ILLINOIS:

Driving the Manufacturing Renaissance

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2025

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President
Illinois Manufacturing Excellence Center (IMEC)
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To Illinois manufacturers and stakeholders:

Manufacturing is central to our national economy, a driver of economic growth and innovation. And Illinois is one of the largest manufacturing hubs in the country, built on extraordinary legacy strengths combined with leading innovation capacity.

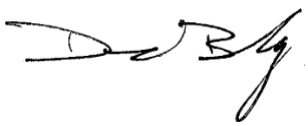
Manufacturing is now transforming at a pace never seen before, as the fourth industrial revolution rapidly changes our economy. Demand for new products is accelerating as new industries emerge and grow. Supply chains are becoming much more complex and interrelated.

These changes create an opportunity – and in fact, a need – for Illinois to develop a next generation of focused manufacturing activities, in order to remain in the forefront of the next generation of manufacturing. This report introduces a new approach to analyzing and identifying these manufacturing activities, highlighting the unique assets that Illinois should strengthen to continue to cultivate its manufacturing prowess.

The report's strategies focus on the tremendous opportunities to support our metal fabrication and electrical component suppliers, in order to fuel growth in automated machinery, grid modernization, and several other legacy and emerging sectors.

We'd like to thank the many Illinois manufacturers who contributed their insights to this analysis and helped shape the report's strategic recommendations, as well as the research and analysis from RW Ventures, LLC and Mass Economics.

IMEC is well positioned to support our state's manufacturers in securing these next-economy growth opportunities. But, IMEC certainly cannot do this work alone. The report proposes ways our state's incredible network of manufacturing stakeholders can work together to grow the manufacturing economy. I look forward to the future opportunities this document will foster.
Sincerely,



Dave Boulay

I. Introduction

Illinois' Manufacturing Opportunity

Manufacturing is and always has been disproportionately important to the US economy. While manufacturing has transformed over time it has remained a backbone of economic growth. And now, the fourth industrial revolution, characterized by a digital revolution and exponential pace of change, is transforming manufacturing once again, giving rise to a manufacturing renaissance. [1]

Manufacturing's renaissance is driven by key economic and political changes. Advanced digital technologies are disrupting manufacturing processes, for instance with smart factory lines or collaborative robots. Massive federal investments have accelerated manufacturing growth, encouraged reshoring, and accelerated the transition to a green economy. These changes are giving rise to new manufacturing processes, supply chains and products. Regions that have historically manufactured a variety of components, for a variety of industries, are best poised to respond to these changes.[2]

Illinois is one such region; it has historically been one of the country's most diverse manufacturing hubs, producing "a very wide variety of products from primary metals, to food, medicine, furniture, textiles, and electronics."[3] It is primed to be a leader of manufacturing's renaissance. But to continue its leadership, Illinois must strategically identify the key activities – industries, capabilities, and practices – that will be important to the next generation of manufacturing in the state – and develop programs to grow them.

Manufacturing in Illinois accounts for almost 13% of the state's output, employs just under 10% of the workforce, and accounts for 5.5% of US value added in manufacturing.

Project Approach: Analyzing Manufacturing Dynamics

The project first develops a new methodology to determine which manufacturing-related economic activities are clustering in Illinois. "Clusters" refer to geographic concentrations of activities that do better economically because of their proximity and connections, shared labor markets, and spillover of knowledge and ideas.4 Activities that cluster together can range from firms to related industries to suppliers.

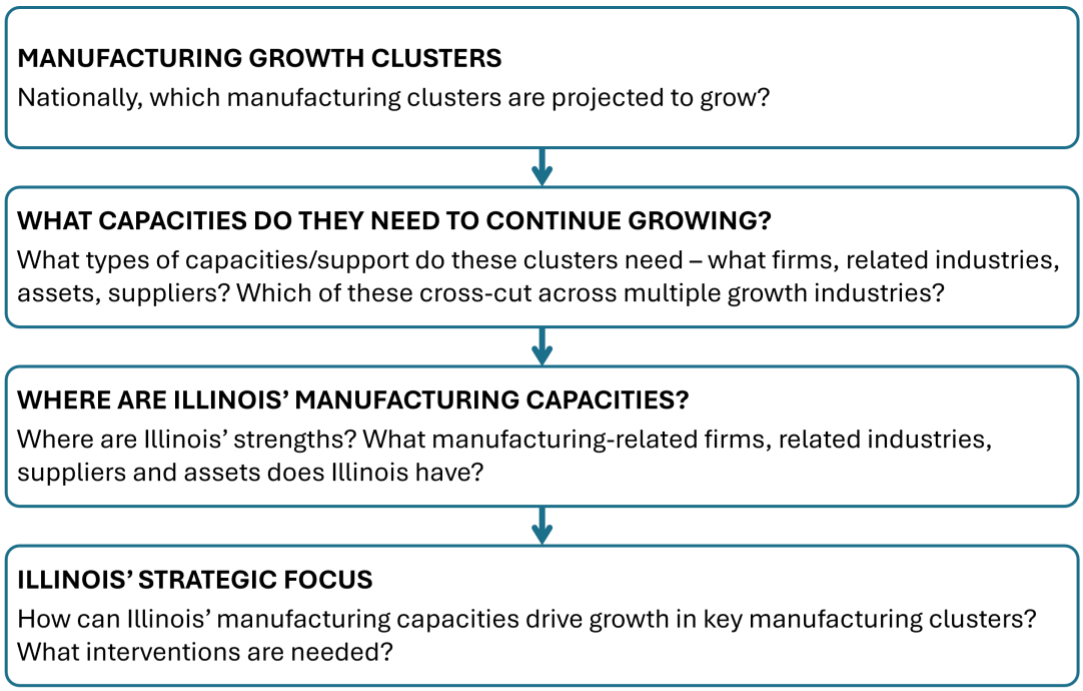
Various methodologies have been developed to assess clustering, but each have their limitations. The most common methodology is cluster mapping, which defines a set of 41 clusters made up of related industries.[5] Typically, each industry is assigned to one core cluster – which ignores that some industries provide essential products and services to multiple clusters. And, these clusters often include first-tier but rarely lower tier supply activity – so they don't capture the breadth of supply chain activity. Another method relies

on input-output tables, which assesses the degree of relatedness, based on purchase activity, of one industry to another. This method starts to paint a picture of supply chains. But, it does not capture many other cluster dynamics, such as the importance of related industries (industries that may not be related to one another through purchase activity, but indirectly support one another's growth).

Perhaps most important: existing methodologies cannot adequately take into account the increasing complexity of supply chains or extremely rapid changes in this economy.[6] The rapid economic changes – particularly to manufacturing – require a new type of analysis to measure what is clustering. The reality is that various entities - firms, related suppliers, support organizations – are clustering together to drive growth, sometimes in multiple economic clusters. In any regional or state economy, there will be *core activities* that support production and innovation in *multiple industries and clusters*.

To capture these dynamics, we undertake a new type of analysis. The analysis looks at manufacturing growth clusters (nationally), assesses the core capacities they need to continue growing, and then identifies areas of strength for Illinois (see Figure 1). Based on this, we develop interventions to grow Illinois' manufacturing economy. At each stage of the analysis, we combine cluster mapping, supply chain analysis, and expert interviews to determine which key manufacturing activities are clustering together to drive economic growth. Essentially: which intersecting activities are most important to growing Illinois' manufacturing sector?

Figure 1: Structure of the Project Analysis

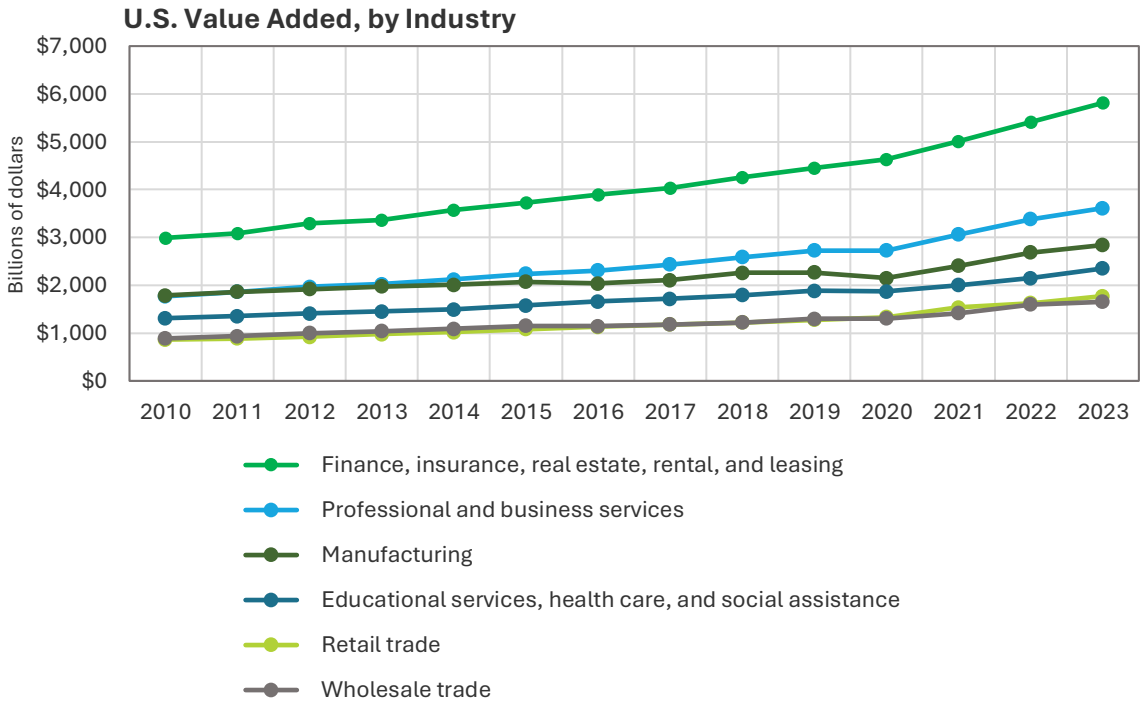


NOTE: The analysis is iterative, going back and forth between national and Illinois manufacturing trends/strengths, and analyzes the broad manufacturing sector at various scales (sub-sector, cluster, industry)

