THE FUTURE OF MANUFACTURING IN ILLINOIS

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STRATEGIC FORESIGHT REPORT

IMEC Future of Manufacturing in Illinois – *Strategic Foresight Report - December 2021*





THE FUTURE OF MANUFACTURING IN ILLINOIS

STRATEGIC FORESIGHT REPORT

ILLINOIS, USA - DECEMBER 2021

The Illinois Manufacturing Excellence Center (IMEC) is engaging stakeholders statewide to discuss the future of manufacturing in Illinois. This strategic foresight report has been produced as part of IMEC's project 'Building the future of Illinois manufacturing' and is intended to nurture future thinking and strategic planning by manufacturers and stakeholders alike.

This report summarizes the outcomes of the 'Future of Manufacturing in Illinois – Think Tank' held in early August 2021, and subsequent input from stakeholder groups across the state's manufacturing ecosystem.

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FOR MORE INFORMATION

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FOREWORD - THE IMPORTANCE OF MANUFACTURING TO OUR FUTURE

Manufacturing is about making, creating, producing, and distributing – the backbone of America's economy. The manufacturing sector in Illinois plays a vital role in the state's economy by providing 592,200 direct manufacturing jobs and $304.8 billion in output. At 12%, manufacturing contributes the single largest share of the Gross State Product and drives innovation by performing more than 70% of private sector R&D. Taken alone, Illinois' manufacturing economy would be the 63rd largest economy in the world.

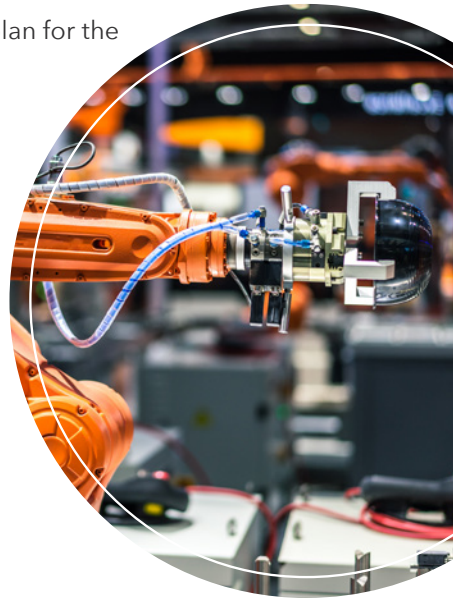
Every aspect of American life is touched by manufacturing, and we rely on the collective intelligence and mindset within the sector to bring us the new and innovative products that sustain us and help us navigate this complicated world. This project is the start of a larger process, that thinks about how to grow and build our vital manufacturing sector in Illinois. It represents a unique opportunity to think about our future in a different way, and to work together to explore, validate and then customize our future planning for the sector.

While it can be challenging to think about the future with all of its uncertainties, it is an essential foundation for shaping solid future strategies and investments. The pandemic has highlighted many strengths and weaknesses in Illinois' manufacturing sector that we need to both address and leverage. Now is the time.

The IMEC team has embarked on this process to help us all better understand the future of manufacturing in Illinois by creating a collective vision to guide the sector as we look ahead to 2030. Now we need to start planning how we are going to take action.

We appreciate you being part of this journey and ask you to join us as we explore and plan for the future of manufacturing in Illinois.

David Boulay, Ph.D., President
Illinois Manufacturing Excellence Center (IMEC)



SNAPSHOT – REPORT HIGHLIGHTS

FIRST STEP IN A LONGER-TERM FUTURE PLANNING PROCESS

This Future of Manufacturing Strategic Foresight work is the first part of a larger future planning process. It aims to deepen our understanding of manufacturing's rapidly evolving industrial and technological landscape, and to explore the future implications within the context of Illinois.

INNOVATION IS THE OVERARCHING TOPIC

Innovation, in this broader context, is about how we tackle the challenges. The project identified two future-splitting themes where innovation would have the greatest systemic impact. These critical future-splitting themes are **Workforce and Workplace** and **Innovation Ecosystems**.

THE GRAND CHALLENGE IS EMBRACING SYSTEMS CHANGE

The challenge for the Future of Manufacturing in Illinois, is how we embrace the next decade. There is an opportunity to 'lean into' the change and bring new thinking to address old problems. The decade ahead will be defined by innovation; and innovation in the broadest sense – which is how we tackle our grand challenges.

FOUR KEY INSIGHTS FROM INDUSTRY STAKEHOLDERS

1. **KEY BENEFICIAL TRENDS ARE CONVERGING**
   Key accelerating macro trends are converging that will amplify the importance of Illinois's food and energy resource base, and the existing strong manufacturing capability.

2. **VERY REAL POTENTIAL TO BECOME A 'GO-TO' GLOBAL INNOVATION HOT SPOT**
   Industry stakeholders have identified the very real potential for Illinois manufacturing to emerge as a global innovation hot spot, built on the existing global gateway status of Chicago, which connects regional Illinois to the world.

3. **WORKFORCE AND WORKPLACE TRANSFORMATION IS A GOLDEN OPPORTUNITY**
   Workplaces are undergoing profound change, which is driving the need for a dual strategy approach to the future Illinois workforce, that both skills existing workers and embraces flexible new workplace models.

4. **STRONG APPETITE TO TACKLE GRAND CHALLENGES AND CREATE A 'SYSTEMS-CHANGE'**
   Stakeholders have identified the need for bold and transformational thinking, to trigger new collaborative approaches to solving grand challenges, such as better linking Illinois into global innovation systems.

This strategic foresight process engaged the manufacturing ecosystem from across the state in a series of interviews, focus groups, and think-tank forums. These sessions built on each other, to create and explore future scenarios for the Illinois manufacturing industry sector.

1.0 INTRODUCTION – OVERVIEW OF THE FORESIGHT PROCESS

The Future of Manufacturing Strategic Foresight project aims to deepen our understanding of manufacturing's rapidly evolving industrial and technological landscape, and to explore the future implications within the context of Illinois. This process is intended to help stakeholders grapple with the opportunities and threats occurring in the rapidly evolving workforce-driven and innovative landscape that is manufacturing. The initiative is intended to contribute to foresight thinking that will help provide a ten-year vision for Illinois manufacturing, in a post-pandemic world, and begin to lay out a strategic roadmap.

THE FUTURE OF MANUFACTURING IN ILLINOIS

STRATEGIC FORESIGHT PROCESS

RESEARCH

- Explore emerging trends and drivers shaping manufacturing
- Macro trends shaping the future of Illinois and Midwest

BACKGROUND RESEARCH

May - July 2021

EXPLORE

- Future scenario planning for manufacturing in Illinois
- Explore Expected and Preferred Futures, and potential high-level actions

THINK-TANK WORKSHOP

August 2021

VALIDATE

- Validate future scenarios and assess implications to specific sectors and geographic areas
- Identify Expected and Preferred Futures, and assess potential implications

11 X STAKEHOLDER GROUP DISCUSSION SESSIONS

August / December 2021

CUSTOMIZE

Develop customized strategic plans to convert aspiration to action

REGIONAL AND SECTOR CUSTOMIZED PLANNING

January 2022 onwards

This Foresight Research work is the first part of a larger process. This initial work has used a combination of research approaches. There has been background trend analysis coupled with broad stakeholder engagement. The outcomes reflect these stakeholder perspectives and inputs and sets the stage for deeper strategic action planning. Subsequent steps will help bring this thinking down to a more local level across the state and will help frame and create unifying strategies for the whole state.

