outside of the County to tailor support services and assist businesses and organizations to create environments e.g., coworking spaces and accelerators etc. • **Partnership Development** – Continue to build new partnerships and deepen existing ones to expand services and support available to local and foreign companies as well as tourists	Short term / Ongoing

Sample Initiative – Cluster Activation / Support Opportunity Areas

Sample Initiative – Talent Attraction & Development

Sample Initiative – Entrepreneurship & Partnerships

**** Note, the above foundational cluster development initiatives apply to all sectors***

10.1.2 Forestry – Sector/Subsector Opportunities & Initiatives

Sector/Subsector Opportunities			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
Green Economy	• Forestry is largely untapped in terms of leveraging biomass and forest residues to create pellets and biofuels, and bioproducts and biomaterials • High LQ/available workforce and technology in region to produce biomass energy • Limited number of companies producing biomaterials • Federal commitments to increase renewable energy and combat climate change; global demand for renewable energy	• **Biomass Campaign** – promote biomass opportunity to local companies and facilitate collaboration with regional partners to develop more biomass projects for local use and export • **Biomaterial Campaign** - promote biomaterial opportunity to local companies and facilitate collaboration with regional partners to develop projects for local use and export	Short term / Medium term Medium term
Real Estate Wave	• Globally, CLT market is projected to reach $982.1 million USD by 2026, from $562.6 million in 2020, at a CAGR of 9.7% during 2021-2026 • Nonresidential green buildings market reached approximately $80 billion in 2020 and is expected to hit $103 billion by 2023[xliii] • 2021 International Building Codes become more permissive • General increase in real estate development YoY	• **CLT Campaign** - promote CLT opportunity to local companies and facilitate collaboration with regional partners to develop projects for local use and export	Short term

Sector/Subsector Opportunities			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
Packaging	• Paper and Paperboard has seen a slight increase in demand in the last 10 years linked to growth in electronic retail sales and associated demand for containerboard products • Exports of Paper and Paperboard were roughly $1.5M in 2020, experiencing an 80% growth, while imports dependency remained heavy at roughly $41M in 2020 with minimal decline in growth at -5%.	• **Containerboard Campaign** - promote containerboard/ paperboard opportunity to local companies and facilitate collaboration with regional partners to develop projects for export and to assist with local import substitution	Short term / Medium term
Tourism	• Abundance of natural landscape • Forest-based tourism allows for social distancing and is Covid-resilient • 450 acres of mountain biking • 1 million acres of publically accessible forest land • More than 1,000 lakes • More than 2,000 miles of trails • Tourism to the State projected to reach rebound from 210K tourists in 2020 to 452K in 2021 and 709K in 2022, reaching close to 2019 levels by 2024[xliv]	• **Tourism Campaign** – build a plan and aggressively target major source regions e.g., Western Europe (largest source market) and domestic markets within the U.S, across Fishing, Hunting and Trapping as well as other outdoor sports and recreational activities	Short term / Medium term

10.2 Energy

10.2.1 Energy - Foundational Cluster Development

Strategic Pillars – Foundational Cluster Development			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
BR&E	• 6 Job Gains from Expansions and 0 Job Gains from Openings in 2019, with 40 Job Losses from Contractions in 2019 (Employer) • Strong LQ of 4.96 in 2019; however, between 2015 to 2019 it has decreased by 10.18%	• **Increase Retention Program** – proactively surveying and meeting with businesses to understand concerns in advance and collaborate towards creating solutions • **Key Account Program** – provided dedicated Economic Development staff resources to businesses with most economic impact or potential to facilitate anchoring them and attracting partners, clients and/or talent	Short term / Ongoing Medium term / Ongoing
Investment Attraction	• No FDI in County (note: there were 6 unspecified destination FDI projects from 2015-2019, which may include the County) • 0 business formations in 2015 or 2019	• **FDI Attraction Plan** – build an FDI Plan and proactively target foreign investors in the target sectors • **Domestic Attraction Plan** – build a Domestic Plan and proactively target US-based investors outside of the State in the sector • **Implement Investment Attraction Plans –** action plans, monitor progress, measure ROI, make necessary adjustments and return to the market with adjusted approach	Short term / Medium term / Ongoing Short term / Medium term / Ongoing Medium term / Ongoing

Strategic Pillars – Foundational Cluster Development			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
Infrastructure Development	• Stakeholder consultations revealed Infrastructure (Transportation and/or ICT) as #1 weakness to do business	• **Infrastructure Analysis** – conduct a comprehensive demand analysis to pinpoint needs and plan infrastructure investments needed to support current and anticipated economic growth	Medium term / Ongoing
Talent Attraction & Development	• Stakeholder consultations revealed Attracting / retaining skilled labor as #1 barrier to growth • Strong LQ of 4.96 in 2019; however, between 2015 to 2019, it has decreased by 10.18% • 0 job gains from openings	• **Talent Attraction Campaign** – develop and marketing plan to entice talent to the region, leveraging rural advantage • **Workforce Development** – work with local businesses, regional partners, and academia to provide training/education and funding to satisfy future needs pipeline	Short term / Ongoing
Entrepreneurship & Partnerships	• 3 non-employer businesses; 0 new non-employer business formations • Local associations, education institutions and major corporate support from flagship company	• **Entrepreneurial Ecosystem Upgrading** – working with entrepreneurs in & outside of the County to tailor support services and assist businesses and organizations to create environments, e.g., coworking spaces and accelerators etc. • **Partnership Development** – Continue to build new partnerships and deepen existing ones in order to expand services and support available to local and foreign companies as well as tourists	Short term / Ongoing

10.2.2 Energy – Sector/Subsector Opportunities & Initiatives

Sector/Subsector Opportunities			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
Green Economy	• Forestry is largely untapped in terms of leveraging biomass and forest residues to create pellets and biofuels • Upstream linkages with Forestry, food processing - waste management & remediation • Large and innovative local flagship company in MN Power • The U.S Energy Information Administration (EIA) forecasts that electricity consumption in the U.S. will increase by 2.2% in 2021[xlv] • Renewable growth may accelerate in 2021 as the new administration starts to execute on a platform that includes rejoining the Paris Climate Accord, investing $2 trillion in clean energy, and fully decarbonizing the power sector by 2035[xlvi]	• **Biomass Campaign** – promote biomass opportunity to local companies and facilitate collaboration with regional partners to develop more biomass projects for local use and export • **Smart Grid Deployment** - pilot and/or deploy smart grids in the County, working with regional energy companies, and/or partnering with research institutions and academia, or private sector service providers	Short term / Medium term Medium term
Real Estate Wave	• Nonresidential green buildings market reached approximately $80 billion in 2020 and is expected to hit $103 billion by 2023[xlvii]	• **Energy Efficient Building Support** – Consider making certain levels of energy efficiency a requirement for some new builds and promote	Short term / Medium term

Sector/Subsector Opportunities			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
	• Energy-efficient buildings are key in the fight against climate change	the funding and subsidies available for constructing and/or retrofitting buildings to be energy efficient	
Energy Technology	• The U.S Energy Information Administration (EIA) forecasts that electricity consumption in the U.S. will increase by 2.2% in 2021 after falling 3.9% in 2020, and electricity sales in the industrial sector specifically will grow by 3.3% in 2021, while sales to the commercial sector will increase by 1.4% in 2021.[xlviii] • New technologies can assist in lowering energy costs and making energy more accessible, in addition to creating new economies	• **Technology Adoption** – pilot new technologies, e.g., Internet of Energy (IoE), Blockchain, Energy-as-a-Service (EaaS) etc. with local energy providers, and/or partner with research institutions and academia, invite local companies to participate and/or share the results with them to foster adoption	Short term / Medium term

10.3 Mining

10.3.1 Mining – Foundational Cluster Development

Strategic Pillars – Foundational Cluster Development			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
BR&E	• Mining operations concentrated among 4 companies • Loss of 198 jobs between 2015 and 2019 • High L.Q. of 4.10 in Natural Resources and Mining vs Minnesota; declined by 25% between 2015 and 2019	• Conduct BR&E surveys to understand gaps, supplier shortages, talent attraction issues • Identify companies that are willing to participate in industry initiatives, host demonstration projects to increase innovation and knowledge transfer • Key Account Program with dedicated Economic Development staff resources to mining operators to attract partners, clients and/or talent	Short term / Ongoing Short term / Ongoing Medium term / Ongoing
Investment Attraction	• No FDI in County (note: there were 3 unspecified destination FDI projects in Agriculture, construction, & mining machinery from 2015-2019, which may include the County) • No business formations in 2015 or 2019 • Canada is one of the countries earmarked for rare earth metals importation (also	• Develop IEDC investment readiness to position Itasca County for facilitation, collaboration, training and information • FDI/ Domestic Attraction Plan– build Plans and proactively target foreign investors. Leverage proximity to Canada • Implement Investment Attraction Plans – action plans, monitor progress, measure	Short term Short term / Medium term / Ongoing

Strategic Pillars – Foundational Cluster Development			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
	Australia, Brazil) could offer processing opportunities[xlix]	ROI, make necessary adjustments and return to the market with adjusted approach	Short term / Medium term / Ongoing
Infrastructure development	• Stakeholder consultations revealed Infrastructure (Transportation and/or ICT) as #1 weakness to do business	• Infrastructure Analysis – conduct a comprehensive demand analysis to pinpoint needs and plan infrastructure investments needed to support current and anticipated economic growth	Medium term / Ongoing
Talent attraction & development	• Stakeholder consultations revealed Attracting / retaining skilled labor as #1 barrier to growth • Mining and Natural Resources L.Q. for Itasca vs Minnesota declined by 25% between 2015 – 2019, with only 9 job gains from openings	• Digital Nomads/Talent Attraction Campaign – develop a marketing plan to entice talent to the region, leveraging rural advantage • Workforce Development – work with local businesses, regional partners, and academia to provide training/education and funding to satisfy future needs pipeline for future mining focussing on technology deployment and sustainable mining	Short term / Ongoing
Entrepreneurship & Partnerships	• Zero business formations in 2015, 2019; • 4 non-employer businesses • Local associations, education institutions, foundations, utilities, and corporate	• **Entrepreneurial Ecosystem Upgrading** – working with entrepreneurs in & outside of the County to tailor support services and assist businesses and organizations to create environments, e.g. mining	Short term / Ongoing