II. National Manufacturing Trends and Opportunities

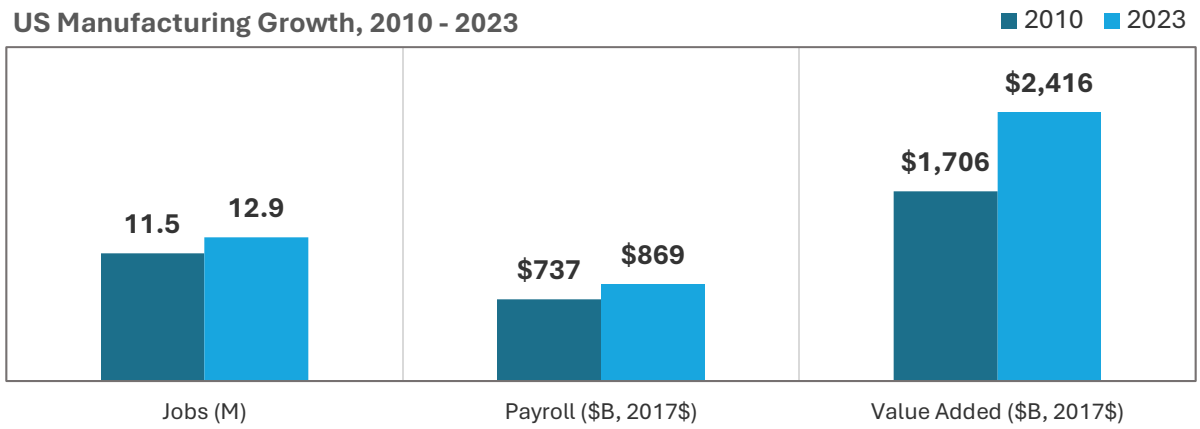
Manufacturing is a critical piece of the US economy, employing nearly 10% of the country's workforce. It accounts for 35% of US productivity growth and drives more innovation than any other sector. Domestic manufacturers comprise a striking 54% of domestic research and development (R&D) and 55% of patents. Manufacturing also has one of the highest value-added (VA) contributions – i.e., contributions to GDP – of any sector, behind only Finance/Insurance and Professional Services (see Figure 2).[7]

Figure 2: U.S. Value Added, by Industry



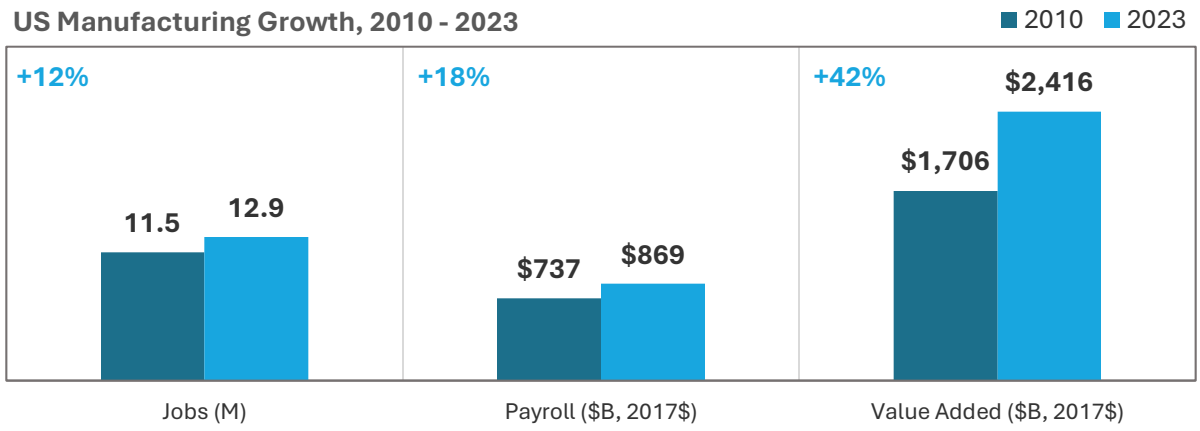
Notes: The top 6 value added industries are displayed. Data source: U.S. Bureau of Economic Analysis, "Value Added by Industry"

On top of this, US manufacturing has been experiencing a renaissance. Between 2010 and 2023, there was a gain of 1.4M manufacturing jobs — a 12% increase. Over this same time period, manufacturing value added grew by 42% (see


US Manufacturing Growth, 2010 - 2023
2010
2023
11.5
12.9
$737
$869
$1,706
$2,416
Jobs (M)
Payroll ($B, 2017$)
Value Added ($B, 2017$)

).[8]

Figure 3: US Manufacturing Growth, 2010 – 2023



Data source: dF-QCEW, BLS-IO tables, Mass Economics analysis

Global Trends in Manufacturing

The future of manufacturing is impacted by several key global trends that are changing manufacturing processes and demand for new products and services. It will be important to consider the impacts of these global trends in manufacturing, in projecting what activities may cluster in the future (even if they are not doing so yet). Key manufacturing trends to consider include:

- **Digital Technologies / AI -** Advanced digital technologies are transforming manufacturing – including the Internet of Things (IoT), artificial intelligence (AI) and cloud computing. Manufacturers can more easily collect real-time data and use it to manage equipment or communicate between pieces of equipment.[9] The digital revolution is also changing manufacturing production processes – which is changing required skillsets for the future workforce. Required skillsets increasingly combine mechanical and software abilities.
- **Automation and Robotics** – Automation is impacting manufacturing workflows, providing benefits including improved quality control and productivity. Robots can increase efficiency of manufacturing processes by performing repetitive tasks like assembly, welding or material handling. The capabilities of these technologies are accelerated by artificial intelligence and machine learning.[10]
- **Electrification** – Electrification is one of the biggest investment opportunities and economic growth opportunities, but requires increased production of electrical equipment to handle increased electricity demands. Demand is increasing for infrastructure to charge electric vehicles, store energy and modernize grids. This growth is further fueled by R&D investments, which predominantly go to electronics (that will enable rapid digitization and electrify products).[11]

In addition, federal investments have accelerated growth, particularly in energy-related industries. These investments, along with Buy America provisions, have also accelerated

reshoring and "nearshoring." US manufacturers are increasing trade partnerships with countries other than China – e.g., Canada and Mexico or the Indo-Pacific region. While funding priorities, supply chains, and trade policies are expected to shift with each election cycle, the need for increased trade partnerships will remain a priority to increase supply chain resilience, and long-term demand for products that can meet our country's increased electricity needs is expected to remain.[12]

To address these changes, the US will need to grow its manufacturing workforce as reshoring occurs – and because over 25% of the workforce is over age 55 and approaching retirement. This also creates a need for ownership transitions to prevent legacy manufacturing businesses from closing.[13] Finally, new and greater financial tools and investments are needed to help businesses scale. New manufacturing business applications have increased 37% in the 2020 – 2024 period, as compared to the previous 5-year period.[14] These businesses need financing to support their establishment and scale-up, and existing businesses need capital to incorporate digitization, automation and electrification trends into their processes.

Growth Clusters and Industries

These trends will impact where future manufacturing growth occurs. Over the past decade, manufacturing value added growth has been driven by **chemicals, food/beverage,** and **computer/electronics**.[15] Job growth has been driven by clusters (as defined by the US Cluster Mapping Project) like **IT and Analytical Instruments; Automotive;** and **Food Processing and Manufacturing** (see Table 1).[16] Looking at sub-sectors (3-digit NAICS) as opposed to clusters shows that job growth is concentrated in **transportation equipment, food, plastics/rubber, chemical, machinery,** and **fabricated metal products** (see Table *2*).[17]

Table 1: Employment Change by Cluster, 2010 – 2023

Cluster (v2022)	**2023 Employment**	**Employment Growth** (2010-23)
Information Technology and Analytical Instruments	1,558,358	41%
Automotive	1,052,746	40%
Food Processing and Manufacturing	1,287,313	35%
Construction Products and Services	963,454	34%
Wood Products	389,392	21%
Downstream Metal Products	478,139	21%
Plastics	668,485	19%
Lighting and Electrical Equipment	350,435	18%
Agricultural Inputs and Services	381,212	16%
Production Technology and Heavy Machinery	1,004,944	13%

Livestock Processing	561,691	11%
Metalworking Technology	452,737	8%
Aerospace Vehicles and Defense	664,612	7%
Upstream Metal Manufacturing	390,279	4%
Furniture	350,002	1%

Notes: Clusters displayed are (1) traded; (2) have 2023 employment over 350,000; (3) have employment growth 1% or greater.

Table 2: Employment Change by Manufacturing Sub-Sector, 2010 – 2023

3D NAICS	Industry Description	2023 Employment	Employment Growth (2010-23)
312	Beverage and Tobacco Product Manufacturing	335,596	83%
336	Transportation Equipment Manufacturing	1,764,527	33%
321	Wood Product Manufacturing	418,820	23%
311	Food Manufacturing	1,732,993	20%
326	Plastics and Rubber Products Manufacturing	733,658	18%
335	Electrical Equipment, Appliance, and Component Manufacturing	413,478	16%
325	Chemical Manufacturing	895,179	14%
333	Machinery Manufacturing	1,124,986	13%
327	Nonmetallic Mineral Product Manufacturing	417,020	13%
332	Fabricated Metal Product Manufacturing	1,440,044	13%
339	Miscellaneous Manufacturing	622,955	10%
331	Primary Metal Manufacturing	372,127	3%
337	Furniture and Related Product Manufacturing	356,434	1%
334	Computer and Electronic Product Manufacturing	1,098,806	0%
324	Petroleum and Coal Products Manufacturing	107,577	-3%
316	Leather and Allied Product Manufacturing	26,294	-7%
322	Paper Manufacturing	357,997	-9%
314	Textile Product Mills	100,190	-16%
323	Printing and Related Support Activities	369,768	-24%
313	Textile Mills	90,164	-24%
315	Apparel Manufacturing	88,166	-44%

Notes: The text calls out sub-sectors where job growth is concentrated, calling out those that have 2023 employment over 500,000.

As digitization, automation, and electrification impact future growth of manufacturing – many of these same clusters/sub-sectors will continue to grow. Manufacturing investments from USA-based investors have been focused on automation, 3D printing, and advanced materials, in addition to IT-focused investments (e.g., software, cybersecurity, cloud computing, AI, IoT).[18] And, their interrelationships will become more complex alongside the rapid changes in our economy. For instance, fabricated metals and electronics both support electrification (e.g., they are important components for electric vehicles). Chemical and electronics manufacturing will be important in growing energy-

related supply chains. And, chemicals and metals manufacturers support materials innovation – for instance as new metal alloys and composites are used to create high performance coatings – which can be applied to growth industries like aerospace, automotive and deep tech.[19]

Key Suppliers

Exploring the increasing complexity of these interrelationships requires an analysis of supply chains. Supply chain relationships are not one-to-one; in fact, most suppliers supply to a wide range of industries (e.g., they are one-to-many). To better understand these patterns, the team created the Supplier Typologies described in the call-out box and identified suppliers that are important to manufacturing (comprise over 2% of a manufacturing industry's inputs) and also contribute to a broad range of manufacturing industries ("Cross-Cutting Suppliers"). In this case, we looked at industries that supply at least 2% to 5 or more industries. These cross-cutting, important supplier industries include **chemicals, fabricated metals,** and **machine shops** (see Table 3).