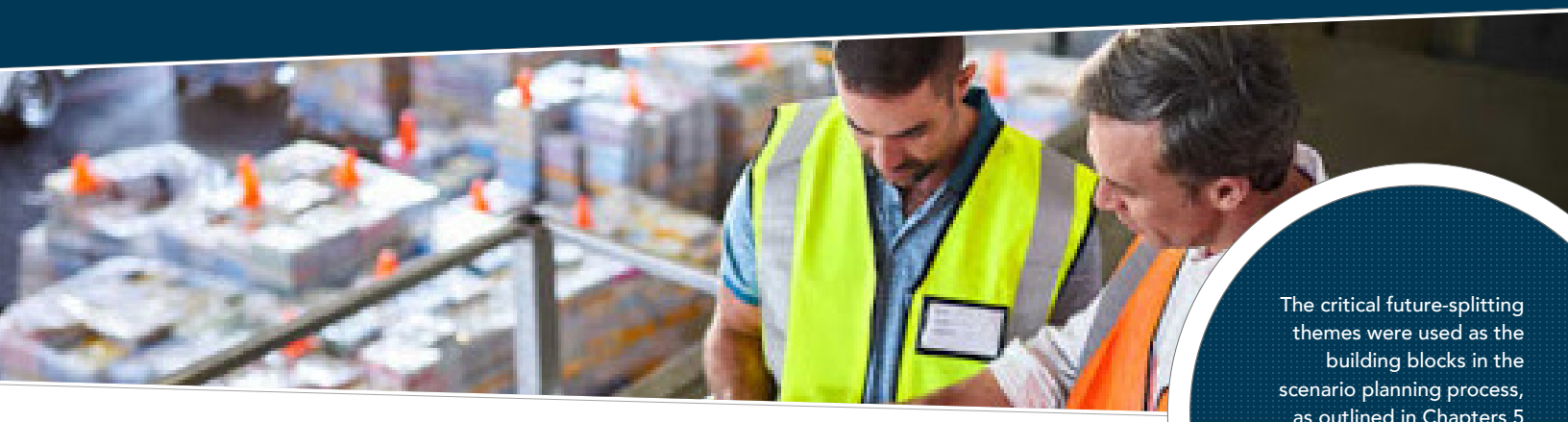
As manufacturing regions across the United States emerge from the COVID-19 pandemic, industries are facing new realities that will impact small, medium, and large manufacturers alike. Anticipating these changes, and being future ready, is essential in today's world.

2.0 HOW TO USE THIS REPORT

This report lays out the findings from each key step in the process. Overall, the process moved from background analysis and exploration, through to building a range of future possible directions for the manufacturing sector in Illinois. This work represents robust 'future gazing' where industry stakeholders considered possible directions and the impacts and consequences of those directions. The process, and the report, then drill down deeper into what people saw as the optimal or preferred future. This understanding helps lay the groundwork for figuring out 'how we get there'. This report lays out the logic about the future, that developed throughout the process. The result is a rather compelling and enticing vision for how the manufacturing sector could evolve in Illinois over the next decade.

THE FUTURE OF MANUFACTURING IN ILLINOIS

Steps in the process	Sections of the report
Identify key themes shaping the future of manufacturing in Illinois	High-level analysis of the main future-splitting themes *(Chapter 3)*
Examine macro trends shaping the future of manufacturing in Illinois	Understand critical trends and their future implications *(Chapter 4)*
Create plausible future scenarios of manufacturing in Illinois	Examine future scenarios and their likely impacts *(Chapters 5 and 6)*
Identify Expected and Preferred Futures, and assess potential future opportunity	Identifying future aspiration and critical insights *(Chapters 7 and 8)*



The critical future-splitting themes were used as the building blocks in the scenario planning process, as outlined in Chapters 5 and 6. They also set the context for the examination of important macro trends shaping the future.

3.0 KEY THEMES SHAPING THE FUTURE OF MANUFACTURING IN ILLINOIS

The methodological basis for this foresight work is built around exploring key future-shaping themes and trends, and then predicting or speculating about future implications and consequences. As we examine the future manufacturing landscape, including macro trends and the implications of the pandemic, one main overarching topic stands out is sharp clarity.

That overarching topic is innovation.

It is well understood that technical innovation is critical in complex sectors such as manufacturing in Illinois, where new technologies and processes are rapidly reshaping the sector. However, equally important is the notion that innovation is essential to how we tackle the grand challenges that face the manufacturing sector. These grand challenges include a range of topics such as workforce, supply chains and adapting to a green economy. Innovation, in this broader context, is about how we tackle the challenges. This innovative thinking helps us wrestle with questions such as 'What new thinking do we need, and what new systems do we need to create?'

In the process of the background research, the project team identified two future-splitting themes where innovation would have the greatest systemic impact.

The critical future-splitting themes are **Workforce and Workplace**, and **Innovation Ecosystems**.

These themes are 'future-splitting', as there are distinctly different possible approaches, which would set the manufacturing sector on different trajectories and outcomes. For example, the approach to solving the current and emerging 'Workforce and Workplace' challenges could have radically different outcomes. Likewise, 'Innovation Ecosystems' explores how our innovation systems work together, and at what scale. Innovation ecosystems can have very different scale and focus, which produce potentially very different outcomes for the manufacturing sector. In this case, the scale of innovation ecosytems in Illinois could range from local to global, particularly in terms of pace of technical innovation, global connectivity, and the global competitive position of Illinois.

The Future of Manufacturing project aims to deepen the understanding of manufacturing's rapidly evolving industrial and technological landscape, and then explore the future implications within the context of Illinois.

4.0 IMPORTANT MACRO TRENDS AND THEIR RELEVANCE TO ILLINOIS

This section explores macro trends shaping the future, that have direct relevance to the overall manufacturing landscape in Illinois. The macro trends represent a set of converging forces that are reshaping industry, society, and our lives. These trends will impact various parts of Illinois in different ways. The decade ahead will be one of rapidly accelerating change, with massive innovation occurring, fueled by new funding from governments and industry. This speed of change has the potential to leave behind some business, sectors, and regions.

The key is to understand the trends, anticipate implications, and then design statewide and localized strategies to adapt or take advantage of these forces of change. Specifically, the key trend topic areas covered in this section included:

- Advanced Manufacturing
- Workforce and Workplace Transitions
- Ongoing Mass Urbanization and Population Shifts
- Importance of Food, Energy and Water
- Implications of Climate Change
- Accelerating Speed of Change

Of most relevance to the discussion on macro trends is the speed and scale at which change is occurring. Newly developed innovations are being implemented globally and locally at all scales, thereby changing the face of industries and society in a rapid and profound way. Manufacturing is at the forefront of this transformation, but other industries are also quickly developing such as agriculture, health care, energy, transportation and mobility, financial services, and retail.

FutureInsight

FUTURE INSIGHTS – ILLINOIS MANUFACTURING:

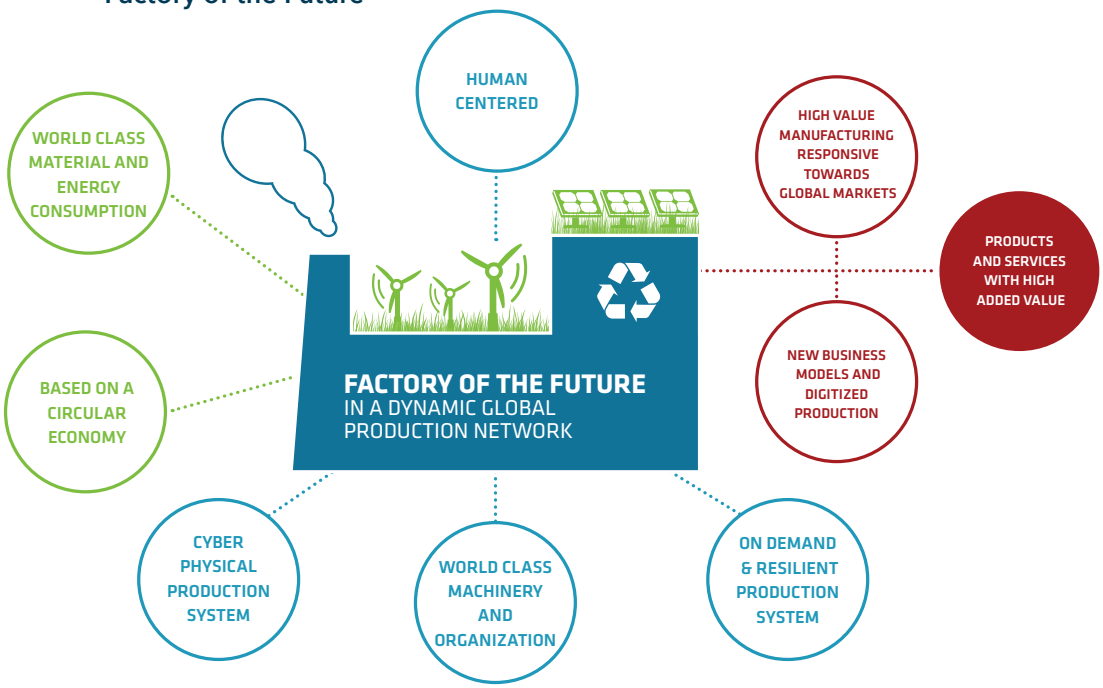
- The global pandemic has served to accelerate many of the existing trends, especially at the level of workplace transformation, and the application of process automation. This pace of change amplifies the challenges and opportunities.
- Exploring the main trends and their implications is critical to robust future thinking. It is also equally important to consider how these trends combine and interact to create specific new opportunities and challenges.