Strategic Pillars – Foundational Cluster Development			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
	• MNEs in region involved in innovative projects	incubators, coworking spaces and accelerators etc. • **Partnership Development** – Continue to build new partnerships and deepen existing ones in order to expand services and support available to entrepreneurs, local and foreign companies as well as tourists	

10.3.2 Mining – Sector/Subsector Opportunities & Initiatives

Sector/Subsector Opportunities			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
Future Mining	• World's largest untouched deposits of copper, nickel and valuable rare earths in NE MN • Gold deposits at Greenstone Terrane, in Itasca County • Mesabi Iron Range • Demand for battery-grade nickel expected to rise 10-to-20-fold by 2030[i] • Geo-political concerns around supply of strategic metals	• **Future Visioning -** Vision and **positioning of** what future mining will look like in Itasca County 'powering the technology age and carbon-free economy' for sector transformation across the economic ecosystem (supply chains, workforce, key ecosystem actors)	Short term / Medium term
Transformative Mining Cluster	• Indicators point to a sector in decline:	• **Innovation Drive -** build knowledge-based business	Short term Ongoing

Sector/Subsector Opportunities			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
	• Between 2015 and 2019 Natural Resources & Mining (NAICs 11,21): Share of total employment declined from 6.1% to 4.6%, L.Q. declined by 25%, with loss of 198 jobs, shift-share differential of -173 jobs • Stakeholder Consultations revealed permitting among the top weaknesses of Itasca County as a place to do business • Very low L.Q. and declining concentration in knowledge-based industries: • Information (0.5.); employment declined by 13.4% • Professional & technical services (0.23); employment declined by 13%	concentration and employment. Consider a Prospect Mining Studio model that brings together start-ups, entrepreneurs, mining industry experts, funding partners, and academics to define challenges, prototype rapidly, and implement pilots at mining sites. • Work with companies, academia, stakeholders to investigate the idea of a hub for mining demonstration projects in remediation, extraction, net-zero practices	
Tap into Resource Potential	• Gold deposits at Greenstone Terrane, in Itasca County, Mesabi Iron Range • Zero business formations in 2015, 2019 • Only 4 non-employer businesses • Low L.Q. (0.23) in professional, scientific & technical services	• **Resource Exploitation** – draw on existing resources to maximize potential: • Work with companies involved in area exploration to determine future potential and opportunities of existing deposits • Catalogue inventory of viable opportunities in mineral deposits for	Short term

Sector/Subsector Opportunities			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
		prospecting/surveying, exploration • Attract more prospectors/ developers to build small business/entrepreneur base • Attract laboratory and testing services	
Sustainable Mining	• Tailings ponds in Mesabi Range by • Environmental benefits include: • Mitigation of environmental health risks; Reduction of acidic drainage from leaching of tailings • Reduce soil and water quality impairment[li] • Environmental remediation for mines is part of the American jobs plan	• **Closing the Loop Remediation** - Develop specialization in closed-loop operations/remediation: • Build on Prairie River Metals scram mining demonstration project • Investigate bioremediation opportunities in tailings ponds and tailings basins with stakeholders to advance industry sustainability and build innovation capacity	Short term / Medium term
Carbon Reduction	• Federal commitments to increase renewable energy and combat climate change; global demand for renewable energy • Major mining companies are developing net-zero operational plans[lii] • Pressure from customers, e.g. Tesla (nickel, cobalt), for sustainable mining practices[liii]	• **Cross Sector Collaboration** - Build cross-sector linkages between energy and mining, working with companies to promote renewable energy deployment in mining operations, use of electrification and hydrogen for materials handling and optimizing processing operations	Short term

Sector/Subsector Opportunities			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
		• Determine potential target companies for investment attraction, developing spin-off companies, and entrepreneurs	
Iron Ore Processing	• Traditional iron ore-based, blast furnace/basic oxygen furnace (BF/BOF) steelmaking method accounts for approximately 5% of all global carbon emissions[liv] • Federal commitments to increase renewable energy and combat climate change; global demand for renewable energy	• **Iron Ore Innovation** - Build on initiatives by U.S. Steel in the development of mustang pellets to pilot new innovations in Iron Ore processing, e.g. using hydrogen to reduce iron oxides, carbon capture, use and storage (CCUS), bioenergy and direct electrification (in conjunction with local energy providers). Utilize results for demonstration projects	Short term
Mining Technology Development	• Highest rate of advanced technology deployment among mining companies in the State (Note: higher than national average) in robotics and A.I. but still a minority of companies (nearly 17% estimated) with plenty of room to improve • The 'Era of Smart Mines'[lv]	• **Advanced Technology Adoption** - pilot new technologies with local mining companies, e.g. digital twinning, A.I., robotics, autonomous vehicles and/or partner with research institutions and academia, invite local mining companies to participate and/or share the results to foster increased adoption	Short term / Medium term
Supply Chain Development	• Supply chain gaps identified in mining supply and services, e.g. Equipment hire, process control equipment, maintenance and repair, fuel	• **Enhance Cross-sector Linkages** - between mining and manufacturing, construction and identify supplier and	Short term

Sector/Subsector Opportunities			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
	handling and storage, mineral fuels, and heavy construction, bulk haulage • Small manufacturing base – low L.Q. (0.5) • Construction company concentration above average - LQ (1.18)	potential diversification opportunities • Address supply chain gaps through domestic investment attraction campaigns • Build a web-based supply chain directory for Itasca County with mining sector information, suppliers, and companies to promote Mining Supply and Services offerings, collaboration and sector development	
Tourism	• Abundance of natural landscape • Tailings offer remediation potential and are an attraction in themselves • Activities allow for social distancing and are Covid-resilient • 450 acres of mountain biking • 1 million acres of publicly accessible forest land • More than 1,000 lakes • More than 2,000 miles of trails • Tourism to the State projected to reach rebound from 210K tourists in 2020 to 452K in 2021 and 709K in 2022, reaching close to 2019 levels by 2024[lvi]	• **Tourism Campaign** – build a plan and aggressively target major source regions, e.g., Western Europe (largest source market) and domestic markets within the U.S. across Fishing, Hunting and Trapping as well as other outdoor sports and recreational activities	Short term / Medium term

Sample Initiative – Transforming Mining Cluster

Sample Initiative – Existing Resources

10.4 Manufacturing

10.4.1 Manufacturing – Foundational Cluster Development

Strategic Pillars – Foundational Cluster Development			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
BR&E	• 70 Job Gains from Expansions and 3 Job Gains from Openings in 2019, with 175 Job Losses from Contractions in 2019, representing a 16.2% decline • Low L.Q. of 0.5 in 2019 • 126 employer/non-employer businesses • Key anchor companies in manufacturing subsectors	• **Increase Retention Program** – proactively surveying and meeting with businesses to understand concerns in advance and collaborate towards creating solutions • **Key Account Program** – provide dedicated Economic Development staff resources to businesses with most economic impact or potential to facilitate anchoring them and attracting partners, clients and/or talent	Short term / Ongoing Medium term / Ongoing
Investment Attraction	• Potentially limited FDI in County - Cutsforth Manufacturing to Cohasset in 2013 (note: there were 16 manufacturing projects unspecified destination FDI projects from 2015-2019, which may include the County excluding bio-medical related products) • Very low rate of business formations: 1 in 2015; 1 in 2019	• **FDI Attraction Plan** – build an FDI Plan and proactively target foreign investors in manufacturing activities that are complementary to mining, forestry and energy • **Domestic Attraction Plan** – build a Domestic Plan and proactively target U.S. based investors outside of the State in manufacturing activities that are complementary to mining, forestry and energy	Medium term / Ongoing Medium term / Ongoing

Strategic Pillars – Foundational Cluster Development			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
	• $26.17/hour in Itasca County, significantly below the State average $30.12 and national average $29.51	• **Implement Investment Attraction Plans –** action plans, monitor progress, measure ROI, make necessary adjustments and return to the market with adjusted approach	Medium term / Ongoing
Infrastructure Development	• Stakeholder consultations revealed Infrastructure (Transportation and/or ICT) as #1 weakness to do business	• **Infrastructure Analysis** – conduct a comprehensive demand analysis to pinpoint needs and plan infrastructure investments needed to support current and anticipated economic growth	Medium term / Ongoing
Talent Attraction & Development	• Stakeholder consultations revealed attracting/retaining skilled labor as #1 barrier to growth • Under-utilized workforce: high proportion f those with manufacturing skills commute outside Itasca County – 929, a greater number than those employed in the sector - 837 • LQ for Itasca vs Minnesota declined by 13.7% from 2015 – 2019 • Only 3 job gains from openings	• **Talent Attraction/Digital Nomads Campaign** – develop and marketing plan to entice talent to the region, leveraging rural advantage • **Workforce Development** – work with local businesses, regional partners, and academia to provide training/education and funding to satisfy future needs pipeline	Short term / Ongoing
Entrepreneurship & Partnerships	• Manufacturing comprises only 3% (89) of non-employer businesses; • Very low rate of business formations: 1 in 2015; 1 in 2019	• **Entrepreneurial Ecosystem Upgrading** – working with entrepreneurs in & outside of the County to tailor support services and assist businesses and organizations to create	Short term / Ongoing

Strategic Pillars – Foundational Cluster Development			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
	• Local associations, education institutions, foundations, utilities, and corporate	environments, e.g. makerspaces, coworking spaces and accelerators etc. • **Partnership Development** – Continue to build new partnerships and deepen existing ones to expand services and support available to entrepreneurs, local and foreign companies as well as tourists	

10.4.2 Manufacturing – Sector/Subsector Opportunities & Initiatives

Sector/Subsector Opportunities			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
Maker Culture	• Systemic workforce participation indicators - Itasca's labor force participation rate (57%) is well below M.N. and U. S. national averages, declining over the last five years • Move to provide makerspaces in M.N. schools[lvii]	• **Maker Movement** - Build a maker/entrepreneur culture from the ground up • Include children's, youth, family programming in makerspaces. Collaborate with local schools on makerspace provision • Ensure facilities (e.g. Cohasset Manufacturing facility) provide inclusive access to encourage the public to take on maker projects	Short term/ Medium term