SUPPLIER TYPOLOGIES

Importance to Any Manufacturing Industry

- **Critical -** Supplies >10% to at least 1 manufacturing industry
- **Primary** - Supplies 5% to at least 1 manufacturing industry
- **Secondary** - Supplies 2% to at least 1 manufacturing industry

Cross-Cutting Importance Manufacturing Industries

- **Cross-cutting -** Median share across 59 manufacturing industries > 0.125%
- **Not cross-cutting -** Median share across 59 manufacturing industries <= 0.125%

Table 3: Cross-Cutting, Important Supplier Industries

Supplier	Supplier Typology	Important to X number of industries
Machine shops; turned product; and screw, nut, and bolt manufacturing	Secondary, Cross-Cutting	10
Truck transportation	Secondary, Cross-Cutting	9
Electric power generation, transmission and distribution	Secondary, Cross-Cutting	7
Fabricated metal product manufacturing (3323,4)	Secondary, Cross-Cutting	5
Chemical manufacturing (3251,2,3,9)	Critical, Cross-Cutting	5

Notes: This table includes industries that (1) supply at least 2% to 5 or more industries (e.g., are "important" to 5 or more industries); (2) have cross-cutting importance to manufacturing industries.

Looking more closely at the industry-supplier relationships of each of these industries reveal some notable relationships:[20]

- **Machine shops** – supplies to varied industries, e.g., fabricated metal, coatings, electrical equipment and motor vehicle manufacturing
- **Chemical manufacturing** – supplies to plastics, rubber, and textiles
- **Fabricated metal** – supplies to food products, electrical equipment and machinery
- **Electrical distribution** – supplies to varied manufacturing operations (e.g., paper, metals)

Data from the input-output table for the US economy provides more detail (see Table 4). This table reveals some of the complexities in supply chains – many of these industries supply to a wide range of others, ***and*** to other firms in the same industry. While this table shows the linkages between industries nationally, it can also serve as a proxy for connections among firms in those industries locally.[21]

Table 4: Input-Output Table, highlighting Cross-Cutting, Important Suppliers

Desc	Animal food manufacturing	Grain and oilseed milling	Sugar and confectionery product manufacturing	Fruit and vegetable preserving and specialty food manufacturing	Dairy product manufacturing	Animal slaughtering and processing	Seafood product preparation and packaging	Other food manufacturing	Beverage and tobacco product manufacturing	Textile mills and textile product mills	Veneer, plywood, and engineered wood product manufacturing	Pulp, paper, and paperboard mills	Converted paper product manufacturing	Printing and related support activities	Petroleum and coal products manufacturing	Chemical manufacturing (3251,2,3,9)	Chemical manufacturing (3255,6)	Plastics product manufacturing	Rubber product manufacturing	Nonmetallic mineral product manufacturing	Iron and steel mills and ferroalloy manufacturing	Alumina and aluminum production and processing	Foundries	Fabricated metal product manufacturing (3321,2,5,6,9)	Fabricated metal product manufacturing (3323,4)	Machine shops; turned product; and screw, nut, and bolt manufacturing	Coating, engraving, heat treating, and allied activities	Commercial and service industry machinery manufacturing	Household appliance manufacturing	Electrical equipment manufacturing	Other electrical equipment and component manufacturing	Motor vehicle body and trailer manufacturing	Motor vehicle parts manufacturing	Railroad rolling stock manufacturing
Electric power generation, transmission and distribution	0.6%	0.8%	1.3%	1.1%	0.6%	0.4%	0.8%	0.6%	0.9%	1.6%	2.0%	4.6%	1.3%	1.6%	0.7%	1.5%	0.5%	2.0%	1.5%	2.5%	2.2%	2.0%	2.9%	1.2%	0.7%	1.5%	2.6%	0.6%	0.4%	0.4%	0.7%	0.4%	0.9%	0.5%
Chemical manufacturing (3251,2,3,9)	2.2%	0.3%	3.3%	0.7%	0.6%	0.1%	--	1.2%	1.2%	24.9%	3.6%	5.8%	2.8%	4.8%	5.6%	22.9%	12.4%	31.4%	16.9%	3.0%	1.2%	0.5%	0.2%	0.8%	1.8%	0.4%	4.7%	1.3%	1.6%	0.2%	2.8%	0.9%	1.8%	--
Fabricated metal product manufacturing (3323,4)	1.6%	--	0.1%	3.1%	0.2%	--	0.6%	0.3%	3.5%	--	0.2%	--	--	--	--	0.1%	0.7%	0.6%	0.3%	0.1%	--	--	--	0.4%	3.3%	1.0%	0.3%	2.8%	0.2%	2.4%	0.6%	0.6%	0.6%	1.4%
Machine shops; turned product; and screw, nut, and bolt manufacturing	--	--	0.2%	0.1%	--	--	--	0.2%	1.1%	0.4%	1.2%	1.5%	1.3%	0.6%	0.1%	0.2%	1.1%	0.9%	2.2%	0.4%	0.4%	1.4%	2.0%	2.6%	2.2%	3.9%	2.3%	1.9%	3.4%	2.5%	1.7%	2.4%	3.1%	3.1%
Truck transportation	2.0%	3.3%	1.7%	2.1%	2.9%	3.6%	4.1%	2.4%	1.7%	1.5%	1.4%	1.5%	1.7%	0.8%	1.1%	0.9%	0.8%	1.0%	1.4%	2.3%	3.7%	1.8%	2.2%	1.0%	1.0%	0.9%	1.1%	0.8%	0.9%	0.9%	1.1%	1.0%	1.4%	0.8%

*Notes: Excerpt from Input-Output table, highlighting the 5 suppliers listed in Table 3 (those that supply at least 2% to 5 or more industries)*Table 3Table 4*. Industries (columns) are only displayed if at least one of the suppliers (rows) provides >2% to that industry. Data is rounded to nearest tenth, and values between 0% - 0.04% are listed as "--".*

III. Illinois Manufacturing Capacities

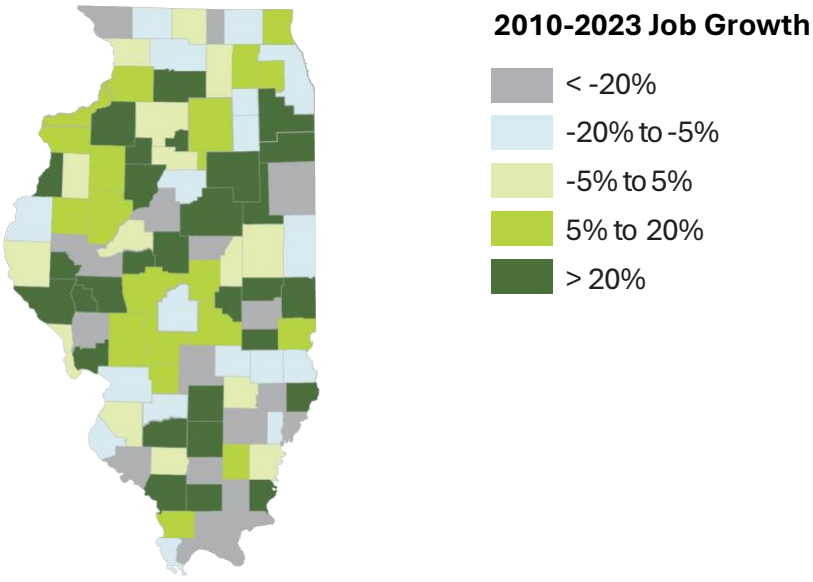
Illinois Manufacturing Overview

The dramatic changes affecting manufacturing will significantly impact Illinois' economy. Manufacturing is one of Illinois' largest traded sectors and a backbone of the state's economy, accounting for almost 13% of the state's output and employing just under 10% of the workforce. Illinois is also a leader in advanced manufacturing, with a 14% higher job concentration than the national average.[22]

While Illinois manufacturing job growth has slowed (3% from 2010-2023 in Illinois versus 12% nationally) – the state still accounts for 5.5% of US value added in manufacturing. And, it still has one of the largest manufacturing job totals, behind only California, Texas and Ohio. Among metro areas, Chicago is the nation's second largest manufacturing hub (behind only Los Angeles) – with 415,000 manufacturing jobs in 2023. Chicago is also one of three of the top 20 largest Metropolitan Statistical Areas (MSAs)[23] to have a manufacturing LQ over 1 (the other two are Detroit and Minneapolis). It has extraordinary legacy manufacturing strengths, having earned a reputation as a "manufacturing metropolis" by the early 20th century.[24]

Illinois' smaller metro areas also contribute significantly to the state's manufacturing prowess. Manufacturing job growth has occurred in micropolitan statistical areas (MicroSAs)[25] and rural counties across the state (see Figure 4). Since 2019, counties that added the most jobs include McLean, DuPage, Will, Rock Island, and Kane.

Figure 4: Illinois Job Growth, by County (2010 – 2023)



Manufacturers set up shop in Illinois for its strong workforce and central location within distribution networks. The state's location at the crossroads of rail and road networks makes it a critical piece of supply chain networks across the country. In fact, nearly 25% of the country's freight trains and 50% of intermodal trains pass through the Chicago region, along with the only single-line rail service that connects the Midwest to Mexico.[26]

Illinois Growth Clusters and Industries

National growth clusters/industries, as reviewed in the prior section, include **IT and Analytical Instruments; Automotive;** and **Food Processing and Manufacturing.** Growth is expected to continue in these clusters as well as growth industries, including **electronics, chemicals, fabricated metals, machinery, plastics/rubber**.