Advanced Manufacturing is driving the creation of new types of ecosystems, where innovation is happening real time in vastly expanded geographic scale. This is driving new collaborations, partnerships, and business models.

4.1 ADVANCED MANUFACTURING – CREATING NEW ECOSYSTEMS

Advanced Manufacturing and Automation, also referred The Fourth Industrial Revolution, is occurring now. Its primary drivers are emerging catalytic technologies, machine learning, speed of change, and the global scale of the revolution. Internet and operational technologies are connecting with increasingly higher speeds across both horizontal and vertical sector networks worldwide allowing for a rapid rate of change and fluidity across the life cycle of evolving products and services. This is moving us towards more autonomous decision making, a changing role for the workforce, new organizational and collaborative paradigms, and new 'smart systems'. *(Industry 4.0: the fourth industrial revolution guide to Industrie 4)*

Factory of the Future



"Advanced manufacturing is not just about investing in technology; it is also about revolutionizing the entire ecosystem in which manufacturing operates."

- IMEC, 2021. Automation Workforce Productivity – How Illinois Manufacturers are Adopting Advanced Technologies: An insight report on automation, workforce, and productivity.

FutureInsight

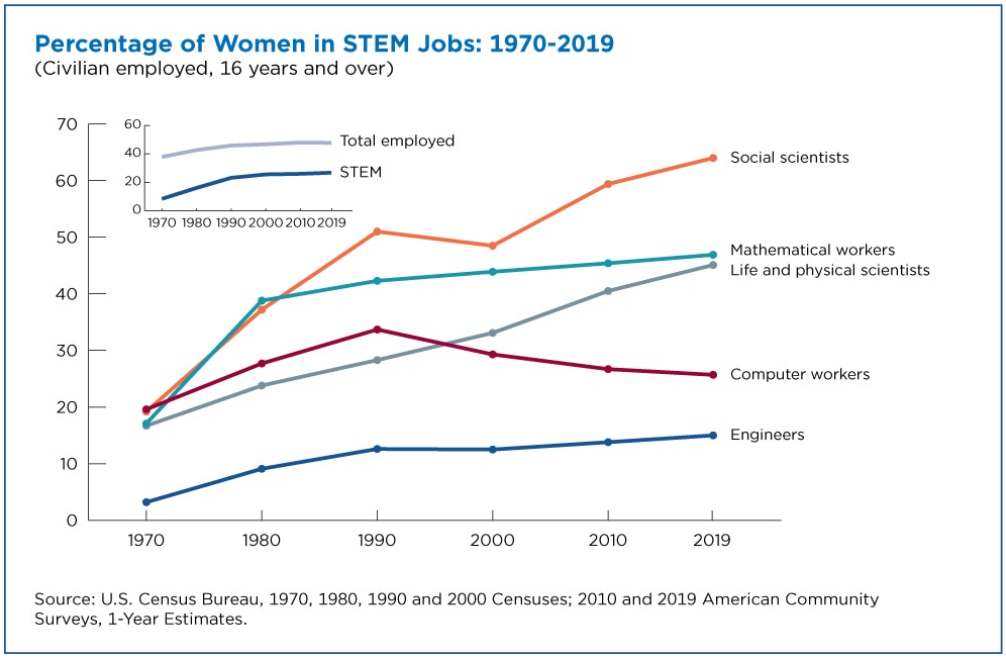
FUTURE INSIGHTS – ILLINOIS MANUFACTURING:

- Illinois manufacturing has the potential to be a 'living laboratory' for experimentation that adapts to fast changing markets and embraces the state's vibrant innovation economy. It follows that future development should incorporate best practices and the cutting-edge research capabilities of its regional manufacturing centers.
- Incorporating advanced manufacturing technologies will provide manufacturers the ability to improve productivity, create new opportunities for growth, and generate higher returns regardless of firm size (IMEC, 2021).

Illinois is already uniquely positioned in a global context, as it attracts some of the top talent in the world to its universities. Translating this talent into part of the local workforce system must be a key approach.

4.2 TRANSFORMATION OF THE WORKFORCE AND WORKPLACE

One of the key impacts of the pandemic, is an acceleration in the transformation of the workforce and workplace. The current skills gap is causing employers to scramble and compete for highly skilled and trained workers. The next five years will likely see radical changes in how workplaces are structured, and how skilled workers are integrated into the workforce. The urgent needs for workforce solutions and workplace transformations offers the chance to apply innovation and new thinking to this grand challenge. For example, the participation of women and underserved populations in the STEM fields have historically been relatively low and offers huge upside potential. Overall, the demand for skilled talent is going to force a much broader perspective on finding the necessary talent pool.



Source: United States Census Bureau 2021

FutureInsight

FUTURE INSIGHTS – ILLINOIS MANUFACTURING:

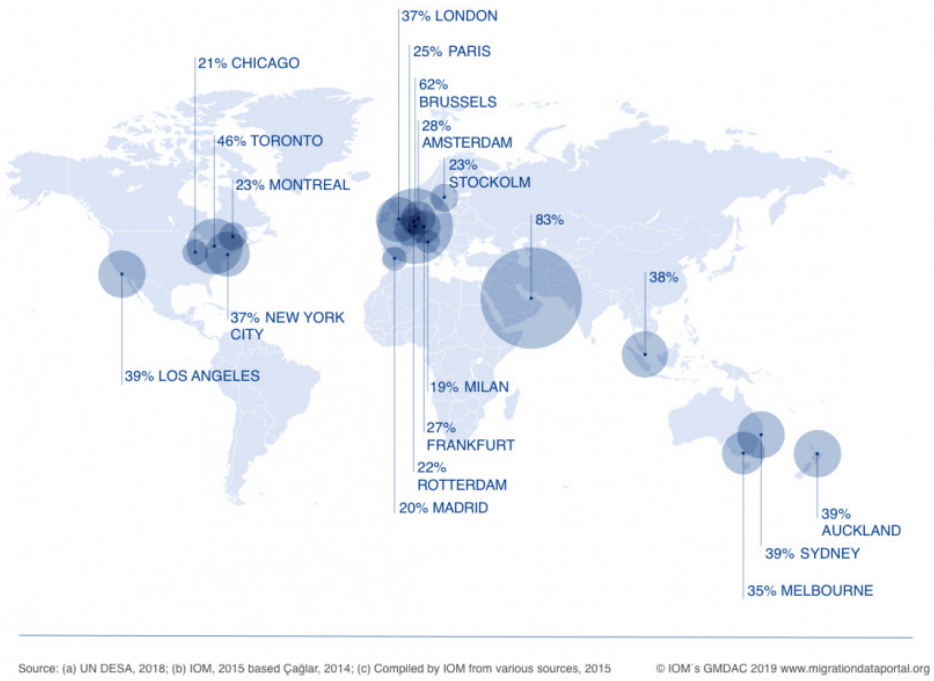
- Solving the workforce challenge is going to be a key focus of all manufacturing sectors over the coming years. This offers the opportunity for innovative new thinking about how workplaces are designed and function.
- The Fourth Industrial Revolution has brought with it accelerated workforce changes. Combined with the global trends, these changes will require an intensely people-focused approach to economic and workforce development in Illinois.