Sector/Subsector Opportunities			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
		• Validate for library equipment provision such as 3D printers	
Manufacturing Technology Makerspace	• Digital technologies have emerged as a powerful tool for helping manufacturers maintain continuity in the face of major challenges such as pandemics[lviii] • 89 non-employer businesses, limited supply of I.T. skills • Low L.Q. in Information in relation to M.N., NE MN and U.S. • Employment density in information services is less than half of the U. S. average	• **Maker Manufacturing Tech** - Develop manufacturing technology-focused makerspace/incubator facility to build knowledge-based skills capacity • Ensure facilities provide a comprehensive range of tools/technologies for product prototyping • Work with manufacturing companies to identify possibilities around in-house makerspaces/prototyping facilities	Short term / Medium term
Maker Movement	• Rapid growth of micro manufacturer and online platforms, e.g. Etsy • Estimated 135 million U.S. adults who are makers[lix]	• **'Meet your Maker'** - Identify local makers via platforms such as Etsy and distributed manufacturing platforms such as Fictiv, 3D Hubs, Additively, Maker's Row and create local interest groups around manufacturing	Short term
Distributed Short-run Manufacturing	• Moves toward reshoring - questioning of 'innovate here' and 'manufacture there' model • Buy America policies	• **Short-run Manufacturing Qualification** - Investigate prototyping and short-run manufacturing capabilities to build local manufacturing capacity for product customization	Short term

Sector/Subsector Opportunities			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
Advanced Manufacturing Technologies	• Manufacturing company's rate of advanced technology deployment in the State is 14% in robotics, 6% in A.I. (Note: higher than national average) in robotics and A.I. but still a minority of companies (nearly 17% estimated) with plenty of room to improve • According to the Boston Consulting Group, the U.S. urgently needs a more aggressive approach to developing and adopting robotic technologies for manufacturing[lx]	• **Advanced Technology Adoption -** pilot new technologies with local manufacturing companies, e.g. A.I., digital twinning, virtual reality, robotics, and/or partner with research institutions and academia, invite local mining companies to participate and/or share the results to foster increased adoption	Short term / Medium term
Complimentary Cluster Building: Forestry **Green Economy Manufacturing**	• Limited number of companies producing biomaterials • Federal commitments to increase renewable energy and combat climate change; global demand for renewable energy • The global Biomaterials Market is projected to reach USD 47.5 billion by 2025 from USD 35.5 billion in 2020, at a CAGR of 6.0% during the forecast period[lxi]	• **Biomaterial Campaign** - promote biomaterial opportunity to local manufacturing companies facilitate cross-sector collaboration with regional partners to develop projects for local use and export	Short term / Medium term
Complimentary Cluster Building: Forestry **CLT Supply Chain**	• Globally, CLT market is projected to reach $982.1 million USD by 2026, from $562.6 million in 2020, at a	• **Leverage CLT Campaign** - in forestry to investigate supply chain manufacturing opportunities to local companies and facilitate	Short term/ Medium term

Sector/Subsector Opportunities			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
	CAGR of 9.7% during 2021-2026 • Nonresidential green buildings market reached approximately $80 billion in 2020 and is expected to hit $103 billion by 2023[lxii] • 2021 International Building Codes become more permissive • Wood products manufacturers in Itasca county; entrepreneurs-16 non-employers	collaboration with regional partners to develop projects for local use and export	
Complimentary Cluster Building: Forestry Packaging	• Paper and Paperboard has seen a slight increase in demand in the last 10 year linked to growth in electronic retail sales and associated demand for containerboard products • Exports of Paper and Paperboard were roughly $1.5M in 2020, experiencing an 80% growth, while imports dependency remained heavy at roughly $41M in 2020 with minimal decline in growth at -5%.	• **Containerboard Campaign** - promote containerboard/paperboard opportunity to local Manufacturing companies and facilitate collaboration with regional partners to develop projects for export and to assist with local import substitution	Short term / Medium term
Complimentary Cluster Building: Mining Supply chain development	• Manufacturing supply chain gaps identified in mining supply and services, e.g. process control equipment, fuel	• **Enhance Cross-sector Linkages** - between mining and manufacturing, to identify supplier opportunities and	Short term

Sector/Subsector Opportunities			
Key Themes	**Evidence**	**Initiatives**	**Timeline**
	handling and storage (fabrication), • Small manufacturing base – low L.Q. - 0.5 but growing L.Q. in Fabricated metals • 4 Fabricated metal companies – including MNE, local companies plus 14 non-employers in Itasca County	potential diversification opportunities ○ Address supply chain gaps through domestic investment attraction campaigns	
Closing the Loop	• High L.Q. in waste management and remediation in relation to the State and U.S. >1	• **Circular Economy** - Identify circular economy opportunities through BR&E activities	Short term/ Medium term
Tourism Manufacturing	• Tourism assets have gained traction in the region derived from natural landscape, forestry and mining remediation • Innovative company Rox Speed F.X. with patent activity • 37 non-employers in leisure related activities fishing and hunting/trapping	○ Explore potential for building on the presence of Rox Speed F.X. for leisure-based manufacturing ○ Complimentary FDI and tourist attraction targeting to major source regions, e.g., Western Europe (largest source market) and domestic markets	Medium term

Sample Initiative – Maker/Entrepreneur Culture

CHILDREN'S PROGRAMMING IN MAKERSPACES

Exposure to manufacturing technology concepts should begin from an early age with family involvement. Provide a combination of children's, youth, family programming in makerspaces to learn the processes of making through hands-on experiences in digital and physical materials. Reinforce this process through collaboration with local schools on makerspace provision.

MAKESHOP®

https://pittsburghkids.org/exhibit/makeshop/

Sample Initiative – Tech Makerspace Incubator

IN-HOUSE MAKERSPACES/ PROTOTYPING FACILITIES

Itasca County is home to several large manufacturers, some of which are IEDC partners, presenting possibilities for in-house makerspaces and prototyping facilities and distributed short-run manufacturing capabilities. This model enables existing employees to harness their creativity and facilitates local manufacturing capacity through skills development and spin-offs.

1B FirstBuild

https://firstbuild.com

Sample Initiative - Partnerships

CO-OPS BEHIND RURAL MAKERSPACES

IDEA CO-OP — CONVERGE • COLLABORATE • CONNECT

IEDC benefits from support from a diverse range of significant actors in the economic ecosystem, including foundations and energy co-ops. Such organizations can have a pivotal role in driving community-driven initiatives, which creates buy-in and enables building a maker/entrepreneur culture from the ground up.

https://idea.coop/

11 Appendix

11.1 Appendix A – Economic Ecosystem Deep Dive

Economic Ecosystem Deep Dive

Comprehensive research was undertaken to compile an inventory of the key actors in the economic ecosystem for renewable energy manufacturing, mining, and forestry value chains with respective up and downstream links.

Information was gathered on the companies, the supply chain, and support to the value chain such as industry associations, education, training, human resources, government support, research and development assets.

This exercise goes beyond NAICs codes to enable a deeper understanding of the cluster characteristics.

Detailed Value Chains can be found below, and the Excel versions can be provided upon request. These charts show Itasca County's value chain in Manufacturing, Mining, Forestry and Renewable Energy with industry subsets. IEDC can also use this information for the compilation of sector directories.

Figure 18 - Manufacturing Value Chain

Manufacturing	
Manufacturer Companies	
Wood Products	Savanna Pallets, Nelson Wood Shims
Printing & Related Support	UPM/Blandin Paper Company, Winton Pulp & Paper Corp
Fabricated Metal Products	RMS Tritec, Superior Rock Bit Company, L&M Radiator, ASV Holdings, Cleveland-Cliffs, Northland Machine, U.S. Steel, NewCon, Northern Castings Corporation,
Plastics and Packaging	Midstate Plastics Corporation, Minnesota Diversified Industries (MDI)
Miscellaneous	Lonza Consumer Health, MNSTAR Group Highland Holdings (electronics), Rox Speed FX **Microbuisnesses:** Bastens - 3D printed items, Gayle L Casselton - leather goods, Jen's Wreaths
Distribution/service	
Manufacturing parts distribution	Dakota Fluid Power, McCoy Construction & Forestry, Terex
Manufacturing servicing/repair	Dakota Fluid Power, Industrial Lubricant, ISCO, H-E Parts
Industry Support	
Specialist Technical & Professional Services	Bastens - 3D printed items, CompuDyne Corporation
Local Logistics and Warehousing: Logistics - truckers, shippers, shipping companies, storage	Broking's Transport, Wille Transport Inc.
Recycling	Holmes Recycling Services, G-Men ES
Funding	The Entrepreneur Fund, Great River Energy, Emerging Entrepreneur Loan Program, Indian Business Loan Program, Work Opportunity Tax Credit (WOTC)
Incubators, co-working, spaces	Manufacturing facility to be built in Cohasset
Commercialization, business support	**Chambers of Commerce:** Grand Rapids, Cass Lake, Deer River, Remer, Leech Lake **Northland Small Business Development Center** **Small Business Development Center (SBDC)** **Natural Resrources Research Institute, University of Minnesota, Duluth:** The Commercialization Services Platform provides expertise coupled with technical core competencies to drive innovation. **Programs:** Commercialization & Financial Support Launch Pad for Entrepreneurs Project Management Business Development
Industry Associations	Arrowhead Manufacturers and Fabricators Association (AMFA), Tri-State Manufacturers' Association, Midwest Manufacturers' Association, Minnesota Precision Manufacturing Association, Manufacturer's Alliance, Central Minnesota Manufacturers Association (CMMA), Women in Manufacturing - Minnesota