Illinois' diverse manufacturing strengths include many of these national growth clusters/industries. Corporate R&D further supports growth in Illinois in **chemicals** (most notably: pharmaceuticals and medicines), **computer and electronic products** (most notably: semiconductor and electronic components), and **transportation equipment** (most notably: aerospace and parts).[27] Small business grants focus on high-performance coatings and subatomic particles.[28] In addition to these investments, Illinois has many other assets (e.g., workforce, research institutions, etc.) that will contribute to their growth, as noted on the following pages. Illinois' major OEMs support growth of local suppliers and process/product innovation – predominantly in the automotive, food manufacturing and packaging, biopharma, medical suppliers, and aerospace industries.[29]

Looking at cluster data, highlighting employment concentrations and growth, reveals which of the clusters that are growing/stable nationally have strengths in Illinois (in this case, are also growing/stable in Illinois and have sizable manufacturing employment). These are listed below and diagrammed in **Error! Reference source not found.**:

1. **Production Technology and Heavy Machinery**
2. **Plastics**
3. **Automotive**
4. **Food Processing and Manufacturing**
5. **Biopharmaceuticals / Life Sciences**

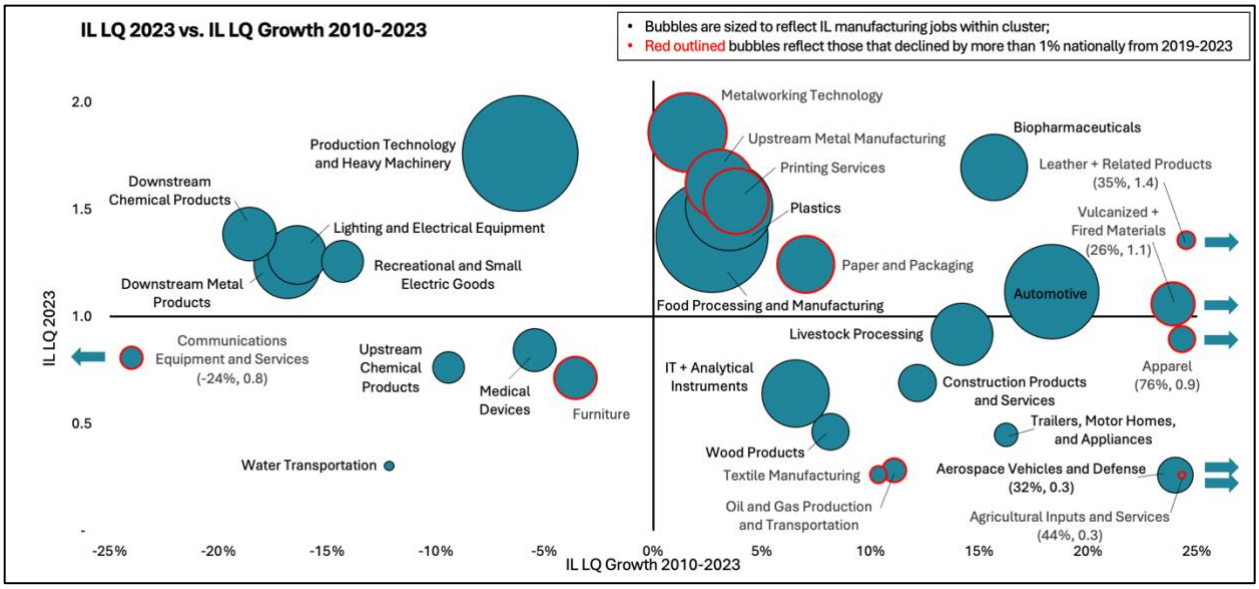
While this data does not capture emerging clusters, the region's investments (noted above) and stakeholder interviews identify emerging areas of interest for Illinois:[30]

6. **Quantum Computing, AI, and Microelectronics**
7. **Energy Tech (Batteries/EVs, Grid Modernization, Clean Energy, etc.)** [31]
8. **Next Generation Agriculture, Ag Tech, and Food Processing**

OTHER CLUSTERS TO NOTE

Note that, while not growing nationally, clusters that have a strong presence and growth trajectory in Illinois include **Metalworking Technology, Upstream Metal Manufacturing, Paper and Packaging,** and **Printing Services.** Clusters that have a strong presence, but low growth, include **Lighting and Electrical Equipment**; **Downstream Metal Products**; **Downstream Chemical Products**. It may be possible that some of the legacy strengths of these clusters can support growth of others. Other clusters worth noting are **IT and Analytical Instruments** (weaker presence, but growing), **Vulcanized and Fired Metals** (stable, low employment – but very high growth), and **Aerospace Vehicles and Defense** (weak presence and low employment – but very high growth).

*Figure 5: Manufacturing-Related **Clusters** – Employment LQ (2023) and Growth (2010-2023)*



Notes: Clusters displayed are as defined by the US Cluster Mapping Project, and contain at least 1 manufacturing industry. Circles are sized to reflect number of manufacturing jobs. For each quadrant:

- *Clusters that are strong (LQ greater than 1) and LQ is growing (2010-2023) are in the upper right quadrant*
- *Those that are weaker (LQ less than 1) but experiencing LQ growth (2010-2023) are in the lower right quadrant*
- *Those that are strong (LQ greater than 1) but experiencing declining LQ growth (2010-2023) are in the upper left quadrant*
- *Those that are weak and are experiencing declining LQ growth (2010-2023) are in the lower left quadrant*

Illinois has many assets that support growth of these 8 clusters. They include:

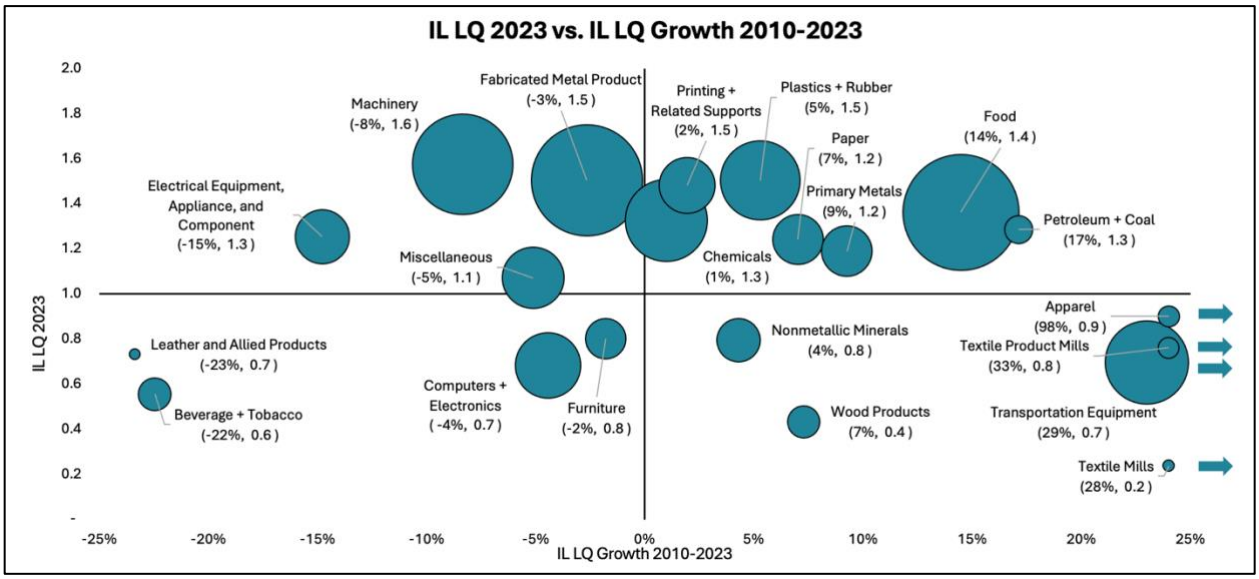
1. **Production Technology and Heavy Machinery -** Illinois is well positioned to grow its automated machinery capacities due to its engineering talent and existing machinery sector strengths (e.g., food product machinery has an LQ of 1.5 and is growing faster than nationally). Illinois also has many legacy strengths that could be leveraged to support growth in this cluster, such as electrical equipment, appliances and components (LQ 1.3, but not growing). Companies like John Deere have pledged to deliver 1.5 million connected machines by 2026.[32]

2. **Plastics –** Plastics product manufacturing is a legacy Illinois strength, and is a critical supplier in Illinois to food and beverage manufacturers, chemical manufacturers, machinery manufacturers, and most significantly – office and household furniture manufacturers (supplying over 10% to this industry). Illinois can contribute to the growth of the Plastics cluster, which includes production of plastic bottles, pipes, firms, sheets, and resins.
3. **Automotive -** Illinois' legacy automotive strengths have been supporting and can continue to support the EV transition. The state already is a leader here: major companies are driving the EV transition (e.g., Rivian), EVs have an LQ of 1.2 and jobs are growing (particularly in the Bloomington area), and state awards support continued innovation (e.g., Rivian was awarded $827M by DCEO to expand its plant).[33]
4. **Food Processing and Manufacturing -** The food processing and manufacturing cluster is also a legacy strength in the state and is experiencing job growth, in particular in MSAs including Chicago and the Quad Cities. While this cluster is often slow to innovate, there is potential to increase innovation through corporate leadership (e.g., Conagra, Ingredion) or growth of startups.
5. **Biopharmaceuticals / Life Sciences -** Biopharmaceutical growth is driven by the state's large companies (e.g., Medline, Baxter, Abbott, GE Health) – many which are moving supply chains in the direction of in-sourcing. Growth is expected to continue in this cluster due to corporate-led and university-led efforts, as well as nonprofit-led research institutes (e.g., CZ Biohub Network).
6. **Quantum Computing, AI, and Microelectronics –** Quantum includes the manufacture of electronic computers, computer storage devices, semiconductors, and other electronic components. This nascent cluster is still defining its workforce needs, career pathways and supply chains – but, Illinois has R&D funding to support its establishment. For instance, the Chicago Quantum Exchange has received several federal investments and is leading a consortium of quantum stakeholders to innovate and deploy deep tech innovations. Illinois has the manufacturing capacity to make quantum related products, for instance machine shops (LQ 1.9), fabricated metal product manufacturing (over 100,000 jobs added between 2010 and 2023), and paints and coatings (LQ 1.5).
7. **Energy Tech (Batteries/EVs, Grid Modernization, Clean Energy, etc.)** - Illinois has many assets to support Energy Tech growth, most notably its metals strengths (which can support production of grid modernization components and the necessary coatings). In addition, Illinois has several energy-related R&D and startup investments. For example, UChicago's Institute for Climate and Sustainable Growth is doing research on prototyping sodium-ion batteries, Argonne is leading a $50M research effort around sodium-ion batteries, and startups are planning to manufacture them.[34]
8. **Next Generation Agriculture, Ag Tech, and Food Processing** – In addition to its ag-science startups, Illinois has the raw materials to respond to rapidly changing next-economy food and agriculture demands. For instance, Illinois' soybean production could support bio-based packaging, biofuels, or food-grade grease (Illinois is the

4th-largest biodiesel producer in the US).[35] Illinois could also leverage federal grants (e.g., iFAB's biofermentation research, a $51M EDA grant).[36]

Illinois has legacy (and existing) strengths in key industries that fuel growth in several of these clusters. Industry strengths are in **metals and machinery, plastics and rubber, chemicals,** and **food** (see **Error! Reference source not found.**).[37] Illinois also has strengths in **electrical equipment, appliances and components**, an industry that is key to much of manufacturing's future growth, in particular addressing electrification trends. It should be noted that this industry may need intervention to grow, given that its employment has been shrinking over the last decade. These state industry strengths align with national strengths (those with high employment growth and/or VA), meaning that growing any of these industries in Illinois will be further supported by growth at the national level.[38]

*Figure 6: Manufacturing **Industries** – Employment LQ (2023) and Growth (2010-2023)*



Notes: Industries are displayed at the 4-digit NAICS level. Circles are sized to reflect number of manufacturing jobs.