Approximately one in five international migrants are estimated to live in just 20 global gateway cities worldwide – Chicago being one of those (IOM, 2015). This gateway city status helps create greater global connectivity and influence.

4.3 GLOBAL CONNECTIVITY – CHICAGO AS A GATEWAY CITY

The search for talent is going to be increasingly global and national. Manufacturing regions are going to be more competitive for global talent if they offer an attractive destination, that can absorb new people and offer relevant cultural experiences. Chicago has a long history of being a key global gateway city. Other downstate regions also attract global talent. This dynamic has served the city and the state well. Now is a unique opportunity to build the global connectivity and relevance of both Chicago and other major regional centers across the state.

FOREIGN-BORN POPULATION IN SOME MAJOR GLOBAL OR WORLD CITIES



Source: (a) UN DESA, 2018; (b) IOM, 2015 based Çağlar, 2014; (c) Compiled by IOM from various sources, 2015 © IOM´s GMDAC 2019 www.migrationdataportal.org

FutureInsight

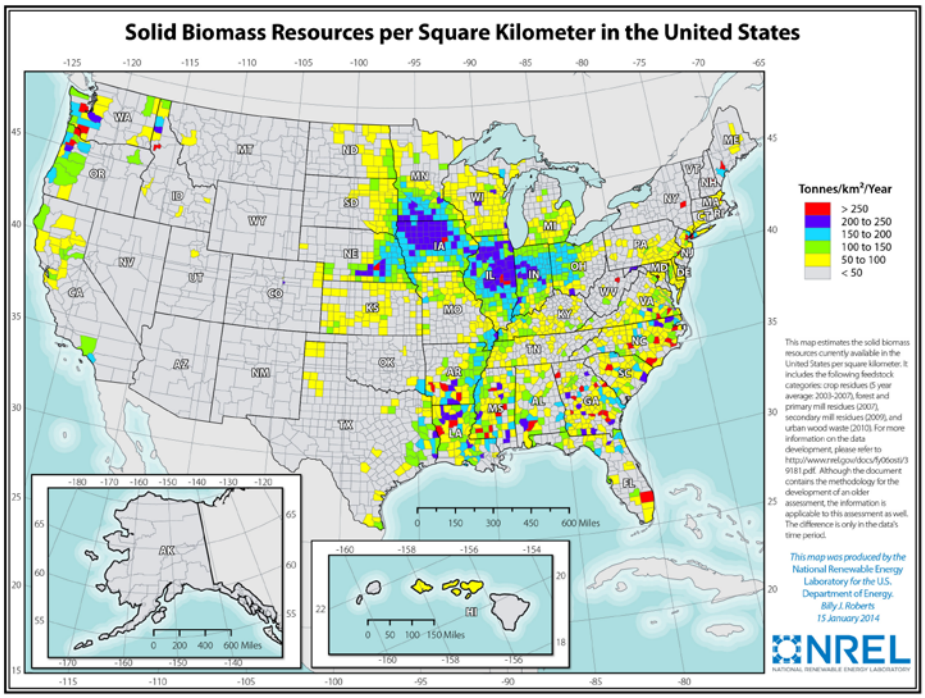
FUTURE INSIGHTS – ILLINOIS MANUFACTURING:

- Chicago is a global gateway city and can offer an attractive destination for mobile international migration. This is a critical attribute to being an attractive and relevant global destination for skilled talent. This global connectivity can be an important value proposition.
- The evolution of mega cities also triggers the creation of smaller more specialized cities, in the broad periphery on these large urban centers. There needs to be an intentional strategy to strongly link these specialized regional centers to the core metropolis of Chicago, to stimulate collaboration and shared opportunities.

With food production the state's largest manufacturing sector, Illinois has an outsized role to play in the future of supplying food to the world. Biomass also offers a potent resource for emerging plant-based products such as biofuels, bioplastics, and plant-based proteins.

4.4 FOOD, WATER AND ENERGY – FUTURE SWEET SPOT FOR ILLINOIS

The growing global population will mean a dramatic increase in the global need for food (60% growth), energy (50%) and water (40%) by 2050 (FAO, 2015). Overall, there is a growing global disconnect between where food can be grown and where it will need to be consumed, which will be amplified by climate change. The ability to produce food and biomass will be a key future economic driver for the upper Midwest region. With some of the highest levels of solid biomass resources per square kilometer in the United States, Illinois is uniquely positioned to be a key player in the coming food revolution, with a combination of food production capability, abundant fresh water, and access to renewable energy.



Source: *NREL, 2014.*

FutureInsight

FUTURE INSIGHTS – ILLINOIS MANUFACTURING:

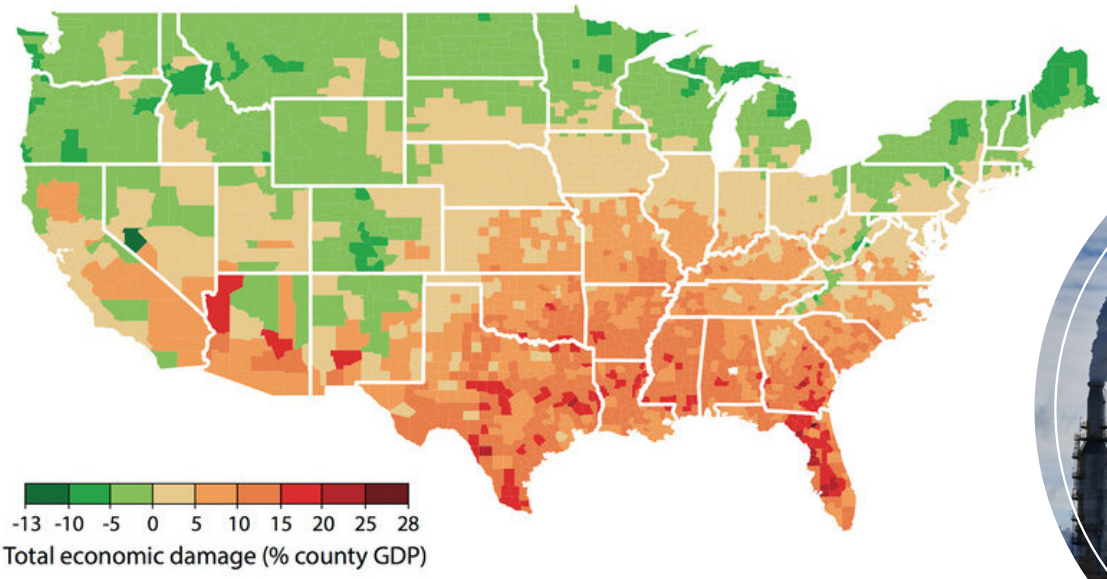
- The Midwest will emerge as one of the most important food producing regions in the world, and Illinois is uniquely positioned as a key location. The challenge is to find creative and innovative ways to ensure this delivers strong economic prosperity to the regional areas.
- In 2019 the food product industry employed 93,000 people and produced $59.2 billion worth of goods in Illinois. (*Manufacturing Matters – Our Impact in Illinois*). With food products the largest manufacturing industry in Illinois, this positions the state in a potential leadership role in global food industry for many years.

The longer-term impacts of climate change could trigger a gradual migration of US population from the south and coastal areas, to the north and center of the country.

4.5 IMPLICATIONS OF CLIMATE CHANGE - MOVING NORTH AND INLAND

The reality of climate change is impacting all areas of the world. From wildfires in the West, flooding in the South and on the East Coast, to changes in weather patterns across the country, the United States is experiencing its damaging effects on a regular basis. Over the past 120 years, the average daily temperature in Illinois has increased by 1-2% and mean precipitation has increased by 5 to 20%, varying across the state. By the end of the century, unprecedented warming of 4-14 degrees is likely and total annual precipitation is projected to increase by 2-10% (The Nature Conservancy, 2021. (*An assessment of the impacts of climate change in Illinois*). In the US, long term GDP impacts are forecast to be predominately negative in the South, and predominately positive in the North. This reflects a forecast of significant economic and social disruption and dislocations, triggered by the impacts of climate change.