Education, Training and Human Resource Support	
Speciallist Education Programs - Local and Regional Institutions - 2-Year College	**Itasca College: A**ssociate's degrees in engineering **Fond du Lac Tribal and Community College**: Introduction to Pulp & Paper Technologies **Rainy River Community College:** Chemistry, engineering, electronics, Industrial technology **Mesabi Range College:** Chemistry,Electrical and Industrial Automation Technology, Electrical Controls and Maintenance, Engineering, Industrial Technology Safety, Industrial Mechanical Technology, Mobile Equipment Service Technician, Process Automation Systems, Welding, **Lake Superior College:** Diplomas/degrees - Computer-aided Design, CNC Programmer, Engineering Technology, Advanced Machine Production Technologist, Machine Production Technologist Diploma, welding, electronic engineering **Hibbing Community College:** Diesel Mechanics - AAS Degree/Diploma -Electrical Maintenance, Heating & Cooling Technician, Associate in Science Degree/Applied Science Degree
Specialist Education Programs - Local and Regional Institutions - University	**University of Minnesota Duluth:**Programs in Industrial Engineering; chemical engineering; chemistry; engineering: civil, mechanical, electrical; computer science; materials Science and engineering; Materials Science and Engineering; applied materials science **The College of St. Scholastica:** Master of Science in Applied Data Analytics; Master of Science in Project Management, Chemistry
Customized programs/training	Northeast Minnesota Office of Job Training, Minnesota Job Skills Partnership, Northforce, **Itasca Community College:** apprenticeship/trainee programs: Electrical & Instrumentation, Manufacturing & Machinist, Pre-Trade and Craft and Welding, national electrical code, **Lake Superior College:** Certificate available in general manufacturing, automated manufacturing, welding, production, machine
Research and Development	
Corporate	**Rox Speed FX, A.S.V. have applied for patents in the last 10 years** **Northland Machine** is committed to the latest advancements in manufacturing: State of the art CNC machines;CAD design software; Coordinate Measuring Machines **Midstate Plastics Corporation:**purchase recycled raw materials to make products, recycle all of plastic **Minnesota Diversified Industries (MDI):** Social innovation - a nonprofit, social enterprise manufacturer
Research and Development	**Itasca Community College:** Fabrication Labs, **University of Minnesota Duluth:** Research Instrumentation Lab, Advanced Materials Center, Materials and Bioeconomy Platform, Materials and Bioeconomy Research Group, School of Mechanical & Industrial Engineering, Minerals and Metallurgy Research Group
Infrastructure	5 Airports: Bigfork Municipal Airport, Bowstring Airport, Deer River Municipal Airport, Gospel Ranch Airport, Grand Rapids A general aviation airport in Grand Rapids, plus easy access to commercial airports in nearby Hibbing, Duluth, and the Twin Cities Federal highway connections to Twin Cities, Duluth, and Fargo metro areas Two Class I railroads: BNSF and CN Foreign Trade Zone status available through the Duluth Seaway Port Authority Three electrical utility companies, Minnesota Power, Lake Country Power, and the North Itasca Electric Cooperative Natural gas: Minnesota Energy Resources - Broadband: 15 providers: including speeds well over 100 Mbps from Paul Bunyan Communications and Mediacom

Figure 19 - Mining Value Chain

Mining	
Mine Exploration	
Exploration - 2010-2019	Vermillion Gold, AngloGold Ashanti Minnesota, ArcelorMittal, Lehmann Exploration
Mine Operations	
Mine Operations: Itasca County	Tacora Resources, Prairie River Minerals, US Steel Keewatin Taconite, Mesabi Metallics, ERP Iron Ore (bankrupt)
Contiguous to Itasca County - Mesabi Range (St. Louis)	Hibbing Taconite, Steel Dynamics, ArcelorMittal Minorca, Cliffs Erie, Mining Resources (Steel Dynamics, Magnetation), United Taconite, Northshore Mining (Cliffs Erie) Mesabi Nugget (Steel Dynamics) Twin Metals Minnesota, Polymet Mining, US Steel (Minntac)
Services	
Drilling & Blasting	Taconite Drilling, Pro Blast Technology, Dyno Nobel
Materials Handling	H-E Parts, Conveyor Belt Services, Champion Charter, Pit & Quarry Supplies
Mineral Processing	Tacora Resources, Prairie River Minerals
Fabrication & Casting	Furin & Shea Welding & Fabricating, ISCO, RMS Tritec, Northern Castings Corporation, R.C. Fabricators
Pumps & Pipelines Water	Amptek, Iracore International, Champion Charter Sales & Service, Jasper Engineering & Equip. Co
Fuel Handling & Storage	L&M Radiator, Edwards
Process Control	Amptek (St. Louis), JDI Contracts, Jasper Engineering & Equip. Co
Power Transmission	Interstate Power Systems, H-E Parts, Border States Electric
Health, Safety & Environment	LVC Companies, General Waste, Environmental Troubleshooters
Emergency Response	Guardian Flight, Range Regional Airport
Site - Construction	JDI Contracts, Hammerlund, The Boldt Company, Seppi Bros, Hoover Construction,
Logistics - Bulk Haulage	Vic's Crane & Heavy Haul, Hammerlund
Equipment & Supplies	
Manufacturing - Specialist Machinery/supplies	Terex, Superior Rock Bit Company, L&M Radiator, Komatsu
Machinery Distributors and Supply	Dakota Fluid Power, Industrial Lubricant, Terex, Ziegler CAT, H&L Mesabi, Lind Industrial Supply, Jasper Engineering & Equipment Company, Graybar, General Equipment & Supplies, Tu, fco, Jasper Engineering & Equip. Co, Sharrow Lifting Products, Mesabi Radial Tire Company
Bulk Products	Dakota Fluid Power
Maintanence & Repair, Components & Parts	Dakota Fluid Power, Industrial Lubricant, ISCO, H-E Parts
Equipment Hire	Vic's Crane & Heavy Haul
ICT Support	
Computer Hardware	CompuDyne Corporation, Torrent Technologies
Computer Software	JDI Contracts, LVC Companies
Automation and Control	Amptek (St. Louis), JDI Contracts
Engineering and Technical Support	
Engineering: Civil, Mechanical/Elect	Barr Engineering and Environmental Science, JDI Contracts, SHE, JPJ Engineering, Golder Associates , GEI, Braun Intertec, Northfield Engineering and Consulting, NTS
Environmental/Reclamation Servic	Taconite Drilling, SEH, JPJ Engineering, Global Minerals Engineering, GEI, Environmental Troubleshooters, Braun Intertec, NTS
Compliance and Risk Services	SEH, Global Minerals Engineering, Environmental Troubleshooters
Testing/Analytical Supplies & Servic	Global Minerals Engineering, Superior Mineral Resources, Primary Sensors & Controls Company
Geotechnical Analysis and Consultir	GEI, Braun Intertec

Industry Support	
Industry Associations/Groups	Minnesota Iron Mining Association, Western Mesabi Region
Natural Resources Research Institute, University of Minnesota, Duluth	The Commercialization Services Platform provides expertise coupled with technical core competencies to drive innovation. **Programs:** Commercialization & Financial Support Launch Pad for Entrepreneurs Project Management Business Development
Commercialization, business support	**Chambers of Commerce:** Grand Rapids, Cass Lake, Deer River, Remer, Leech Lake **Northland Small Business Development Center** **Small Business Development Center (SBDC)** **Natural Resrources Research Institute, University of Minnesota, Duluth:** The Commercialization Services Platform provides expertise coupled with technical core competencies to drive innovation. **Programs:** Commercialization & Financial Support Launch Pad for Entrepreneurs Project Management Business Development
Funding	**MN Department of Iron Range Resources & Rehabilitation:** Taconite Economic Development Fund, Drilling Incentive grants, Mineland Reclamation grants The Entrepreneur Fund, Emerging Entrepreneur Loan Program, Great River Energy, Indian Business Loan Program, Work Opportunity Tax Credit (WOTC)
Education, Training and Human Resource Support	
Speciallist Education Programs - Local and Regional Institutions - 2-Year College	**Itasca Community College:** diplomas/associate degrees chemistry; engineering; natural science, geography & GIS, environmental science **Fond du Lac Tribal and Community College:** dipomas/associate degrees Geographic Information Systems, Chemistry, Environmental Chemistry, Geology **Rainy River Community College:** Chemistry, engineering, electronics, Industrial technology **Mesabi Range College:** Chemistry, Construction Management, Drafting, Electrical and Industrial Automation Technology, Electrical Controls and Maintenance, Engineering, Geology, Industrial Technology Safety, Industrial Mechanical Technology, Mobile Equipment Service Technician, Process Automation Systems, Welding, **Lake Superior College:** Diplomas/degrees - Computer-aided Design, CNC Programmer, Engineering Technology, Advanced Machine Production Technologist, Machine Production Technologist Diploma, welding, Civil Engineering Technology, Electronic Engineering **Hibbing Community College:** Diesel Mechanics - AAS Degree/Diploma -Electrical Maintenance, Heating & Cooling Technician, Geography/ Geographic Information Systems (GIS), Associate Degree in Science/ Applied Science **Vermilion Community College:** Land Surveying, Environmental Science, Water Quality Science

Speciallist Education Programs - Local and Regional Institutions - University	**University of Minnesota Duluth:** geology; environmental science; chemical engineering; chemistry; engineering: civil, mechanical, electrical; computer science; environment, sustainability & geography; environmental science; geographic information science; geological science; Materials Science and Engineering; applied materials science **The College of St. Scholastica:** Master of Science in Applied Data Analytics; Master of Science in Project Management, Chemistry
Customized programs/training	Northeast Minnesota Office of Job Training, Minnesota Job Skills Partnership, Program Iron Mining Association of Minnesota, Northforce, Minerals Education Coalition; **Itasca Community College:** apprenticeship/trainee programs: Electrical & Instrumentation, Manufacturing & Machinist, Pre-Trade and Craft and Welding, national electrical code **Lake Superior College:** Certificate available in workplace safety **Minnesota State -Advanced Minnesota** Training courses: Mine Safety and Health Administration (MSHA), New Miner, Refresher training Occupational Safety and Health Administration (OSHA)
Research and Development	
Corporate - Mining	**Prairie River Minerals:**constructing and operating a demonstration-scale scram mining and processing facility **Cliffs' Northshore Mining** first in nation to produce pellet that will be used by electric arc furnace 'Mustang Pellets' **Nu-Iron Technologies (a wholly owned, full subsidiary of Nucor Steel)** Metallized Iron Nodule Production to demonstrate the ability to continuously produce high-quality iron nodules at low cost with University of Minnesota's Natural Resources Research Institute (NRRI)
Centres of Excellence	**University of Minnesota Duluth:** U-Spatial, Natural Resources Research Institute - Minerals and Metallurgy, Engineering/ Process Modeling, Extractive Metallurgy,Mineral Characterization/Geology, Mineral Processing/Comminution/Benefication, Product Diversification/Alternative Iron-making Technologies, Taconite By-Product Development, 5 labs. Research Instrumentation Lab **Itasca Community College:** Fabrication Labs
Infrastructure	5 Airports: Bigfork Municipal Airport, Bowstring Airport, Deer River Municipal Airport, Gospel Ranch Airport, Grand Rapids A general aviation airport in Grand Rapids, plus easy access to commercial airports in nearby Hibbing, Duluth, and the Twin Cities Federal highway connections to Twin Cities, Duluth, and Fargo metro areas Two Class I railroads: BNSF and CN Foreign Trade Zone status available through the Duluth Seaway Port Authority Three electrical utility companies, Minnesota Power, Lake Country Power, and the North Itasca Electric Cooperative Natural gas: Minnesota Energy Resources - Broadband: 15 providers: including speeds well over 100 Mbps from Paul Bunyan Communications and Mediacom
Companies in St. Louis County indicated in red	