Taking an even more detailed look at industry data (e.g., looking at 6-digit NAICS) reveals that many of Illinois' key industries fuel growth in metals-and-machinery-related clusters (see Table 5).[39] Many of these industries are made of up of small and medium sized enterprises (SMEs); for instance, 47% of metalworking machinery firms have less than 50 employees and 39% of machine shops have less than 50 employees (see Table 6). These SMEs are critical to Illinois manufacturing growth, and it will be important to support them to continue the state's manufacturing leadership.

Table 5: Manufacturing Industries, mapped to Clusters

Industry	Industry Description (manufacturing)	6D Industry Emp 2023	6D Industry LQ 2023	IL Emp Growth 2010-2023	US Emp Growth 2010-2023	IL Emp Growth 2019-2023	US Emp Growth 2019-2023	Porter Cluster
326199	All Other Plastics Product	23,700	1.9	-17%	***16%***	**0%**	0%	Plastics
332999	All Other Miscellaneous Fabricated Metal Product	6,600	2.0	13%	19%	-9%	***1%***	Downstream Metal Products
332119	Metal Crown, Closure, + Other Metal Stamping (except Autom.)	6,400	3.3	**16%**	11%	-12%	-8%	Upstream Metal Manufacturing
335313	Switchgear and Switchboard Apparatus	4,300	2.8	-21%	-3%	**17%**	11%	Lighting and Electrical Equipment
325510	Paint and Coating	3,900	2.3	**1%**	1%	**3%**	-2%	Downstream Chemical Products
334512	Automatic Environ. Ctrls. For Resid., Comm, and Appliance Use	3,900	7.2	-31%	-15%	**2%**	-9%	IT and Analytical Instruments
333618	Other Engine Equipment	3,300	1.7	**19%**	8%	**6%**	0%	Production Tech. + Heavy Machinery
333993	Packaging Machinery	3,200	3.2	-3%	-4%	**32%**	12%	Production Tech. + Heavy Machinery
333996	Fluid Power Pump and Motor	2,900	3.9	**38%**	19%	-3%	-5%	Production Tech. + Heavy Machinery
332431	Metal Can	2,400	2.7	-21%	-16%	10%	22%	Downstream Metal Products
332111	Iron and Steel Forging	2,200	2.7	-32%	-10%	-8%	-10%	Upstream Metal Manufacturing
332991	Ball and Roller Bearing	2,200	2.8	**36%**	-24%	**1%**	-22%	Production Tech. + Heavy Machinery
332613	Spring	2,100	3.3	-11%	***21%***	-11%	-12%	Upstream Metal Manufacturing
333413	Industrial and Commercial Fan + Blower + Air Purification Equip.	2,000	1.6	**35%**	25%	3%	4%	Production Tech. + Heavy Machinery
332618	Other Fabricated Wire Product	1,900	1.9	**23%**	13%	-12%	-4%	Upstream Metal Manufacturing
332216	Saw Blade and Handtool	1,900	1.8	-28%	***20%***	-19%	-8%	Downstream Metal Products
334412	Bare Printed Circuit Board	1,800	1.7	33%	34%	-13%	-3%	IT and Analytical Instruments
335932	Noncurrent-Carrying Wiring Device	1,800	4.2	8%	21%	-14%	-1%	Lighting and Electrical Equipment
333612	Speed Changer, Industrial High-Speed Drive, and Gear	1,600	3.5	**13%**	-1%	-10%	-6%	Production Tech. + Heavy Machinery
331523	Nonferrous Metal Die-Casting Foundries	1,600	1.8	-9%	***6%***	-17%	-11%	Automotive
332439	Other Metal Container	1,600	2.7	-17%	***23%***	-7%	-6%	Downstream Metal Products
333241	Food Product Machinery	1,300	1.6	**17%**	8%	1%	8%	Production Tech. + Heavy Machinery
332919	Other Metal Valve and Pipe Fitting	1,200	2.0	-15%	-29%	-6%	-5%	Production Tech. + Heavy Machinery
333995	Fluid Power Cylinder and Actuator	1,100	1.8	37%	40%	**3%**	-7%	Production Tech. + Heavy Machinery
324191	Petroleum Lubricating Oil and Grease	1,100	2.5	-27%	***7%***	-22%	-1%	Downstream Chemical Products
333613	Mechanical Power Transmission Equipment	1,100	2.0	**69%**	-8%	-10%	-3%	Production Tech. + Heavy Machinery

IL EMP > 1,000	IL LQ >= 1.5	growing in IL	**growing in IL faster than US (bold)**	***growing in US; declining in IL (bold/italics)***	*growing in US faster than US total econ*

Notes: This table includes the largest 25 industries in Illinois. Their associated Porter Cluster (as defined by the US Cluster Mapping Project) is listed in the right-most columns

Table 6: Manufacturing Industries and Business Size Distributions

Industry 4D NAICS	Coating, Engraving, Heat Treating, + Allied Activities	Machine Shops; Turned Product; + Screw, Nut, + Bolt	Metalworking Machinery	Spring + Wire Product	Forging + Stamping	Other Food	Railroad Rolling Stock	Steel Product from Purchased Steel	Other Fabricated Metal Product	Bakeries + Tortilla	Plastics Product	Converted Paper Product	Electrical Equipment	Paint, Coating, + Adhesive	Engine, Turbine, + Power Transmission Equipment	Sugar + Confectionery Product	Audio + Video Equipment	Agriculture, Construction, + Mining Machinery	Grain + Oilseed Milling	Pharmaceutical + Medicine
<20	19	20	25	9	8	6	4	6	6	15	3	4	5	7	3	5	4	2	1	1
20-49	19	19	22	20	15	9	7	6	9	11	8	9	8	9	5	1	6	2	1	1
50-249	41	38	29	32	25	24	23	28	22	10	19	21	17	10	10	9	10	6	7	4
250-499	9	9	6	13	12	19	18	6	7	6	8	3	5	6	12	4	0	7	0	2
<500	88	86	81	74	61	59	50	46	43	42	38	36	34	32	30	19	19	17	8	8

Notes: This table only displays industries with Illinois employment LQ >= 1.5. Manufacturing industries are listed are 4-digit NAICS. Business size breakdowns are listed by percentage.

Key Suppliers

In addition to assessing growth clusters and industries, the team examined supply chains: both through review of input-output tables to identify supplier linkages and through interviews with manufacturers to understand lower-tier supply chain activity. This is especially important because, while Illinois is home to several OEMs and Tier 1 suppliers, the majority of manufacturers operate as Tiers 2, 3, and 4 (and these suppliers rely on other lower tier suppliers for inputs).[40]

Like other regions, manufacturers in Illinois source some of their inputs from within the region, some from within the U.S. and others from foreign countries. Local suppliers are especially attractive, as they allow manufacturers to be more flexible and responsive to their own clients, move towards just-in-time production, and use less warehouse space for inventory. Manufacturers in Chicago, for instance, source about 50% of their inputs within the region.[41] In Illinois, most manufacturers source raw materials outside of the region due to limited availability and price points. This is particularly true for manufacturers that are high-volume or large-scale. But other tiers of the supply chain are sourced locally.

Several of the cross-cutting, important suppliers nationally (see Table 4) also have strengths in Illinois: **chemicals, fabricated metals,** and **machine shops**. In particular, machine shops have a very strong presence in Illinois as compared to the rest of the country – with a 2023 employment Location Quotient (LQ)[42] of 1.9. Interviews with manufacturers highlighted other key suppliers and some of the lower tier supply chain activity that is missed in input-output tables:

- **Metals components** – The region has historical strengths in processes like stamping, turning, CNC machining, foundry, forgings, and wire forming and many of these capabilities continue to support the metal components industry. This includes products like wires, motors, bearings, controls – and even casings and enclosures for electronics. Some of these strengths have moved overseas (in particular, labor intensive processes) and Illinois would benefit from strengthening some of these activities. Automation may help facilitate growth in metals components manufacturing.
- **Metals coatings** – The region has strengths in R&D in materials innovation, particularly in metal coatings. This could support growth in – for instance – energy storage (e.g., coatings for battery storage systems), automotive parts (e.g., protective coatings), machinery (e.g., anti-abrasion coatings), and electronics (e.g., anti-corrosion or conductive coatings).[43]
- **Electronics components** – Multiple manufacturers rely on a single local supplier for electronics components (or a few foreign suppliers) but given the prevalence of electronics components that are needed across so many industries, there is a need for a broader network of suppliers. In particular, there is a need for suppliers that can produce high performance electronics for emerging industries and/or high-precision industries like aerospace. This could include products like sensors, capacitors, inductors, transistors, and circuits. Legislation that encourages reshoring may help the U.S. to build these capabilities.
- **Job shops** – There are a variety of job shops in Illinois which line up into supply chains for OEMs. And, many job shops supply to and from other job shops. In particular, along the I-90 corridor there is a cluster of machine tool builders – and throughout the state, many machine shops that serve the metals industry. These job shops employ a strong community of toolmakers throughout the state, producing precision tools (in addition to dies, molds, etc.).
- **Chemicals** – This industry supplies many others (e.g., agriculture, food, water, automotive, microchip). The state has chemical suppliers that can address emerging industries as well – for instance, suppliers of ultra-pure HCl to coat microchips.

Several of Illinois' growth clusters share common suppliers: **machine shops, fabricated metal components, metals coatings, electrical equipment manufacturing, plastics**. The conversations with manufacturers emphasized the importance of two in particular: **fabricated metals** (metal components, metal coatings, machine shops) and **electronics components** to support manufacturing growth. Input-output tables reveal why: both

fabricated metals and electronics components supply to a wide range of interrelated industries (see Table 7). Electrical components are key pieces of machinery supply chains, but also household appliances and lighting. Fabricated metal products are important to industries like machinery, food and beverage, and transportation. Both are critical components of machinery manufacturing, and the growing presence of electronics in machinery manufacturing may be indicative of the increasing impact of automation on this industry, as products like sensors are increasingly needed to detect parameters and inform adjustments to machinery operations. Both fabricated metals and electronics components have the potential to grow in Illinois, as they supply growing clusters and can help manufacturing respond to next-economy trends.