Mapping the Potential Economic Effects of Climate Change



Source: *Christopher Joyce, MPR News, June 29, 2017.*

FutureInsight

FUTURE INSIGHTS – ILLINOIS MANUFACTURING:

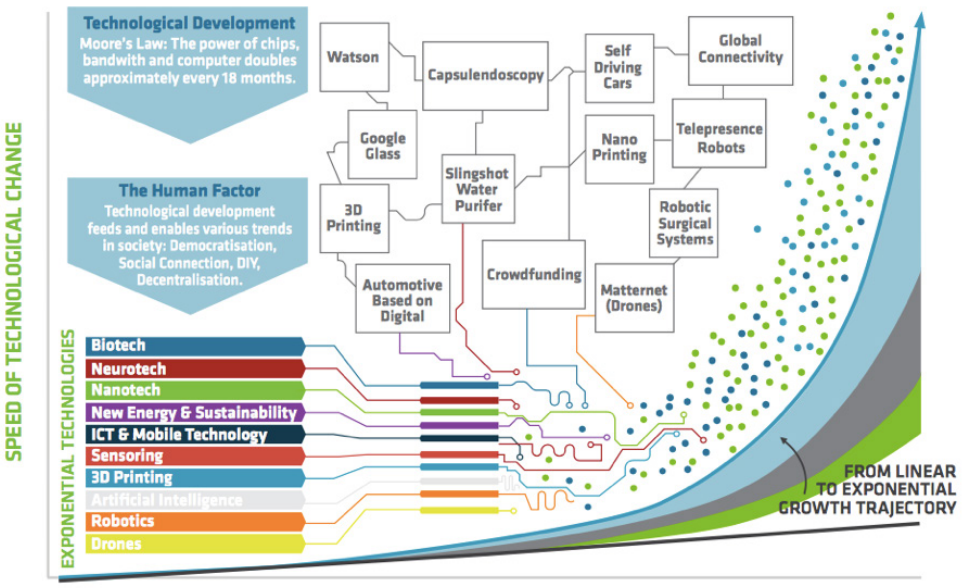
- The upper Midwest is in a unique position of being a region that may see GDP increases, and some climatic benefits such as more moderate winter climates. This long-term trend could increase the region's attractiveness.
- This potential migration of people and businesses, offers the opportunity to create a new relevance and era of growth in the state. The challenge is to ensure the policy settings make the state one of the attractive destinations in the upper Midwest.

The Fourth Industrial Revolution is defined by digital technologies that are driving enormous speed of change. The challenge for manufacturing ecosystems will be to absorb the pace of change.

4.6 GET READY! – THE ACCELERATING SPEED OF CHANGE

The innovations developing in the Fourth Industrial Revolution are being implemented globally at all scales, thereby changing the face of industries and society in a rapid and profound way. How Illinois reacts and keeps ahead of this change will determine how well it does in this new era. Technological developments and adoption are increasing in speed, reaching an exponential rate of change, and affecting almost all industries in all countries. Manufacturing is at the forefront of this transformation, but other industries are also quickly developing. Shifts in these industries are altering how we live, work, plan and interact and will transform the functions of our buildings, neighborhoods, cities and beyond. One of the greatest challenges will be for businesses and economies to absorb and respond to this speed of change.

Exponential Speed of Change



Source: Deloitte. 2014. Industry 4.0 Challenges and solutions for the digital transformation and use of exponential technologies.

FutureInsight

FUTURE INSIGHTS – ILLINOIS MANUFACTURING:

- Illinois has achieved world leadership status in key areas of innovation, a result of decades of investment and research. While this is not easy to wrest away, the global pace of innovation is accelerating. Staying ahead will require ongoing investment and bold thinking to drive the changes that are needed.
- The converging technologies will create an acceleration of system-wide transformation. This will especially favor regions that have well developed ecosystems, where innovations and ideas are shared rapidly between parts of the value chain.

The key emerging trends outlined in this chapter are likely to lead to a significant 'shake-up' of industry and manufacturing, especially over the next decade. Coming out of the pandemic – it will be important for regions to have a clear desired trajectory – a vision - and a set of strategies to navigate an evolving business world.

4.7 THE GRAND CHALLENGE – EMBRACING SYSTEMS CHANGE

Exploring the future of manufacturing in Illinois, especially in the grip of a global pandemic, can be a disconcerting task. On one hand the immediate future appears to be littered with critical challenges – workforce constraints, escalating supply chain squeezes and operational challenges. In addition, the decade ahead looks to be filled with turbulence as we see accelerating change, emerging climate change challenges and rapidly changing societal demands. There are no doubt grand challenges. But they are no different to those being faced by many other regions and industries in the country and the world.

A deeper exploration of the trends shows some significant promise. Background research also shows the possibility of convergent forces and trends that could bring significant beneficial change. In addition, Illinois has some outstanding capabilities, historical strength, and unique global positioning. An analysis of regional performance, in today's world, suggests that regional success and strength comes in large part by the level of collaboration being applied. Deep and large-scale collaboration requires moving out of local or sector silos, into larger more multi-disciplinary collaborations.

The challenge for the Future of Manufacturing in Illinois, is how we embrace the next decade. There is an opportunity to 'lean into' the change and bring new thinking to bear on old problems. The decade ahead will be defined by innovation; and innovation in the broadest sense – which is how we tackle our grand challenges.

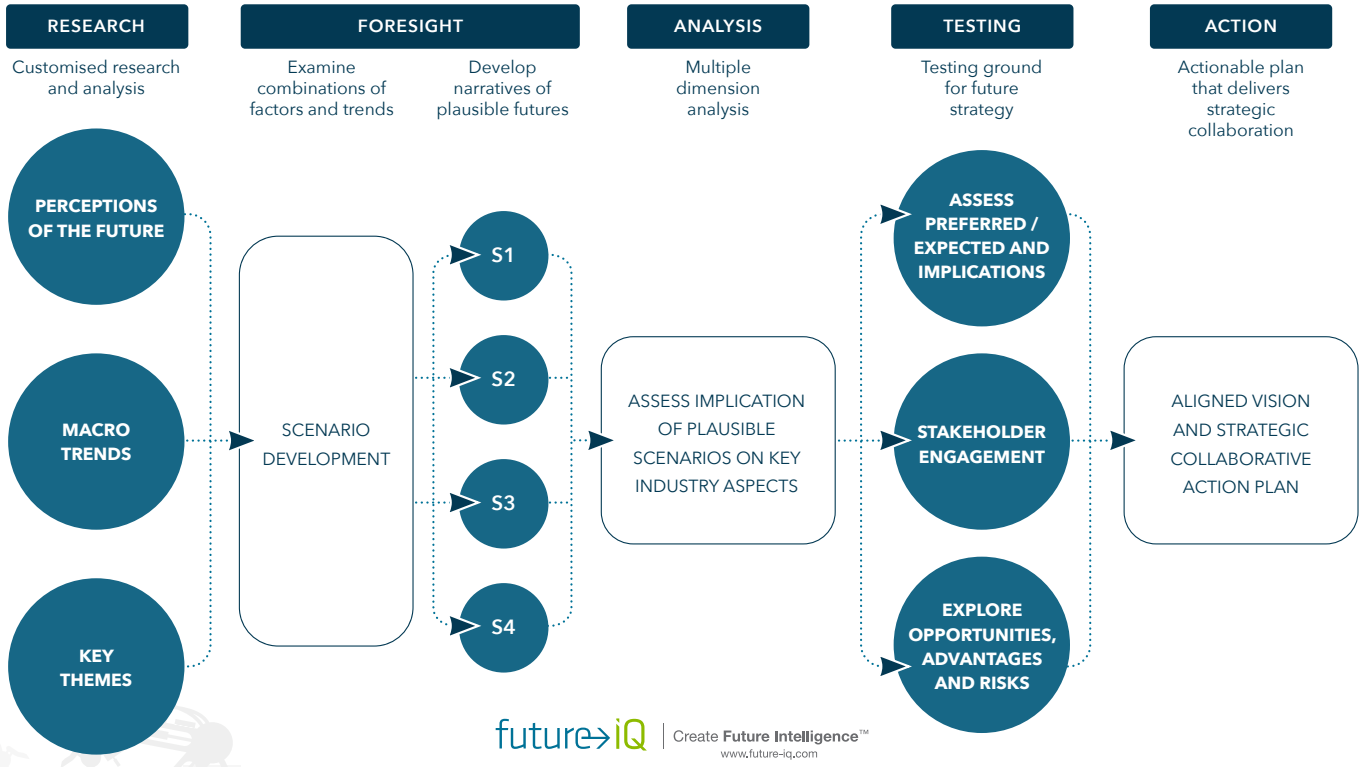
Dealing with and harnessing the complex and interrelated forces that are shaping the future of manufacturing in Illinois will require a systems approach. The primary systems will be focused around the two big themes – how we tackle and build our innovation ecosystems; and how we embrace the workforce and workplace changes that are being accelerated by the pandemic. The next Chapter plays out a series of different 'systems approaches' and considers the implications and consequences.