Figure 20 - Forestry Value Chain

Forestry	
Companies / Descriptions	
Inputs	
Woodlot owners, logging	For timberland area within 90 miles of Grand Rapids, 40% are privately-owned and 47% public. Statewide, private landowners control approximately 47% of Minnesota's timberland. State and local governments manage about 40%. Along with public and private sources of timber, Minnesota also has several industrial timberland owners, such as Forest Capital Partners, **UPM-Blandin Paper Company** and Potlatch, Evergreen Christmas Trees, Rivard Companies
Secondary Processing	
Processing for bio-mass, pulp, wood products, fuel, chemicals, bio-chemicals	Grand Rapids is the most centrally located with respect to wood supply. Estimates based on 2005-2009 FIA (Forest Inventory Analysis) data show 75.8 million dry tons of merchantable biomass within 60 miles of Grand Rapids. Over 77% of this biomass is in hardwood cover types. **MN Power**, **UPM Blandin Paper Mill**, Sappi North America, Ever-Green Energy, Rivard Companies Inc. DBA Central Wood Products, The Mulch Store, Green Friendly Wood Pellets, Wood Pellet Coop, Great Lakes Lumber Company Pellet and Grill Division, Interstate Pellets, H. E. Westerman Lumber Company, Hill Wood Products, Mat Inc., Pallet Resource Corp, Simonson Lumber Company of St. Cloud, Simonson Properties Company, Sylva Corporation
Inputs for pulp production	Aspen still comprises nearly 50% of the statewide harvest with it a preferred species by Minnesota's pulp and paper industry. Maple and spruce/fir are also species in demand for pulpwood. There are 8 paper/pulp producers and wood products manufacturing operations within 120 miles of Grand Rapids
Saw mills / Pulp mills, Papermills/ Millwork	Blackduck Saw Mill, **Rajala Mill Co**, Summit Sawmill, Wagner Sawmill Blackduck, Cass Forest Products, Critchfield's Custom Sawmilling, Tasler Northwoods Inc, PotlatchDeltic, Siwek Lumber & Millwork, Ferche Millwork, Hedstrom Lumber Company, Heritage Millwork, Northern Contours Of Kentucky, Ely Winton Pulp & Paper Corp, International Paper Co, J. B. O'meara Co.
Next generation engineered wood e.g. CLT, wood fibre insulation etc.	Regional sawmills reported currently producing 300 million board feet (MMBF) of lumber in the grades and species suitable for producing CLT. More than half of the surveyed mills' current production was reported as 2 x 4 lumber, which is not currently preferred for CLT. Of the total volume of lumber suitable for CLT produced within the region, more than 80% is being sold to consumers through retailers International Bildrite
Wood products Manufacturing	Savanna Pallets, Nelson Wood Shims
Recycling / Processing of Secondary Resources	
Disposal and Recycling	Hathaway Tree Service, B & D Wood Recycling And Composting, Dunham Brothers Wood Recycling, Environmental Wood Supply, Minnesota Wood Recyclers
Composting	B & D Wood Recycling And Composting, , The Mulch Store, Minnesota Mulch and Soil, Cottage Grove Compost Site

Intermediate and Final Demand Uses	
Fuel / energy production including Biomass	**Minnesota Power**, Boise Cascade, Sappi, District Energy, Hill Biomass
Built Environment, Reconstituted Wood Product Manufacturing	Minneapolis's T3 building - the first modern, tall wood building in the U.S. Built in November 2016, the seven-story, 220,000-square-foot structure, altered parameters within the commercial building industry Great Lakes Lumber Company (flooring), Siwek Lumber & Millwork Corp (doors, windows, sheds, garages etc)., Api Garage Door Company, Colonial Craft, Ferche Millwork, Glenbrook Lumber & Supply, H-Window Co, Hill Wood Products, International Bildrite, Lexington Manufacturing, Littfin Lumber Co, Lloyd Lumber Co., Marshall Truss Systems, Midwest Hardwood Corporation, Navy Island Inc., P & M Truss, Shaw/Stewart Lumber Co, St. Croix Valley Hardwoods, Structural Wood Corporation, Truss Specialists, Unidoor Corporation, Buffalo Veneer & Plywood Company, Hill Biomass, J.R. Jones Fixture Company, Lindsay Windows
Packaging Print & Paper Products	Packaging Corporation of America (Boise Paper), **Blandin Paper Company**, Business Card Service, Cloud 9 Design, Kempf Paper Corporation, Liberty Paper, Minnesota & Ontario Paper Co., Patriot Converting, Plainwell Paper Company, Potlatch Corporation, Minnesota Paper Company, Potlatch Corp., Sappi, Priority Envelop, SNAFU Designs, Stora Enso Duluth Paper Mill
Furniture / Residential Supplies	Aaron Carlson Corporation, Acorn Millwork, Advanced Office Concepts, Buffalo Veneer & Plywood Company, Commercial Millwork Solutions, Hill Wood Products, Woodline Manufacturing, Foldcraft, J.R. Jones Fixture Company, Siewert Cabinet & Fixture Manufacturing
Other Consumer Goods: Textiles, Paint, Tires, Glue, Fertiliser	Agristrand Mankato, **Airmark**, Artistic Finishes, Diamond Brands Incorporated, Impact Innovations, Lexington Manufacturing, M D I Government Services, Mcgowan Manufacturing Company, Page & Hill Forest Products Inc, Precision Press, Staggemeyer Stave Co, The Hadley Companies, Webway, International Paper, Hill Biomass
Fishing, Hunting and Trapping	**Minnesota Deer Hunter's Association**, Audubon Center Of The North Woods
Industry Support	
Manufacturing Support - Machinery – saws, cutting machines, graders, dozers, excavators, trucks, front-end-loaders, skidders	**Ponsse North America Inc**, Savage Trailers Inc, Viking Mat Co., Builtrite Handlers & Attachments, Johnson Bros. Metal Forming Co., Bell Lumber & Pole Company, Norbord Minnesota, Hedstrom Lumber Company, Inc., Louisiana Pacific Corp., PotlatchDelticm, Berry Pallets, United Packaging, Viking Pallet Corporation, Villaume Industries, Wood'n Pallets Inc, Woodland Container Corporation
Machinery Distributors	Forestry Equipment Sales, Birnstengel Equipment, Bobcat, Crawfords Equipment, Lano Equipment, Midwest Hardwood Corporation
Specialist Technical & Professional Services – Planning, Mapping, legal, insurance, science, biologists, habitat management, archeological expertise	Kunde Co. Inc (GPS field data recorders); Molpus (Land Management, Strategic Planning and Information Systems, Legal & Accounting etc.), Precision Landscape & Tree Inc (tree disease treatment, timber management etc.), Logan Tree Experts

Itasca County - Specialist Logistics and Warehousing: Logistics - Heavy equipment operators, truckers, shippers, shipping companies, storage, timber tract operators	Broking's Transport Incorporated, Wille Transport Inc.
Minnesota - Specialist Logistics and Warehousing: Logistics - Heavy equipment operators, truckers, shippers, shipping companies, storage, timber tract operators	North American Trailer, Savanna Pallets, Savage Trailers Inc, Rockland Industrial Products, Advanced Courier Services, Inc., Anderson Trucking Service, Inc., Autumn Transport, Inc.,Canadian National, Cargill Marine And Terminal, Inc., CF AirFreight Corporation, Dart Transit Company, Drop Ship Express, Duluth, Missabe & Iron Range Railway Company, Freerksen Trucking, Inc., Fruth Trucking, Inc., J&R Schugel Trucking, Inc., Lawrence Leasing, Inc., Logistics Planning Services, Inc., Midwest Specialized Transportation, Inc., Minn-Tex Express, Inc., Minnesota Commercial Railway Company, MinStar Transport, Inc., Night Train Trucking, Inc., North Star Rail Intermodal LLC, Northern States Transportation, Inc., Northwest Airlines, Inc., NWA, Inc., Progressive Rail Incorporated, Ravelll Trucking, Inc., Soo Line Corporation, Soo Line Railroad Company, Inc., Stockman Transfer, Inc., Sun Country Airlines Holdings, Inc. , Sun Country Holdings, LLC, Sun Country, Inc., Twin Express Inc., Waletich Corporation, Western Co-op Transport Association, Carlson Timber Products
Access to land	Fairly supportive. IEDC would purchase the land then sell to investor, providing for a faster process. Getting around issues with tax forfeit land/properties. A usable program exists. There are thoughtful land development strategies tied to land harvests.
Natural Resources Research Institute, University of Minnesota, Duluth	**Chambers of Commerce:** Grand Rapids, Cass Lake, Deer River, Remer, Leech Lake **Northland Small Business Development Center** **Small Business Development Center (SBDC)** **Natural Resources Research Institute, University of Minnesota, Duluth:** The Commercialization Services Platform provides expertise coupled with technical core competencies to drive innovation. **Programs:** Commercialization & Financial Support Launch Pad for Entrepreneurs Project Management Business Development
Funding/Programs	The Minnesota State Legislature established the Bioincentive Program in 2015 to encourage commercial-scale production of advanced biofuels, renewable chemicals, and biomass thermal energy through production incentive payments. Biomass Thermal Energy Production Incentive Program (Minnesota Dept of Agriculture) Advanced Biofuel Production Incentive Program Renewable Chemical Production Incentive Program Rural Energy for America Program (REAP) Funds Available for Biomass Installations. Clean Energy Resource Teams (CERTs) provides seed grants for energy efficiency and renewable energy projects throughout Minnesota. Funding covers labor costs, spurring community development and supporting local jobs. MN Business First Stop program - to help renewable energy and clean technology companies large and small with all aspects of project development, including feedstock identification, financing, environmental permitting, and site selection Department of Natural Resources' (DNR) Forestry Resource Assessment Unit Minnesota Logger Education Program (MLEP)