Table 7: Input-Output Table, Highlighting Select Suppliers highlighting metals, machinery and electrical equipment

Industry Description	Fruit and vegetable preserving and specialty food manufacturing	Beverage and tobacco product manufacturing	Rubber product manufacturing	Foundries	Fabricated metal product manufacturing (3321,2,5,6,9)	Fabricated metal product manufacturing (3323,4)	Machine shops; turned product; and screw, nut, and bolt manufacturing	Coating, engraving, heat treating, and allied activities	Machinery manufacturing (3331,2,4,9)	Commercial and service industry machinery manufacturing	Metalworking machinery manufacturing	Engine, turbine, and power transmission equipment manufacturing	Electric lighting equipment manufacturing	Household appliance manufacturing	Electrical equipment manufacturing	Other electrical equipment and component manufacturing	Motor vehicle body and trailer manufacturing	Motor vehicle parts manufacturing	Aerospace product and parts manufacturing	Railroad rolling stock manufacturing	Other transportation equipment manufacturing	Furniture and related product manufacturing (3371,2)	Other furniture related product manufacturing
Fabricated metal product manufacturing (3321,2,5,6,9)	0.1%	0.3%	2.7%	2.4%	8.6%	1.5%	2.8%	2.1%	2.9%	2.7%	1.1%	4.4%	2.7%	5.4%	2.7%	2.1%	1.9%	3.0%	1.6%	4.5%	2.3%	2.9%	4.2%
Fabricated metal product manufacturing (3323,4)	3.1%	3.5%	0.3%	--	0.4%	3.3%	1.0%	0.3%	0.8%	2.8%	0.1%	1.7%	0.3%	0.2%	2.4%	0.6%	0.6%	0.6%	0.5%	1.4%	0.5%	0.3%	--
Machine shops; turned product; and screw, nut, and bolt manufacturing	0.1%	1.1%	2.2%	2.0%	2.6%	2.2%	3.9%	2.3%	1.8%	1.9%	1.4%	0.8%	2.0%	3.4%	2.5%	1.7%	2.4%	3.1%	0.4%	3.1%	1.2%	1.4%	0.6%
Machinery manufacturing (3331,2,4,9)	0.7%	1.4%	--	0.6%	0.1%	0.2%	0.3%	1.4%	4.5%	1.2%	0.8%	0.7%	0.1%	0.5%	--	0.1%	1.1%	1.2%	0.5%	0.6%	--	0.1%	--
Electrical equipment manufacturing	--	0.4%	0.1%	--	0.7%	0.1%	0.7%	0.3%	2.8%	1.0%	2.3%	1.1%	2.3%	4.6%	12.0%	0.3%	0.1%	0.3%	0.1%	1.0%	0.1%	0.1%	0.1%
Other electrical equipment and component manufacturing	--	--	--	0.2%	0.5%	--	0.1%	--	0.5%	3.1%	0.3%	1.0%	2.1%	3.2%	0.5%	3.1%	0.8%	1.1%	0.3%	--	--	--	--

Notes: Excerpt from Input-Output table, highlighting select suppliers: fabricated metal products, machine shops, machinery, and electrical equipment. Industries (columns) are only displayed if at least one of the suppliers (rows) provides >2% to that industry. Data is rounded to nearest tenth, and values between 0% - 0.04% are listed as "--".

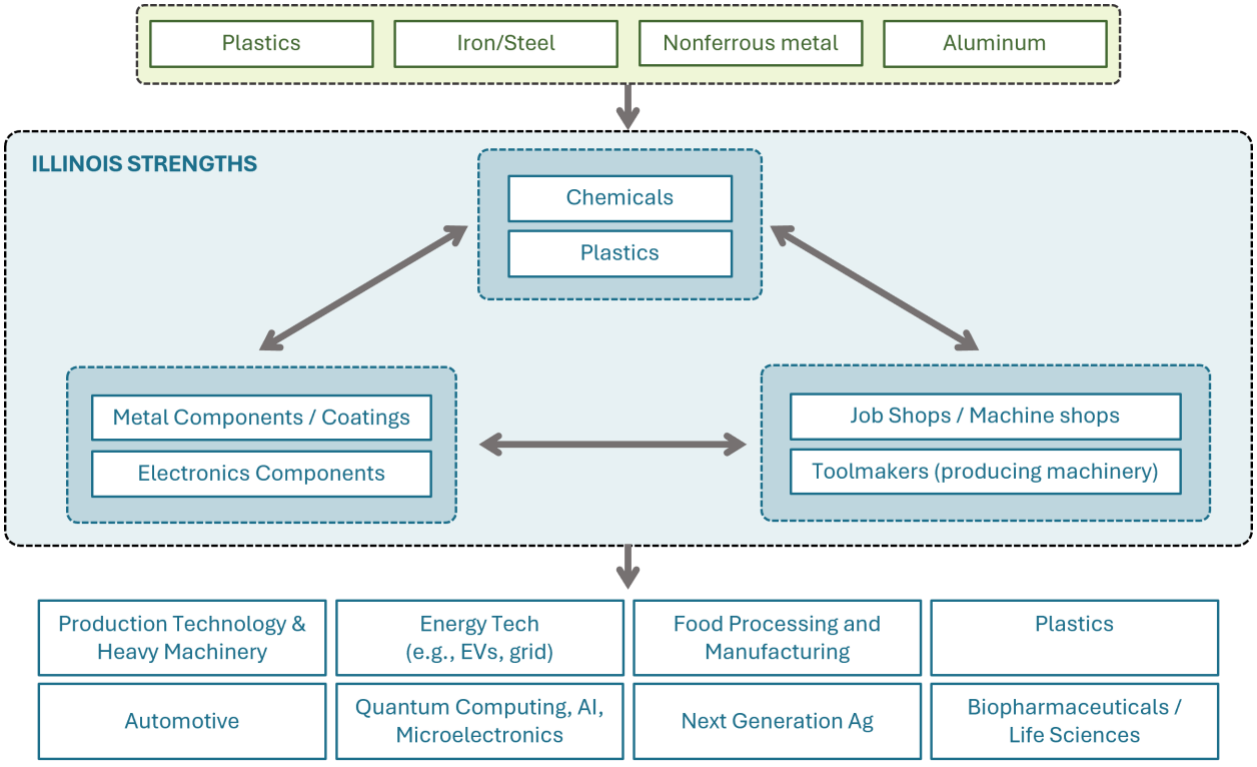
IV. Illinois Future Manufacturing Opportunities

The critical suppliers identified - **metal components and coatings**; **electrical components** – support each of Illinois growth clusters:

1. **Production Technology and Heavy Machinery**
2. **Plastics**
3. **Automotive**
4. **Food Processing and Manufacturing**
5. **Biopharmaceuticals / Life Sciences**
6. **Quantum Computing, AI, and Microelectronics**
7. **Energy Tech (Batteries/EVs, Grid Modernization, Clean Energy, etc.)**
8. **Next Generation Agriculture, Ag Tech, and Food Processing**

Strengthening these suppliers – and connecting them with new opportunities in these growth clusters – can help Illinois to be a global competitor in future manufacturing (see Figure 7). Note that, as the economy continues to change, these opportunities may change as well. The above analysis – examining the intersections of firms, related industries, and suppliers – can be undertaken periodically to identify new areas of focus for Illinois manufacturing investment.

Figure 7: Illinois' Key Manufacturing Strengths



These two suppliers have tremendous strengths in Illinois but also opportunity to scale further:

- **Metal components and coatings** – Illinois' high concentration of metal fabricators, many of them small businesses, are especially important to growth clusters (e.g., machinery, automotive, energy tech, quantum).[44] Paints and coatings, like metal fabrication, supports many sectors, is highly concentrated in Illinois with an LQ of 1.5 and has been growing faster than in the U.S. overall. This is particularly important because innovative metal coatings are growing in demand, being used to maintain certain properties on product surfaces while allowing the product itself to be more lightweight. Illinois has R&D to support growth high-performance coatings - for applications in industries including energy (solar cells, batteries), automotive, and aerospace.[45] But, for Illinois to maintain its leadership, metals manufacturers will need continuous support to connect them to emerging industries and R&D resources.
- **Electronics manufacturing** – Illinois has legacy strengths in this industry, and has the potential to produce the many products required for electrification and automation (e.g., sensors for cobots). But, Illinois needs more support to produce the electronics components required for rapidly growing industries like energy storage, automated machines, or aerospace. This may entail increased collaborative innovation or R&D efforts, or efforts to scale the electronics manufacturing workforce, which has been shrinking over the last decade.

These suppliers fuel growth in several key Illinois clusters, as noted above. As examples, we highlight two specific opportunities: within Production Technology & Heavy Machinery: **Automated Machinery**; within Energy Tech: **Grid Modernization**. Note that many of the manufacturing capacities that are important to growing Automated Machinery and Grid Modernization are also important to growing Illinois' other key clusters.

- **Automated Machinery**: There is already a growing presence of companies that produce robots, but a greater need for production of cobots (e.g., robots that move small components from one spot on an assembly line to another). Cobots require high precision electronic sensors that can sense torque, force, position and temperature. Many cobots can be integrated into existing machines, thus helping a manufacturer to automate without buying an entirely new machine or significantly altering their production process. But, to scale the production of cobots, greater partnerships and collaboration are needed. There is opportunity to automate machinery within legacy sectors like food processing, which will require very high precision electronics.
- **Grid Modernization**: As electrification creates tremendous need for new grid modernization products (energy storage, distribution and transmission), new metal and electrical components will be needed. This will require continuous improvement to traditional electronics like resistors, capacitors, inductors, diodes, transistors, and switches and also require energy storage innovation and production. Illinois has potential to scale production of these products, including batteries, inverters, capacitors, transformers, transmission systems, wire cables,

volt controls, meters and switches. The region currently produces some of these components (e.g., Parr Instruments, cabling companies that support solar panel production) but has the potential to do more locally by connecting our supplier base to grid- and storage-related innovations, and by nurturing more Tier 1-2 suppliers. These components also require high performance coatings, which Illinois has capacity to do more of locally.

The manufacturing renaissance creates a major opportunity for Illinois manufacturers – not just to grow the Automated Machinery and Grid Modernization sectors but to address many of the trends impacting manufacturing (e.g., digitization, electrification, automation). To seize the opportunity to lead the manufacturing renaissance, Illinois needs to target investments to the specific manufacturing capacities that are critical to its growth.

V. Strategies

Strategies are designed to accelerate Illinois' manufacturing growth. They focus on providing support to critical suppliers – **metal components and coatings**, and **electrical components –** that drive growth across multiple clusters.

Note that these are initial strategies, and should be continually refined as IMEC uncovers new manufacturer needs and growth opportunities. Some of these strategies may be undertaken by IMEC, but others may be led by, or done in collaboration with, key partners (e.g., mHUB, Elevate, Chicagoland Food and Beverage Network, Cook County Bureau of Economic Development, Next Street, Chicago Metro Metals Consortium, P33, UI Labs / MxD, Manufacturing Renaissance, Discovery Partners Institute, Urban Manufacturing Alliance, West Side Forward, World Business Chicago, Southland Development Authority, Argonne, Fermilab, Chicago Workforce Alliance, etc.).