Each scenario has its subsequent consequences and impacts on the future of the manufacturing. No one future scenario is the 'perfect' future. They represent different possibilities for the future, as each comes with its attendant challenges and implications.

5.0 CREATING PLAUSIBLE FUTURE SCENARIOS

This Future of Manufacturing in Illinois strategic foresight project aims to explore the future of manufacturing, in a post Covid world, and looking out over the next decade. The methodological basis for this foresight work is scenario planning. During this process, four different future scenarios were created, that play out the potential future implications of key themes and trends. These scenarios provide a valuable 'testing ground' to assess preferred future outcomes.

To create the scenarios, the previously identified key macro themes of **Workforce and Workplace**, and **Innovation Ecosystem** were used to create the scenario matrix (refer Chapter 6). This matrix creates four distinct scenario spaces, which describe different possible futures created by the combination of the conditions at the end of each axis. During the future scenario planning workshop held in early August 2021, industry stakeholders developed a narrative for each future scenario. These four scenarios paint very different plausible futures for the Future of Manufacturing in Illinois. The workshop participants considered them all as largely plausible futures. Narratives and descriptions of each scenario, as developed by the workshop participants, are included in the following chapter.



Scenarios offer different potential and plausible views of the future. The scenario development process allowed stakeholders to examine the implications and consequences about different future directions.

6.0 MANUFACTURING IN ILLINOIS – VIEWS OF THE FUTURE IN 2030

Narratives and descriptions of each scenario as developed by the Think-Tank workshop participants are included in the following section. The names help evoke the sense of each scenario future, and together paint a 'future canvas' of plausible futures.

Plausible Scenario Matrix 2030

A

B

There is deliberate investment in developing a wide-reaching approach to building innovation capacity in the state. This draws in global expertise in digital transformation and technology solutions. Resources and ideas are shared between technical and supply chain clusters, and innovation needs are explored and tackled in a connected ecosystem-wide approach, often reaching globally.

Broad innovation ecosystem approach

The regional and industry approach to solving talent and skills shortage is retraining and retooling existing people, and attraction of new talent. The primary approach focuses on continually upskilling and retaining the local workforce. Strong connections are made through the whole education system. Workers are incentivized to stay loyal and stay local.

Retool, home-grown and attraction

THIRD INNOVATION COAST

INVEST, INNOVATE, ADVANCE

Ecosystem

Workforce and Workplace

Innovation

DESIGN GLOBAL, MANUFACTURE LOCAL

LOCAL BULLSEYES

Workplace transformation

Radical reinvention of the workplace drives more automation, outsourcing and flexible workplace roles. The workplace becomes more flexible, and new work styles and patterns are embraced. A central group of primary workers, coupled with automation and technology provide the core operations, with a more fluid supporting network of workforce and workplace solutions.

A

B

D

C

Local innovation ecosystem approach

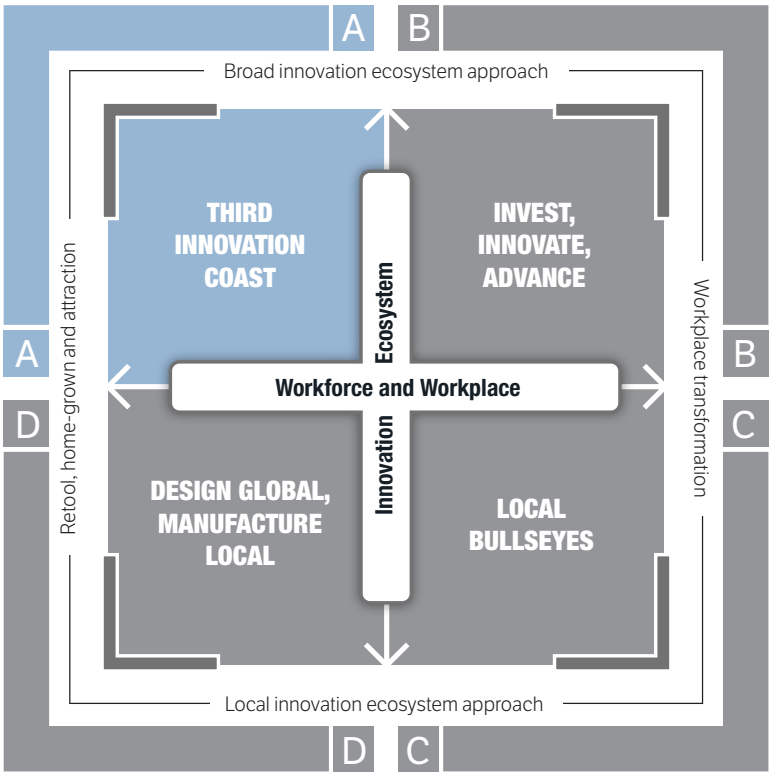
The focus is primarily on developing an innovation culture based on the local ecosystem expertise and technology capability. Deep investment is made in building local capacity for innovation by boosting technological expertise and competency in priority areas. This local expertise is viewed as a strategically valuable asset and becomes the core of regional competitiveness.

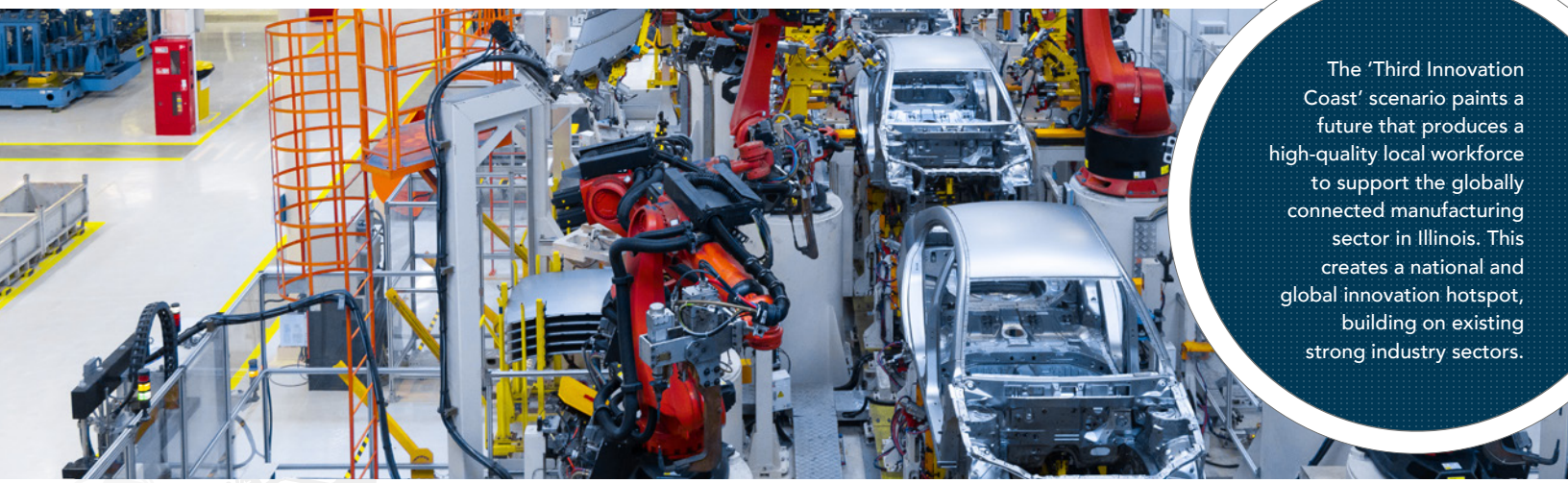
D

C

6.1 SCENARIO A: THIRD INNOVATION COAST

This scenario forecasts a future where industry doubles down on retraining and upskilling its local workforce and there is deliberate investment in developing innovation capacity in the manufacturing sector. Because of the collaborative outward looking ecosystem approach, resources and ideas are shared between technical and supply chain clusters. It is forecast in this scenario that innovation excels in sectors that can leverage their strong local resources and skills, such as in food systems, agriculture, energy, aerospace, and electric vehicles. Local colleges and universities play a strong role in producing a high-quality workforce that draws global innovation to the state. Existing globally connected areas flourish. However, some rural areas may further depopulate as manufacturing concentrations into specialized centers around the state and draws talent from surround rural communities.