Industry Associations	Minnesota Forestry Association, Minnesota Timber Producers Association, MN Women's Woodland Network, The Minnesota Forest Resources Council (MFRC), The Minnesota Association of Soil and Water Conservation Districts (MASWCD), The Minnesota Christmas Tree Association (MNCTA), Minnesota Maple Syrup Producers Association, The Minnesota Forest Resources Partnership, North Shore Forest Collaborative, Minnesota Bio-Fuels Association
Education, Training and Human Resource Support	
Speciallist Education Programs	**Itasca Community College** - Forestry Resources program University of Minnesota's College of Food, Agricultural and Natural Resource Sciences Hennepin Technical College Northwest Technical College Vermilion Community College Leech Lake Tribal College
Customized programs/training	The Minnesota Logger Education Program (MLEP) Department of Forest Resources faculty (various programs)
Research and Development	
Corporate	Minnesota Association of Consulting Foresters, Sappi North America, **Minnesota Power**
Forestry	**Natural Resources Research Institute, University of Minnesota, Duluth Materials and Bioeconomy Platform:** Forest and Land Research Group DNR's Utilization and Marketing Program, Forestry Resource Assessment Unit The Minnesota Forest Resources Council (MFRC)
Advanced Wood Products	**Natural Resources Research Institute, University of Minnesota, Duluth, Materials and Bioeconomy Platform:** Forest and Land Research Group, Advanced wood products, materials **DNR's** Utilization and Marketing Program, Forestry Resource Assessment Unit **The Minnesota Forest Resources Council (MFRC)**
Biomass	**Itasca Community College:** Engineering program and the Power Generation program Biomass Project **Natural Resources Research Institute, University of Minnesota, Duluth Materials and Bioeconomy Platform:** Biomass Thermal Processing (Lab to Pilot Scale), Anaerobic Digestion, Organosolv Processing, Energy Products **Minnesota Power** **MN Business First Stop** DNR's Utilization and Marketing Program prepares biomass supply analyses for individuals interested in developing a biomass facility. This program aims to help individuals make informed decisions regarding the most efficient and sustainable use of woody biomass resources.
Networks of Centres of Excellence - National	Natoinal Association of State Foresters, American Forests, American Forest & Paper Association, The American Tree Farm System, Society of American Foresters, The Forest Resources Association, The Pellet Fuels Institute, Advanced Biofuels USA, Biomass Thermal Energy Council, Forest Products Society, Forest Resources Association, American Wood Council, National Hardwood Lumber Association, Renewable Energy Institute, The Biomass Power Association, American Biogas Council, American Biomass Association, US Industrial Pellet Association, The R&D arm of the Forest Service, a component of the U.S. Department of Agriculture
Infrastructure	5 Airports: Bigfork Municipal Airport, Bowstring Airport, Deer River Municipal Airport, Gospel Ranch Airport, Grand Rapids A general aviation airport in Grand Rapids, plus easy access to commercial airports in nearby Hibbing, Duluth, and the Twin Cities Federal highway connections to Twin Cities, Duluth, and Fargo metro areas Two Class I railroads: BNSF and CN Foreign Trade Zone status available through the Duluth Seaway Port Authority Three electrical utility companies, Minnesota Power, Lake Country Power, and the North Itasca Electric Cooperative Natural gas: Minnesota Energy Resources - Broadband: 15 providers: including speeds well over 100 Mbps from Paul Bunyan Communications and Mediacom

Figure 21 – Renewable Energy Value Chain

Renewable Energy	
Inputs	
Forest Residues - Pellets etc.	Green Friendly Wood Pellets, Wood Pellet Coop, Great Lakes Lumber Company Pellet and Grill Division, Interstate Pellets
Food waste	Second Harvest Heartland
Energy Generation	
Wind	**MN Power**, Great River Energy, Juhl Clean Energy Assets, National Grid Renewables, Adams Wind Generations, ALP Wind, Aspenall Energies, Averill Wind, Bendwind, Little Rock Wind, Blue Sky Wind Farm, Buffalo Wind Energy, CG Windfarm, City of St. Cloud Hydroelectric Utilit (municipally owned), DanMar and Associates, NRG Energy, Duke Energy Renewable Services, Abu Dhabi National Energy Company PJSC, FPL Energy, Fenton Power Partners, Fey Windfarm, Goodhue Wind, Grant County Wind, Green Field Wind Farm, Greenview Power, Groen Wind, Hog Creek Wind Project, Jeffers Wind , JMC Wind, Juhl Clean Energy Assets, Juhl Energy Development, Lake Country Wind Energy, Lakefield Wind Project, Lakeswind Power Partners, Larswind, Little Rock Wind, Maiden Winds, MD & E Wind, National Renewable Solutions, National Wind, Norfolk Wind Energy, Northern Alternative Energy, Northern Alternative Energy, Northern Lights Wind, NRG Thermal, Odell Wind Farm, Odin Wind Farm, Power Blades Windfarm, Prairie Rose Wind, Renewable Solutions, Northern States Power Company, Sierra Wind, Skybridge Solar, SoCore Energy, Stahl Wind Energy, Trishe Resources, Valley View Transmission, Wind Energy America, Winona Wind Holdings, Woodstock Hills, EDF Renewables, Algonquin Power, Avangrid, Enel Green Power, **North Itasca**
Solar	**MN Power**, Great River Energy, Juhl Clean Energy Assets, National Grid Renewables, NRG Energy, Duke Energy Renewable Services, Ecos Energy, Footprint, Geronimo Community Solar Gardens, Gopher CSG 1, Hilltop Farm CSG 1, Juhl Clean Energy Assets, Lindstrom CSG 1, National Renewable Solutions, Nokomis Energy, Nordic Solar, NRG Thermal, Randolph CSG 1, Richmond CSG 1, SunE Lahr 1, Sunrise Energy Ventures, Taylors Falls 1 CSG 1, United States Solar Corporation, AES Distributed Energy, Enel Greenpower, NextEra Energy, **North Itasca Electric Cooperative**
Hydro	**MN Power**, Ford Motor Company, Xcel Energy, City of Hibbing PUC, Brookfield Renewable Partners, Boise Cascade
Biomass / Waste	Boise Cascade, Sappi, **Minnesota Power**, District Energy, Covanta Hennepin Energy, MMPA, Xcel Energy, Koda Energy, District Energy
Combined Heat & Power	NRG Thermal, Ever-Green Energy (a biomass-fired combined heat and power plant), Juhl Clean Energy Assets, University of Minnesota
Secondary Processing	
Manufacturing	Footprint GBC
Biofuel	Epitome Energy, Hill Biomass, MinnErgy, National Renewable Solutions, Otoka Energy Corporation, Tellurian Biodiesel, SynGas Technology, Viresco AD, Renewable Energy Group
By-products e.g. bioplastics, storage	National Grid Renewables
Environmentally Friendly	
Energy Efficien Buildings, Clean Energy	Darcy Solutions, Sundevil Power Holdings

Support Services	
Distributors	Werner Electric
Manufacturing Support - Equipment and machinery – heavy equipment (installations, maintenance and repair), technical equipment (generators, systems, processes and technology)	MMT Heating & Cooling, Industrial & Environmental Concepts, Spark Power
Equipment maintenance	Cedar Creek Energy, Spark Power, Mortenson Wind Energy Services
Itasca County - Specialist Transportation	Broking's Transport Incorporated, Wille Transport Inc.
Minnesota - Specialist Transportation	Savage Trailers Inc, Rockland Industrial Products, Advanced Courier Services, Inc., Anderson Trucking Service, Inc., Autumn Transport, Inc., Canadian National, Cargill Marine And Terminal, Inc., CF AirFreight Corporation, Dart Transit Company, Drop Ship Express, Duluth, Missabe & Iron Range Railway Company, Freerksen Trucking, Inc., Fruth Trucking, Inc., J&R Schugel Trucking, Inc., Lawrence Leasing, Inc., Logistics Planning Services, Inc., Midwest Specialized Transportation, Inc., Minn-Tex Express, Inc., Minnesota Commercial Railway Company, MinStar Transport, Inc., Night Train Trucking, Inc., North Star Rail Intermodal LLC, Northern States Transportation, Inc., Northwest Airlines, Inc., NWA, Inc., Progressive Rail Incorporated, Raveill Trucking, Inc., Soo Line Corporation, Soo Line Railroad Company, Inc., Stockman Transfer, Inc., Sun Country Airlines Holdings, Inc. , Sun Country Holdings, LLC, Sun Country, Inc., Twin Express Inc., Waletich Corporation, Western Co-op Transport Association
Engineering & Technical Support	Project Resources Corporation, Randolph CSG 1, Renewable Solutions, SoCore Energy, United States Solar Corporation, Spark Power, Juhl Clean Energy Assets
Industry Support	
Industry Associations	Minnesota Renewable Energy Society, **Itasca-Mantrap Cooperative Electrical Association**, Midwest Renewable Energy Association (MREA), Clean Energy Economy MN (CEEM), MnSEIA, Minnesota Renewable Energy Society (MRES), Clean Energy Resource Teams (CERT), Energy & Environmental Building Alliance, Energy Efficient Building Association, Windustry, Clean Grid Alliance, Minnesota Bio-Fuels Association, NABCEP (North American Board of Certified Energy Practitioners) Associate Program - Solar, Wind
Natural Resources Research Institute, University of Minnesota, Duluth	**Chambers of Commerce:** Grand Rapids, Cass Lake, Deer River, Remer, Leech Lake **Northland Small Business Development Center** **Small Business Development Center (SBDC)** **Natural Resources Research Institute, University of Minnesota, Duluth:** The Commercialization Services Platform provides expertise coupled with technical core competencies to drive innovation. **Programs:** Commercialization & Financial Support Launch Pad for Entrepreneurs Project Management
Funding/Programs	The Minnesota State Legislature established the Bioincentive Program in 2015 to encourage commercial-scale production of advanced biofuels, renewable chemicals, and biomass thermal energy through production incentive payments. Advanced Biofuel Production Incentive Program Biomass Thermal Energy Production Incentive Program Renewable Chemical Production Incentive Program Rural Energy for America Program (REAP) Funds Available for Biomass Installations. Clean Energy Resource Teams (CERTs) provides seed grants for energy efficiency and renewable energy projects throughout Minnesota. Funding covers labor costs, spurring community development and supporting local jobs. MN Business First Stop program - to help renewable energy and clean technology companies large and small with all aspects of project development, including feedstock identification, financing, environmental permitting, and site selection MnDRIVE Bioremediation program