Strategies include:

1. **Connect manufacturers to growth markets.** The economy is rapidly changing, giving rise to a manufacturing renaissance – changing manufacturing processes, supply chains and products. Manufacturers will need to pivot to remain competitive, continuously assessing new market opportunities and associated product, process and partnership development needed to meet these opportunities. Programming could include:
    a. *Broker connections between firms to address these gaps*. Identify new manufacturing growth opportunities (led by IMEC, or done in partnership with manufacturing-focused economic development organizations), identify specific components that OEMs need locally, and broker connections to Illinois firms that can provide these components. This could mean pairing a manufacturer with mechanical capabilities with a manufacturer with robotics capabilities in order to produce cobots. Or, pairing a plastics

manufacturer with a toolmaker to develop a new die to accommodate the new material. This could leverage IMEC's existing DoD-funded work in casting and forging.

b. *Strengthen firms in selected markets or supply chains*. Identify existing Illinois manufacturers that with modest support can meet identified growth opportunities (and then, per 1a, build market connections between the two). To do this, IMEC could conduct capability assessments of firms and provide deep one-on-one firm support to help them scale or address common challenges they are facing. This could mean, for instance, supporting firms that make fabricated metal components and coatings by assisting with product development, technology/automation enhancement, innovation support, or business planning (with a particular focus on accessing automated machinery / grid modernization opportunities).

2. **Support entrepreneurs to seize new market opportunities**. The above strategy recommends brokering connections between OEMs and Illinois firms that can supply components. In some cases, this may lead to identification of areas where there are not enough firms to fill supply chain gaps. In these areas, entrepreneurship will be needed to grow local production. For instance, to scale production of high performance electronics, IMEC could work with partners to support a cohort of entrepreneurs focused on electronics that support grid modernization. IMEC could also help commercialize R&D in areas like complex electronics to support automation.

While the above strategies may be the best focus for IMEC to drive future manufacturing growth, there are many other supports that manufacturers will need to remain competitive in our rapidly changing economic landscape. These could include, for instance:

- **Shared Demonstration/Prototyping Facility** – To accelerate growth of emerging industries and use of newer techniques, multiple companies expressed a need to integrate new processes into their production lines, in particular noting 3D printing and laser welding. A shared facility could assist manufacturers in testing new pieces of equipment to minimize the risk before integrating them into their production lines.
- **Succession Planning** – To maintain the strength of legacy industries and help them grow, this will be important. This could include industries like Metalworking Technology and Upstream Metal Manufacturing – both strong in Illinois and critical to other industries, but not growing.
- **Investment Capital** – Support the formation of new funds to invest in manufacturing. Funding needs will vary for each manufacturing industry, with some requiring more commercialization support, others requiring retooling support or factory investments, and others requiring scale-up support.
- **Technical Assistance –** Continue, and build upon, IMEC's existing programming to provide technical assistance to manufacturers in areas where the economy is

rapidly changing (e.g., digitization support), or areas where manufacturers need assistance to grow (e.g., workforce support).

The above strategies represent one starting point – but, as IMEC proceeds to support firms in the state's growth industries, many more learnings will help to refine and generate additional support strategies.

VI. Conclusion

Illinois is one of the country's most diverse manufacturing hubs and poised to be a leader of manufacturing's renaissance. But to do this, deliberate intervention is needed. IMEC and partners must continuously assess leading manufacturing growth opportunities and identify/grow the concentrations of firms, related industries and suppliers that interact to seize these market opportunities. In the near term, Illinois has potential to grow as a manufacturing leader of Grid Modernization and Automated Machinery products. To do this, Illinois must strengthen the firms that produce metal components and coatings and electrical components – and it must improve their connections to machinery and energy tech markets. IMEC is well positioned to support our state's manufacturers in securing these next-economy growth opportunities and looks forward to leading, with partners, growth of Illinois' tremendous manufacturing economy.

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[2] Broadly: the pace of change in the economy is increasing: "creative destruction" is disrupting industries, occupations and places; while new products, firms, industries and markets are rapidly emerging, leading to enormous opportunities for new wealth creation. Brophy, Paul, Weissbourd, Robert, and Andy Beideman, *Transformative Economies: Emerging Practices for Aligning Growth and Inclusion*, Federal Reserve Bank of Philadelphia: 2017; For more detail on advanced digital technologies, see: https://www.defense.gov/News/News-Stories/Article/article/3189049/us-manufacturing-ecosystem-key-to-economic-growth-innovation-competitiveness/; For more detail on smart factory lines, see: https://www.automation.com/en-us/articles/february-2024/advanced-technologies-transforming-manufacturing; For more detail on collaborative robots, see: https://www.mdpi.com/2075-4698/14/2/19#B4-societies-14-00019; Federal investments include the $1.9 trillion American Rescue Plan Act, the $1.2 trillion Infrastructure Investment and Jobs Act, the $280 billion CHIPS and Science Act, and substantially increased defense spending. Katz, Bruce. "How Cities Can Thrive in the New Industrial Era." January 18 2024. The New Localism; https://www2.deloitte.com/us/en/insights/industry/public-sector/infrastructure-bill-projects-agency-execution.html
[3] https://cmap.illinois.gov/wp-content/uploads/FULL-Technical-Report-web.pdf
[4] For instance, they share resources (e.g., labor pools), reduce transportation and transaction costs, and facilitate knowledge exchange. http://rw-ventures.com/wp-content/uploads/2017/01/Strengthening-region-report_1-11-11.pdf; Some clusters may be a few blocks (e.g., Manhattan's garment district) while others may be several states (e.g., the Great Lakes' auto industry cluster). Joseph Cortright, "Making Sense of Clusters: Regional Competitiveness and Economic Development," The Brookings Institution, March 2006, 6.; LISC Chicago and RW Ventures, "Linking Neighborhood Development to Regional Cluster Development: Phase 2 Proposal to the MacArthur Foundation," November 2011; Ellison, Glenn, Glaeser, Edward L., & Kerr, William R. (2010). "What Causes Industry Agglomeration? Evidence from Coagglomeration Patterns," American Economic Review, Volume 100, pp. 1195–1213.
[5] LISC Chicago and RW Ventures, "Linking Neighborhood Development to Regional Cluster Development: Phase 2 Proposal to the MacArthur Foundation," November 2011; Cluster mapping relies on the US Cluster Mapping Project, a database that identifies 41 clusters. These 41 clusters are comprised of 589 industries. Cluster mapping also maps relatedness of clusters (e.g., the automotive cluster is linked to 6 related clusters, for instance, metal manufacturing). LISC Chicago and RW Ventures, "Linking Neighborhood Development to Regional Cluster Development: Phase 2 Proposal to the MacArthur Foundation," November 2011.
[6] Processes such as cluster mapping have limitations, for instance, it identifies entities that are co-located and *could* collaborate, but not necessarily those that do. It also does not take into account the level of intensity of collaborations between firms. https://www.hbs.edu/ris/Publication%20Files/Cluster%20Mapping%20as%20a%20Tool%20for%20Development%20_%20report_ISC%20WP%20version%2010-10-17_c46d2cf1-41ed-43c0-bfd8-932957a4ceda.pdf; And, it does not capture the breadth and depth of supply chains that support cluster growth, instead only providing insights on forward and backward linkages between industries. e.g., Ed Feser uses input-output data from 399 industry segments to calculate the degree of link between industries. Feser calculates the "proximity" (i.e., how many rounds of spending in one industry it takes to affect another industry) and "magnitude" (i.e., the size of the transactions) of each industry to each other industry. These linkages are tested in both directions, viewing each industry from the perspective of both buyer and seller. Strong backward links to the same industries indicate shared suppliers, while strong forward links to the same industries indicate shared customers; For more on supply chain complexities, see: https://www.ey.com/en_us/insights/consulting/how-the-great-supply-chain-reset-is-unfolding; https://www.brookings.edu/articles/six-ways-to-improve-global-supply-chains/; For more on rapid economic changes: "Recent evidence suggests that the emergence of a global and knowledge-based economy is affecting what economic activities most benefit from clustering." Basic cluster analysis "fails to capture the nuances of why a particular cluster has formed, what characteristics and circumstances particular to its members and location drive its performance, and how intervention might further increase its productivity." LISC Chicago and RW Ventures, "Linking Neighborhood Development to Regional Cluster Development: Phase 2 Proposal to the MacArthur Foundation," November 2011.
[7] Employment: 2023 data. Source: data-Fab analysis of QCEW data; Productivity growth: 2022 data. Source: https://www.defense.gov/News/News-Stories/Article/article/3189049/us-manufacturing-ecosystem-key-to-economic-growth-innovation-competitiveness/. Manufacturing also comprises 60% of exports; R&D: 2022 data. Source: data-Fab analysis of NSF BERD (for Domestic R&D at companies, nominal); https://nam.org/manufacturing-in-the-united-states/facts-about-manufacturing-expanded/; Patents: 2022 data. Source: https://www.defense.gov/News/News-Stories/Article/article/3189049/us-manufacturing-ecosystem-key-to-economic-growth-innovation-competitiveness/; Manufacturing also has one of the highest multiplier effects of any sector: for every $1.00 spent in manufacturing, there is an impact of $2.68 to the overall economy. National Association of Manufacturers (NAM) calculations using 2020 IMPLAN data; Value added: Manufacturing comprises 11.5% of US value added (VA). 2023 data. Source: data-Fab analysis of BEA GDP by Industry ; Value added definition: https://www.bea.gov/help/glossary/value-added
[8] Source: dF-QCEW, 2010-2023; Mass Economics analysis. There was also a 15% increase in establishments in this same time period.
[9] https://www.defense.gov/News/News-Stories/Article/article/3189049/us-manufacturing-ecosystem-key-to-economic-growth-innovation-competitiveness/; https://www.ibm.com/think/insights/manufacturing-trends; https://www.ibm.com/think/insights/manufacturing-trends
[10] https://ibtinc.com/industrial-automation-future-trends/; https://www.ibm.com/think/insights/manufacturing-trends; https://www.plunkettresearch.com/7-key-trends-shaping-the-manufacturing-automation-and-robotics-industry-insights-for-investors-consultants-and-marketing-professionals-in-2025/
[11] https://www.morganstanley.com/ideas/electrification-grid-energy-transition-opportunities; https://www.woodmac.com/news/opinion/the-challenge-of-growing-electricity-demand-in-the-us-and-the-shortage-of-critical-electrical-equipment/; https://www.morganstanley.com/ideas/electrification-grid-energy-transition-opportunities ; Katz, Bruce. "How Cities Can Thrive in the New Industrial Era." January 18 2024. The New Localism; 2023 R&D spending:

semiconductor and other electronic components (13.7%), other computer and electronic manufacturing (13.6%) and motor vehicles and parts (9.6%). https://nam.org/manufacturing-in-the-united-states/facts-about-manufacturing-expanded/