The 'Third Innovation Coast' scenario paints a future that produces a high-quality local workforce to support the globally connected manufacturing sector in Illinois. This creates a national and global innovation hotspot, building on existing strong industry sectors.

In the 'Third Innovation Coast' scenario, the current downward trend in Illinois competitiveness is reversed and the manufacturing sector leads the country in manufacturing employment opportunities.

SCENARIO A: 2030 CHARACTERISTICS – THIRD INNOVATION COAST

The characteristics of this scenario point to a future where manufacturing in Illinois is expanding quickly as manufacturers are highly dialed in to global markets. Universities and K-12 programs are coordinated and leveraged to support the needs of Illinois manufacturers. Illinois becomes known as the third innovation coast, rivaling the West Coast (San Francisco) and East Coast (Boston).

Industry Innovation & Collaboration Profile

Innovation and collaboration within the state grows exponentially as manufacturing becomes increasingly global.

- Innovation flourishes in existing manufacturing sectors.
- Global automation companies are attracted to Illinois to support the growth of the sector.
- Increased opportunities in energy, electric vehicles, aerospace and agriculture.

Technology Application & Adoption

Accelerated adoption of Industry 4.0 technologies occurs across the manufacturing sector.

- Illinois leads the nation in technology adoption in the manufacturing sector.
- Manufacturers collaborate across systems to create a unified network of local supply chains.
- Adoption of new technologies helps to mitigate workforce shortages.

Geographic Distribution & Concentration

Existing globally connected manufacturers flourish.

- Existing IL manufacturing regions grow exponentially.
- Areas of the state that already have strong global connections gain strength and attract workers.
- Depopulation of rural areas continues as workers move to manufacturing centers.

Supply Chain Configuration & Behavior

Existing globally connected supply chains are strengthened and expanded.

- Food system innovation excels as climate change impacts the country.
- Climate change impacts in the South and on the coasts opens a niche for IL supply chains.
- New processes and procedures are imported to upskill workers.

Workforce System and Profile

The local workforce is highly adaptable and skilled as educational systems support continuous educational and training opportunities.

- Educational systems align to provide K-12 and college level pipelines for needed talent.
- Businesses are attracted to a highly skilled workforce in IL.
- Quality of life issues deter new workers from coming to Illinois.

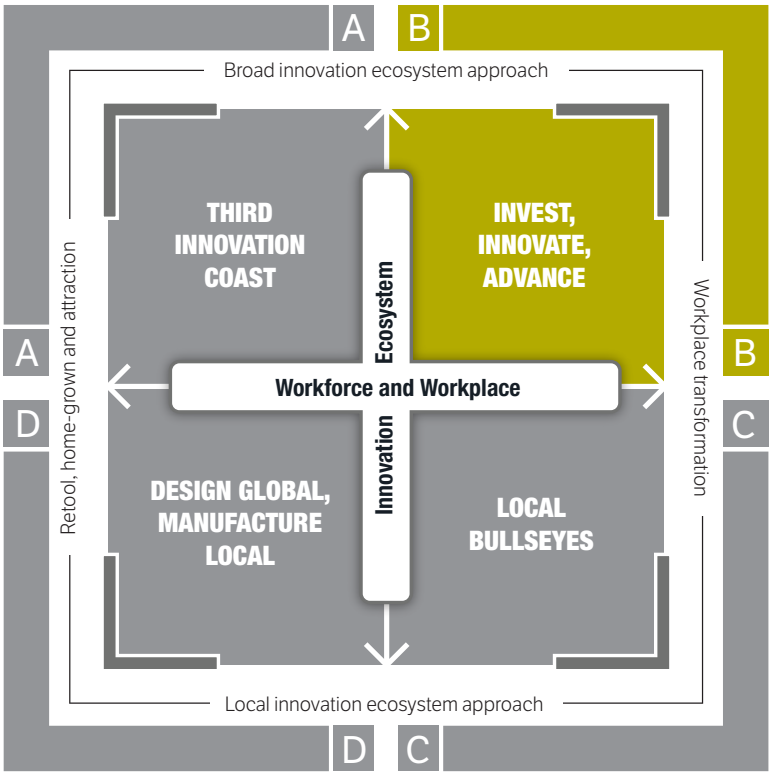
2025 HEADLINE NEWS:
"Game-changing prototypes originate in Illinois."

2030 HEADLINE NEWS:
"Illinois leads globally in autonomous vehicles."

2040 HEADLINE NEWS:
"From fly-over to global innovation center."

6.2 SCENARIO B: INVEST, INNOVATE, ADVANCE

This scenario forecasts a future where the manufacturing innovation ecosystem is intricately tied to global markets and supply chains. An expanded marketing focus reaches new markets and demand for Illinois products worldwide grows. The acceleration and adoption of new technologies makes cost sharing and collaboration easier between firms. The workplace is transformed by technology and automation, and robots expand the talent pool. Expanded broadband access rapidly changes learning and workplace patterns to become both more flexible and remote, allowing for a greater diversity of talent. The push on workplace and workforce transformation drives more remote work and learning. This creates a potential risk of losing social cohesiveness and concerted efforts are required to keep students and employees engaged and connected. Businesses may become less locally rooted and become more globally mobile.



The 'Invest, Innovate, Advance' scenario paints a future where the manufacturing sector is extremely creative, collaborative and outward looking. The flexible workplace allows for many different workstyles creating an inclusive and diverse work environment.

In the 'Invest, Innovate, Advance' scenario, there is tremendous opportunity for the State of Illinois to become a role model for manufacturing worldwide. The challenge will be to make sure smaller manufacturers and workers are provided the means to participate and succeed and not get left behind.

SCENARIO B: 2030 CHARACTERISTICS – INVEST, INNOVATE, ADVANCE

The characteristics of this future paint a future where high investment in technological solutions throughout the state provides broadband everywhere enabling remote work and a more diverse workforce. Less emphasis on local workforce development may cause unskilled workers to fall through the cracks.

Industry Innovation & Collaboration Profile

The manufacturing industry in IL highly collaborative and synergistic.

- National and global marketing efforts increase as IL manufacturing gains access to global markets.
- Increased diversity leads to better, faster innovation.
- Associations take over bidding processes and take a bigger role in executing and sharing information and decision-making.

Technology Application & Adoption

High levels of technology application and adoption increases use of robots and automation.

- Use of robots increase to expand the talent pool and allow for off-site operating options.
- Workforce skills require upskilling to match technology levels.
- Technology provides the option of hybrid learning; distance learning and training becomes the norm.

Geographic Distribution & Concentration

New manufacturing enterprises are created across the state as information and costs are shared.

- Investment in transportation systems are required as metro areas grow.
- Homegrown manufacturers consolidate or grow.
- New markets open and employment opportunities expand to support new technology advancements.

Supply Chain Configuration & Behavior

Cost sharing and collaboration is made easier between firms.

- Energy efficiency will change Investments in transport. Less people will commute requiring less office space.
- Just on time supply will create more balanced supply chains.
- More collaboration between product development boosts innovation and growth.