Education, Training and Human Resource Support	
Specialist programs	**Itasca Community College** Century College - Energy Technical Specialist Associate in Applied Science degree with concentrations in: Biodiesel, Solar and Wind MWCTC (Minnesota West Community & Technical College) - Wind Energy Technology program MWCTC - Wind Energy Mechanic, Diploma
Customized training programs	MWCTC (Minnesota West Community & Technical College) - Biofuels MWCTC - Technology Biodiesel, Certificate MWCTC - Solar Photovoltaic Technician, Certificate MWCTC - Windsmith, Certificate Biofuels Technology Ethanol, Certificate Minnesota State Universtiy - Renewable Energy certificate Century College - Solar Assessor Certificate Century College - Solar Sales and Marketing Certificate Century College - Advanced Photovoltaic Energy Systems Certificate Fond du Lac Tribal & Community College - Clean Energy Technician certificate Midwest Renewable Energy Association Training - Solar, Wind
Research and Development	
Research Centres and Laboratories - renewable energy	**Itasca Community College:** Engineering program and the Power Generation program Biomass Project **Natural Resources Research Institute, University of Minnesota, Duluth Materials and Bioeconomy Platform:** Energy Management Research Group, Materials and Bioeconomy Research Group **Minnesota Power** Sappi North America
Networks of Centres of Excellence - National	Renewable Energy Institute, The Pellet Fuels Institute, Advanced Biofuels USA, Biomass Thermal Energy Council, Interstate Renewable Energy Council (IREC), North American Board of Certified Energy Practitioners (NABCEP), Solar Energy Industries Association (SEIA), WINDExchange, American Wind Energy Association (AWEA), American Clean Power Association, The Biomass Power Association , American Biogas Council, American Biomass Association, US Industrial Pellet Association, NABCEP (North American Board of Certified Energy Practitioners)
Infrastructure	5 Airports: Bigfork Municipal Airport, Bowstring Airport, Deer River Municipal Airport, Gospel Ranch Airport, Grand Rapids A general aviation airport in Grand Rapids, plus easy access to commercial airports in nearby Hibbing, Duluth, and the Twin Cities Federal highway connections to Twin Cities, Duluth, and Fargo metro areas Two Class I railroads: BNSF and CN Foreign Trade Zone status available through the Duluth Seaway Port Authority Three electrical utility companies, Minnesota Power, Lake Country Power, and the North Itasca Electric Cooperative Natural gas: Minnesota Energy Resources - Broadband: 15 providers: including speeds well over 100 Mbps

11.2 Appendix B – Sample Initiatives Case Studies

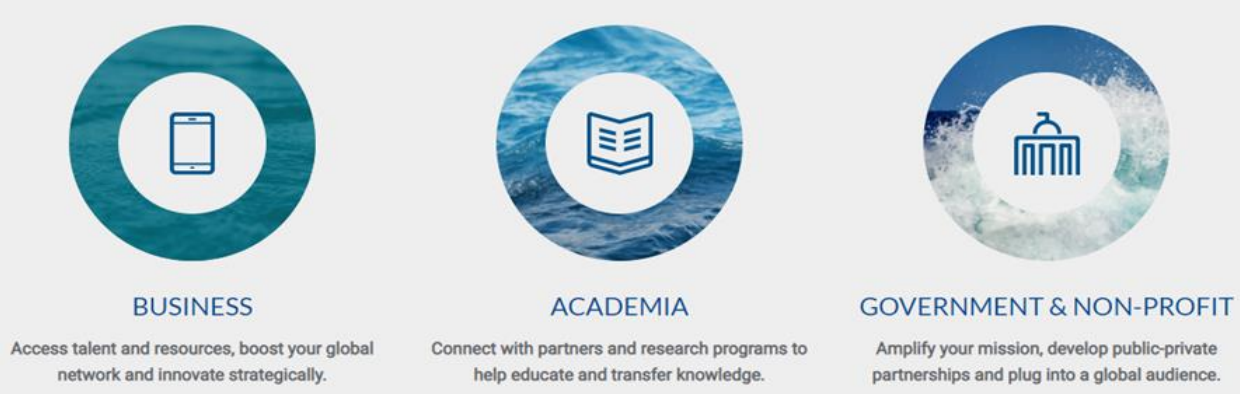
11.2.1 Sample Initiative Case Study – Cluster Activation

Milwaukee Water Council

https://thewatercouncil.com/

THE WATER COUNCIL

The Water Council is a 501(c)(3) non-profit organization dedicated to solving critical global water challenges by supporting innovation in freshwater technology and driving those new solutions to the industries that need them. The Water Council's mission is to drive economic growth in the world's water hub through partnership, talent, innovation and stewardship programs for the water industry. We champion connections in the global water community through:



Headquartered in Milwaukee, Wisconsin, USA, next to the world's largest freshwater system and home to one of the most influential freshwater technology hubs in the world, The Water Council (TWC) is recognized as a global center for advancing water technologies and stewardship. At its heart, TWC is a non-profit membership organization that connects, convenes and showcases the hub comprised of more than 238 water technology businesses and the diverse water leadership network of 200 members it is linked to from around the world. While TWC's mission is centered on driving economic development, attracting and connecting world-class talent and supporting water-focused technology innovation, its larger goal is to help secure freshwater resources for the world by driving solutions to the numerous industries that need and use a large amount of water.

While these companies might not consider themselves in the water business, virtually every industry – consumer brands, manufacturing, agriculture, food and beverage processing, pharmaceuticals, electronics and construction – needs freshwater to exist. TWC is the epicenter of global freshwater connectivity and is uniquely positioned to liaison between companies that develop water solutions and these water-using businesses that need water management tools.

TWC achieves its goals through convening global water leaders and water-users, showcasing and supporting its members from 20 US states and 10 countries and offering more than a dozen initiatives designed to provide resources, programming and networking opportunities to businesses, engineers, entrepreneurs, utilities, government agencies, academia and NGOs. Established in 2009, the driving force behind The Water Council's success is the vibrant spirit of collaboration between public, private and academic sectors with a strong, shared commitment to finding new solutions to critical global water challenges.

11.2.2 Sample Initiative Case Study – Talent Attraction & Development

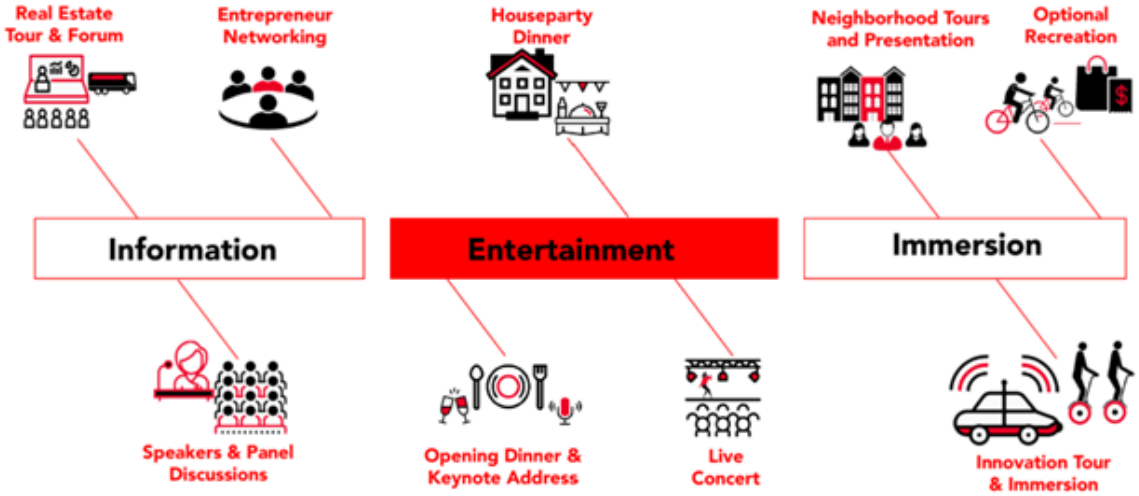
Detroit Homecoming

https://detroithomecoming.com/

Reconnect with your hometown. Detroit Homecoming is a celebration of the city by its former residents. For three days, expats learn, network, and explore, discovering new ways to support the economic and social renaissance of their hometown. Homecoming leverages the financial, social, and human capital of its former residents to stimulate the city's economic and social progress.

The annual event was designed to encourage the women and men who grew up in Detroit and its metro area to use their individual success for the collective benefit of their hometown. Expat attendees are able to travel to Detroit from their new cities and be immersed in the inner-workings of local revitalization efforts, reconnect with their hometown, be surrounded by fellow former residents and become inspired to make a difference.

After attending Detroit Homecoming expats are required to begin or complete an outcome in the city or metro area. Such outcomes can include pro-bono volunteer projects, real estate or startup investments, company or project relocation to Detroit, new partnerships with local companies or city government, or business attraction.



Impact

The Detroit Homecoming team has tallied more than $606 million in economic impact from local initiatives and projects led by or invested into by expats after attending Detroit Homecoming.* This figure also includes projects that resulted from local relationships formed at our annual event. Expats have directly invested over $361 million into projects and initiatives in Detroit. For every dollar invested in Detroit Homecoming, the region enjoys $100 of economic impact. Expats specifically invest $60 for every 1 dollar invested in the event.