[12] Reshoring: Katz, Bruce. "How Cities Can Thrive in the New Industrial Era." January 18 2024. The New Localism. Reshoring has also accelerated in the wake of COVID-19 supply chain disruptions. https://www.alliedmarketresearch.com/metal-and-metal-manufactured-products-market, https://www.areadevelopment.com/manufacturing-industrial/q1-2024/manufacturing-momentum-is-building.shtml; Regions that have strong local suppliers are poised to be more resilient and competitive. Nearshoring: https://www.foreignaffairs.com/china/globalization-dangerous-myth-economy-brad-setser; Trade partnerships: Canada and Mexico partnerships are encouraged by the USMCA trade agreement. https://www2.deloitte.com/us/en/insights/industry/manufacturing/global-supply-chain-resilience-amid-disruptions.html, while Indo-Pacific region partnerships are encouraged by the Indo-Pacific Economic Framework and Americas Partnership for Economic Prosperity. https://www.economicstrategygroup.org/wp-content/uploads/2023/11/Lovely_2023_Chapter.pdf

[13] https://blog.burnsmcd.com/why-the-future-of-manufacturing-depends-on-a-new-kind-of-workforce-and-how-to-build-it

[14] BFS Time Series, monthly data from 2005 to 2024. From 2015 – 2019, an average of 64,604 manufacturing business applications were registered per year. From 2020 – 2024, an average of 88,806 applications were registered. Note that BFS Time Series data was filtered for: (1) Seasonally adjusted data; (2) Business applications (rather than business registrations). https://www.census.gov/econ/bfs/current/index.html

[15] Areas within manufacturing with the highest VA contributions are chemical products; food, beverage, and tobacco products; and computer and electronic products – as categorized in data from BEA value added by industry, for both durable and non-durable goods). https://www.nist.gov/el/applied-economics-office/manufacturing/manufacturing-economy/total-us-manufacturing

[16] Note that employment growth alone is not a predictor of economic growth, because at times outputs increase with fewer employees.

[17] Source: dF-QCEW, 2010-2023; Mass Economics analysis
There was also a 15% increase in establishments in this same time period.

[18] Q1 2020 to Q3 2023. https://jahaniandassociates.com/manufacturing-transactions-by-usa-based-investors/

[19] Energy related supply chains are vast and make products that include – for example – batteries, carbon capture and storage, critical minerals, electric vehicles, fiber optic cables, fuel cells and electrolyzers, hydropower, nuclear energy, rail cars, semiconductors, solar power, wind power, and wireless technology; For more detail on materials innovation and new alloys and composites, see: https://link.springer.com/article/10.1007/s11837-018-3224-2; applications of nanoparticles can improve material properties (e.g., strength, durability, flexibility) of a range or products or coatings, https://www.gray.com/insights/nanotechnology-and-manufacturing-the-future-is-bright/; New alloys and composites include: magnesium and aluminum alloys, polymer composites, and carbon fiber. https://www.tfgusa.com/innovations-in-parts-fabrication/; And, processes like 3D printing provide manufacturing options for new material composites that can result in high-strength, complex, lightweight structures. https://www.tritool.com/blog/reaching-new-heights-how-new-trends-are-accelerating-innovation-in-the-aerospace-manufacturing-industry

[20] Note: Truck transportation is not included in this list because it doesn't "supply to" industries in the same way that the others do (instead, it provides a service to industries, for instance shipping products for food-related industries).

[21] LISC Chicago and RW Ventures, "Linking Neighborhood Development to Regional Cluster Development: Phase 2 Proposal to the MacArthur Foundation," November 2011.

[22] https://nam.org/mfgdata/regions/illinois/; https://www.intersectillinois.org/key-industries/advanced-manufacturing/

[23] "Each metropolitan statistical area must have at least one urban area of 50,000 or more inhabitants." https://www.census.gov/programs-surveys/metro-micro/about.html; State-wide manufacturing job totals: https://www.industryselect.com/blog/top-10-us-states-for-manufacturing.

[24] US and Illinois comparisons (job growth) and Illinois % of US value added - Source: dF-QCEW, 2010-2023; BLS Employment Projections Program, Input-Output Matrices; Mass Economics analysis; Largest manufacturing hubs: Chicago Business Bulletin, July 2023, Issue No.4, Innovation in Manufacturing & Chicagoland Advantages; Chicago MSA jobs (2023) - Source: dF-QCEW, 2023; BLS Employment Projections Program, Input-Output Matrices; Mass Economics analysis; Chicago earned the reputation of "manufacturing metropolis" by early 20th century, see: https://worldbusinesschicago.com/app/uploads/2023/08/Innovation-in-Manufacturing_August-2023.pdf

[25] "Each micropolitan statistical area must have at least one urban area of at least 10,000 but less than 50,000 population." https://www.census.gov/programs-surveys/metro-micro/about.html

[26] https://cmap.illinois.gov/regional-plan/goals/recommendation/maintain-the-regions-status-as-north-americas-freight-hub/; Note: rail service between Midwest and Mexico is the CPKC Mexico Midwest Express

[27] 2022 data. Analyzing 3D NAICS manufacturing data, 33% of corporate Illinois R&D goes to chemicals, 28% to computer and electronic products, and 19% to transportation equipment. Source: data-Fab analysis of NSF BERD (for Domestic R&D at companies, nominal)

[28] Several SBIR/STTR awards focus on high performance coatings, and subatomic particle or nanoparticle technologies. These can be viewed by visiting https://www.sbir.gov/awards, and searching the database with the following filters: Data with award abstracts; Award year 2020 +; Award amount $500k or more; Illinois; Abstract contains the word "manufacture" or "manufacturing"

[29] While Illinois' major OEMs fluctuate with plant openings and closures, the largest manufacturers are currently focused on these industries. https://www.industryselect.com/blog/top-10-manufacturing-companies-in-illinois

[30] These emerging sectors are also called out in: https://dceo.illinois.gov/content/dam/soi/en/web/dceo/documents/ilinois-2024-economic-growth-plan.pdf

[31] Energy tech related supply chains that have strengths in Illinois include: Electric vehicles, fuel cells and electrolyzers, rail cars, nuclear energy – as well as energy efficient lighting, energy efficient appliances, wastewater treatment technologies, energy transmission equipment, and environmental monitoring technologies: https://cleangrowthtool.rmi.org/?tab=Region-View

[32] https://dceo.illinois.gov/content/dam/soi/en/web/dceo/documents/ilinois-2024-economic-growth-plan.pdf
[33] https://rivian.com/newsroom/article/rivian-to-receive-827M-in-illinois-state-funding-to-expand-normal-il-facility; Note: The team calculated the LQ for EVs by defining it as inclusive of the following NAICS: 336110 Automobile and Light Duty Motor Vehicle Manufacturing; 336120 Heavy Duty Truck Manufacturing; 336330 Motor Vehicle Steering and Suspension Components (except Spring) Manufacturing; 336340 Motor Vehicle Brake System Manufacturing; 336350 Motor Vehicle Transmission and Power Train Parts Manufacturing; 336360 Motor Vehicle Seating and Interior Trim Manufacturing; 336370 Motor Vehicle Metal Stamping; 336390 Other Motor Vehicle Parts Manufacturing
[34] https://www.anl.gov/article/a-new-era-for-batteries-argonne-leads-50m-sodiumion-innovation-push; https://dceo.illinois.gov/news/press-release.30028.html
[35] Largely due to companies like because of companies like ADM, LanzaTech, and REG. https://dceo.illinois.gov/content/dam/soi/en/web/dceo/documents/ilinois-2024-economic-growth-plan.pdf
[36] https://www.eda.gov/funding/programs/regional-technology-and-innovation-hubs/2023/iFAB-Tech-Hub, or https://www.igb.illinois.edu/article/ifab-awarded-51-million-eda-tech-hubs-grant-propel-central-illinois-biomanufacturing-leader
[37] "Metals and machinery" includes Machinery, Fabricated Metal Product, Primary Metals. Note that, as compared to other large MSAs, the Chicago MSA has disproportionate strengths in **food** and **primary metals**. Food has an employment location quotient (LQ) of 1.2, where all other 19 MSAs have an LQ below 1. Primary metals has an LQ of 2.0, where all other 19 MSAs have LQs below 1.1.
[38] The industry grouping strengths roughly align at the state and national level; the difference is that the Illinois analysis looks at 4-digit NAICS, while the national analysis looks at 3-digit NAICS and BEA industry groupings.
[39] 10 industries support growth in Production Technology and Heavy Machinery; 4 in Downstream Metal Products; 4 in Upstream Metal Manufacturing. Other clusters are supported by large, concentrated industries too (1 industry supports growth in Plastics; 2 in Lighting and Electrical Equipment; 2 in IT and Analytical Instruments; 2 in Downstream Chemical; 1 in Automotive).
[40] Note that the top 5 most impactful manufacturing commodities in Illinois - based on their contribution to VA and Output – are **chemical manufacturing, motor vehicle parts manufacturing, pharmaceutical and medicine manufacturing, iron and steel mills and ferroalloy manufacturing,** and **plastics product manufacturing**. Source: dF-QCEW, 2023; BLS Employment Projections Program, Input-Output Matrices; Mass Economics analysis
[41] Chicago Business Bulletin, July 2023, Issue No.4, Innovation in Manufacturing & Chicagoland Advantages.
[42] Location Quotient (LQ) measures a region's industry specialization relative to the US. For example, an LQ of 1.0 in Metals Manufacturing means that the region and the nation are equally specialized in Metals Manufacturing; while an LQ of 1.8 means that the region has a higher concentration in Metals Manufacturing than the nation. See: https://www.bea.gov/help/faq/478
[43] There is also potential to support growth with 3D printing capabilities that can print materials made of metal composites that have the same properties as metal coatings.
[44] Although quantum is a nascent sector, its growth is supported by federal awards (e.g., The Bloch Quantum Tech Hub was awarded funds from EDA to scale industry adoption of quantum technologies). And, several SBIR/STTR awards use subatomic particle or nanoparticle technologies.
[45] Several SBIR/STTR awards focus on high performance coatings. These can be viewed by visiting https://www.sbir.gov/awards, and searching the database with the following filters: Data with award abstracts; Award year 2020 +; Award amount $500k or more; Illinois; Abstract contains the word "manufacture" or "manufacturing"