Expat investment and outcomes have resulted in over 1 million square feet of redeveloped real estate and over 1,800 hours of pro-bono volunteer and advisory services. These outcomes have taken place in over 30 neighborhoods and have involved more than 40 nonprofits and initiatives and more than 20 startups and small businesses.

*Expat survey results verified by Detroit Homecoming

11.2.3 Sample Initiative Case Study – Entrepreneurship & Partnerships

Center for Innovation & Entrepreneurship (CIE)

https://cob.mnsu.edu/center-for-innovation-and-entrepreneurship/

Center for Innovation & Entrepreneurship (CIE) is located at Minnesota State University, Mankato. Mankato, population 41,720, is in south central Minnesota. In May of 2017, the CIE officially opened its doors. In the first year, it had 7,500 visitors – 44 percent students and 56 percent community members. Regular meetings are held in the CIE's space, including the Entrepreneurship Club; 1 Million Cups; Social Media Breakfast; SBDC staff, SBDC Business Roundtable and SBDC Coffee Connections; Women Executives in Business; Old Town Association; and the South Central Minnesota Business Development Network. Businesses from a variety of industries use the space for meetings and special events.

The Takeaways

How can EDOs help create a resource like this in their communities? The first requirement is visionary leaders or champions who are positioned to make final decisions and commit capital. This process, the work involved, and the community-building is a long haul. Second, is a passionate and energetic director. We are fortunate to have a successful entrepreneur who herself knows exactly what it takes to create an environment for innovation and entrepreneurship – and has the right people, programming, organizations, community, and place to build a strong and enduring entrepreneurial ecosystem.
Third, is a committed community of philanthropists, engaged business and industry leaders, supportive governments, and active alumni.

Back Story

It all started back in 1996. Minnesota State University, Mankato, offered its first entrepreneurship course, held an entrepreneurship fair, and opened an entrepreneurship center on campus. By 2004, the College of Business had added entrepreneurship courses, a global entrepreneurship center, and an entrepreneurship club. In 2010 the university began offering an entrepreneurship and innovation minor and an integrated business experience program that is a statewide curriculum award winner.

More entrepreneurship clubs were formed, new scholarships were created and awarded. The Big Ideas Challenge competition and the StartUp Camp, a summer camp for high school entrepreneurs, were launched. By 2016, the College of Business was ready to do more. The vision was created: to be the premier destination in the region to connect innovation talent and resources, learn the practice of innovation and entrepreneurship, and launch startups and solutions ventures.

Story from article by Lisa Hughes, Minnesota Department of Employment and Economic Development, in ED Now on IEDC's web site.

11.2.4 Sample Initiative Case Study – Maker/Entrepreneur Culture

Makeshop® (Pittsburgh, PA)

https://pittsburghkids.org/exhibit/makeshop/

Makeshop is a 1,800-square-foot space that supports learning in making with digital and physical materials. The space is divided into three. One provides carefully designed materials that introduce young children to making. The Digital Dream Lab, is an interactive table and projection screen where children learn the basics of object-oriented programming through interlocking wooden blocks representing parts of code and that cue changes on the screen. The third space can be closed off and has a large workshop table with making equipment that requires more supervision for safety reasons, including a sewing machine, woodworking tools, and soldering irons. Makeshop is facilitated by teaching artists who have expertise in making.

Young visitors to Makeshop range in age from toddlers to teens, and they often come accompanied by siblings, parents, and grandparents. Makeshop also hosts weekly workshops, school field trips, afterschool youth programs, and Make Nights, which draws older participants. Family members often interact and facilitate each other's work. These informal interactions with learners show how the Makeshop fluidly adapts tools, materials, and design processes to the participants' needs, skills, and interests. This fluidity is also shown in connections between different activities.

Makeshop also offers workshops, including one for very young children and their families that primarily focuses on materials exploration and an afterschool youth program, where participants return weekly to engage in interest-driven making trajectories. These often begin with skill acquisition, such as how to use a soldering iron, and then progress in various directions based on interests and intentions. In addition, Makeshop hosts guest makers who highlight an aspect of their craft through focused workshops with the public on weekends.

Makeshop is part of the Remake Learning network, promoting engaging, relevant, and equitable learning practices to support young people navigating rapid social and technological change. The program includes support for rural communities in southwestern Pennsylvania and northern West Virginia through finding connections, resources, and opportunities to ignite engaging, relevant and equitable learning for young people.

Adapted from: Sheridan, K. M., Rosenfeld Halverson, E., Litts, B. K., Brahms, L., Jacobs-Priebe, L., & Owens, T. (2014, Winter). Learning in the Making: A Comparative Case Study of Three Makerspaces. Harvard Educational Review, 84(4).

11.2.5 Sample Initiative Case Study – Tech Makerspace Incubator

1B FirstBuild (Louisville, KY)

https://firstbuild.com

General Electric (GE) Appliances established its FirstBuild micro-factory at the University of Louisville (KY) Campus in 2014 to keep pace with changing market demands and compete with more cutting-edge offerings. When FirstBuild was launched in 2014, 'mind-to-market' could take up to four years at GE. In its first year of operation, FirstBuild was able to bring new products from mind to market in an average of only eight months, reducing to four months two years later.

The 43,000square-foot facility combines a makerspace, a low-volume manufacturing facility, and a retail store, which provide local makers with the opportunity to showcase their ideas in design, prototype, manufacture and, eventually, sell kitchen gadgetry of the future. In FirstBuild's space, engineering and graphic design students work side-by-side with GE engineers. Another partnership with IDEAS Louisville, a local arts organization, brings art into the space by launching its artist-in-residence program. FirstBuild also regularly hosts community and student groups, such as a local robotics program.

FirstBuild is a physical and global online community of funders, buyers, and product development enthusiasts who propose, validate, and test ideas and product iterations on FirstBuild's open innovation platform. Active user feedback brings innovative products to market faster. By 2017, FirstBuild had a maker community of 23,000. By shortening the product development cycle from years to months, FirstBuild has raised levels of funding more typically seen at a tech startup. For example, FirstBuild's second product launch was for the Opal Nugget Ice Maker, a $500 device that produced the same kind of "chewable ice" found at some popular restaurant chains. The Indiegogo campaign raised $500,000 in its first two days and $2.7 million in its first 30 days.

Beyond delivering a better business model for GE, FirstBuild can also provide significant value for the region through its infusion of dynamic, innovative activity into the manufacturing ecosystem through bringing corporate crowdfunding to the mainstream and serving as a platform for broad product creation. FirstBuild is linked with the priorities of the Bluegrass Economic Advancement Movement | LouisvilleKY.gov (BEAM), a public-private initiative focusing on improving the competitiveness of the region's manufacturing sector.

11.2.6 Sample Initiative Case Study – Partnerships

Idea Co-Op, Hancock County, Greenfield, IN

https://idea.coop/

Makerspaces are products of a community's unique economic environment. Each reflects a different understanding of what the maker movement represents (National League of Cities - Center for City Solutions and Applied Research, 2016).

Maker spaces in rural America have evolved quickly over the past decade. Rural economic development organizations are turning to makerspaces to foster employment growth through entrepreneurship and startups. Broadband access is essential for today's businesses, and telecommunications providers are a natural partner. Many rural telecommunications companies were initially cooperatives built by engaged community members. Their economic development role is bottom-up and community-driven, which, in turn, results in local buy-in.

Telecommunications companies can enable the formation of the technology-driven businesses of the future as an innovation engine, a connector point, and through the provision of physical space and technology. External support from NineStar Connect and Blackfoot Communications has proven pivotal for Idea Co-op (IN) through C2Mbeta (MT). They are working directly with entrepreneurs to foster small business growth on their terms and use their voices to influence their communities' growth and change.

At the intersection of this paradigm shift and the resources needed to make it happen is the rural telco opening themselves up to their neighbors, with a vested interest in developing its economic base (Young, Hilgefort, & Bedir, 2019).

Co-ops Behind Rural Makerspaces

The Co-op has 15,000 square feet of creative space with a fabrication lab for loT, 3D printing and virtual reality-based applications, and meeting, conference, and general office rooms for daily business operations.

There are 26 acres of tillable land for agricultural technology research and experimentation reflecting the rural characteristics of the region.

11.2.7 Sample Initiative Case Study – Transforming Mining Cluster

Prospect Mining Studio (New York, NY)

https://prospectminingstudio.com/

Prospect Mining Studio supports startups of all stages, forward-thinking innovators, and prominent researchers as they build, pilot, and scale frontier technologies that will advance the natural resource and mining industries, focusing on sustainable and socially responsible solutions. A catalyst for change in the industry, the studio is a partnership between leading Indian mining conglomerate, the Vimson Group, and innovation hub, Newlab.

Each 12-month program cycle consists of four stages – discover, convene, engage and pilot. The goal is to explore new possibilities in mining by bringing together startups, entrepreneurs, mining industry experts, venture partners, and leading academics from across the globe to define challenges, prototype rapidly, and implement pilots at mining sites, all while building efficiencies, measuring impact and disrupting the status quo. Prospect Mining Studio recently announced a partnership with the Canada Mining Innovation Council (CMIC), which will support startups in the program.

Outcomes

- Bring together frontier technologies and applied entrepreneurship to address the mining industry's most pressing challenges around efficiencies, future of the workforce, data optimization and reducing the carbon footprint
- Establish partnerships between mining industry leaders and innovators from startup and academic research communities
- Validate and advance solutions to market through piloting at mining sites
- Create unique investment deal flow to commercialize technologies and scale businesses that gain traction in the Studio

11.2.8 Sample Initiative Case Study – Existing Resources

Web-based mining supply chain directory

https://miningdirectory.thunderbay.ca/

THUNDER BAY CEDC COMMUNITY ECONOMIC DEVELOPMENT COMMISSION

Thunder Bay CEDC developed a Mining Supply and Services Directory to promote the capabilities of the existing 400+ mine supply and service businesses in Thunder Bay. The directory allows local companies to be found based on a company name, keyword or business type category search and promotes local capabilities to foreign and existing exploration and mining companies.

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