Workforce System and Profile

The IL workforce is diverse and innovative. Less direct contact risks less loyalty to the employer.

- Increased automation requires investment in both capital and workforce as more specialization of skills is required.
- Personal and professional relationships suffer due to work from home and lack of being together.
- New employees have less engaged onboarding resulting in less attachment to workplace and increased turnover.

2022 HEADLINE NEWS:

"Governor announces plan to increase investments for manufacturers to compete globally."

2030 HEADLINE NEWS:

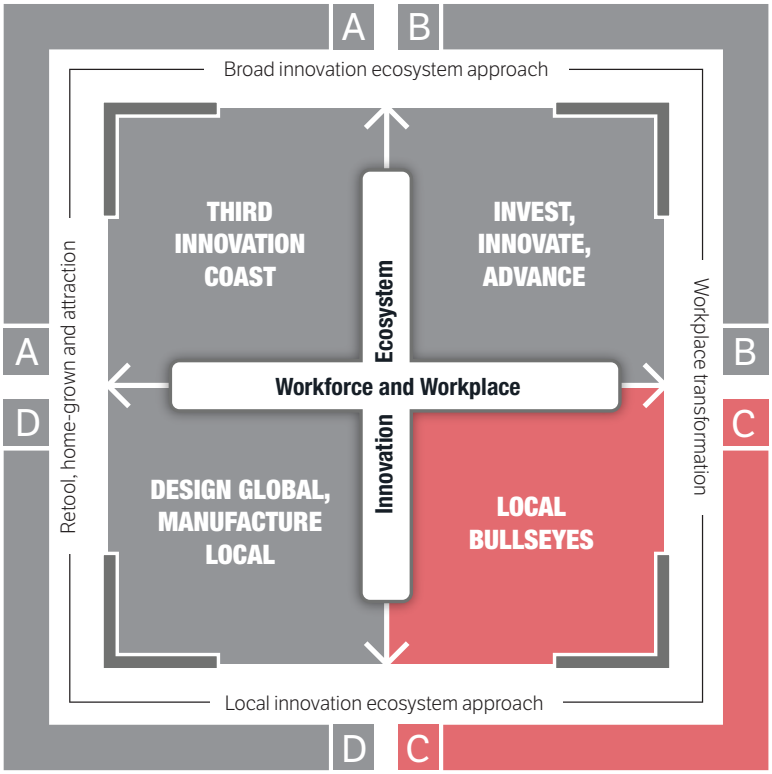
"Public-private partnership formed with education to help workforce and manufacturing firms to produce more jobs and skilled workforce."

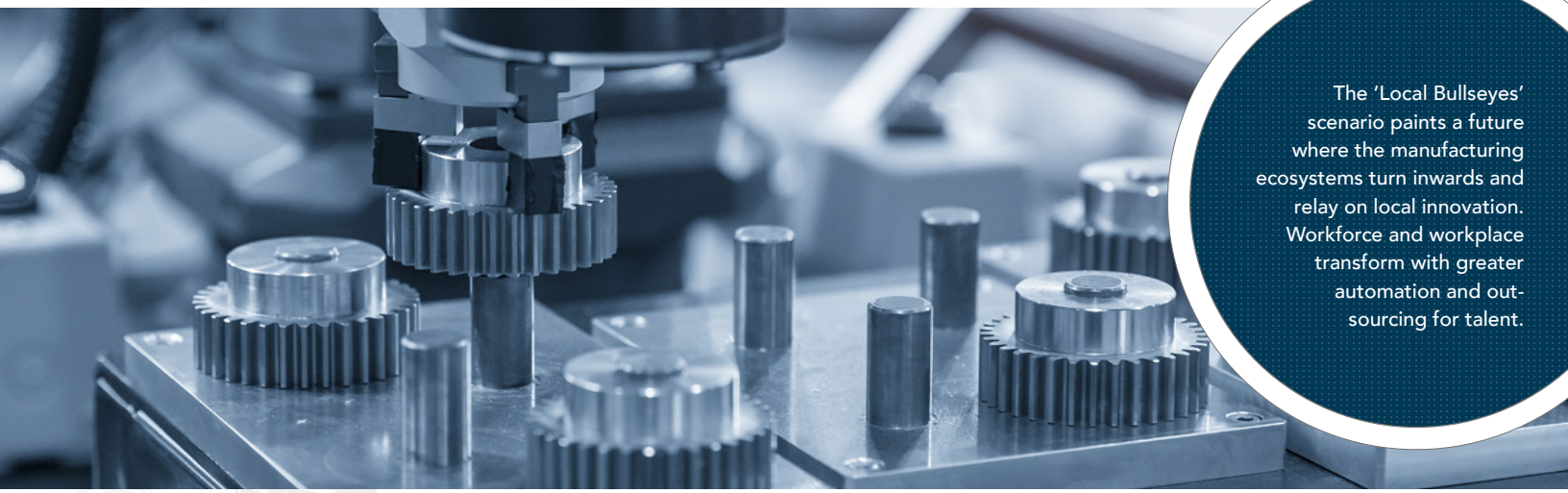
2040 HEADLINE NEWS:

"Illinois leads Midwest in manufacturing renewable energy infrastructure."

6.3 SCENARIO C: LOCAL BULLSEYES

This scenario forecasts a future where the innovation ecosystem is hyper-locally focused on building local expertise and technology capability. Local incubator training centers promote collaboration between centers and a 'hub and spoke' ecosystem is developed to maintain agility and responsiveness. At the same time, exciting workplace transformations are taking place with increased automation and technology use. Some outsourcing takes place to keep up with the demands for talent. Technology enables increased connection to local resources and public-private partnerships increase to pull talent to local centers. Large manufacturers develop best practices and share with smaller manufacturers. Trust is high locally, but manufacturers are not well connected with outside supply chains and over time run the risk of becoming isolated.





The 'Local Bullseyes' scenario paints a future where the manufacturing ecosystems turn inwards and relay on local innovation. Workforce and workplace transform with greater automation and out-sourcing for talent.

In the 'Local Bullseyes' scenario, it was acknowledged that change takes time and that the current accelerations in technology and information could leave behind those manufacturers with solely local connections.

SCENARIO C: 2030 CHARACTERISTICS – LOCAL BULLSEYES

The characteristics of this future paint a future where there is much excitement around new workplace solutions and automation provides manufacturers with the relief they need to maintain high levels of productivity. There are definite winners and losers depending on technology adoption levels and the hyper-local focus on supply and demand gradually isolates many Illinois manufacturers.

Industry Innovation & Collaboration Profile

Industry collaboration on a local level occurs creating 'hub and spoke' centers.

- Larger manufacturers develop solutions that are shared with small manufacturers.
- Open ecosystems develop on the local level but risk creating silos of innovation.
- Collaboration between Illinois manufacturing centers is high but isolated from global activities.

Technology Application & Adoption

Technology is embraced in the workplace, but not applied to connect adequately with the world.

- Automation increases productivity for manufacturers.
- There are winners and losers depending on the level of technology adoptions.
- Technology solutions in the workplace turn to automation to address the gap in local talent supply.

Geographic Distribution & Concentration

Illinois manufacturers are concentrated in localized centers of activity.

- Public-private partnerships increase to develop local workforce.
- Manufacturing grows in existing manufacturing center locations.
- Geopolitical issues continue to plague policy making and local politics impacting manufacturing.

Supply Chain Configuration & Behavior

Global volatility creates a pull to increase local manufacturing of products and components.

- Local supply chains strengthen as trust is high among manufacturers in local and regional settings within Illinois.
- Large manufacturers develop best practices to share with local small manufacturers.
- Supply chain silos develop, and many Illinois manufacturers lose access to critical resources.

Workforce System and Profile

Flexible workplace settings provide much needed workforce to local manufacturing.

- This is an exciting time for local manufacturers to be able to broaden reach and diversify its workforce through remote work.
- Automation and the flexible workplace provide much needed agility for manufacturers.
- Flexible workplaces would allow for outsourcing that could impact local workforces negatively.

2025 HEADLINE NEWS:

" Local partnerships spur economic growth and innovation."

2030 HEADLINE NEWS:

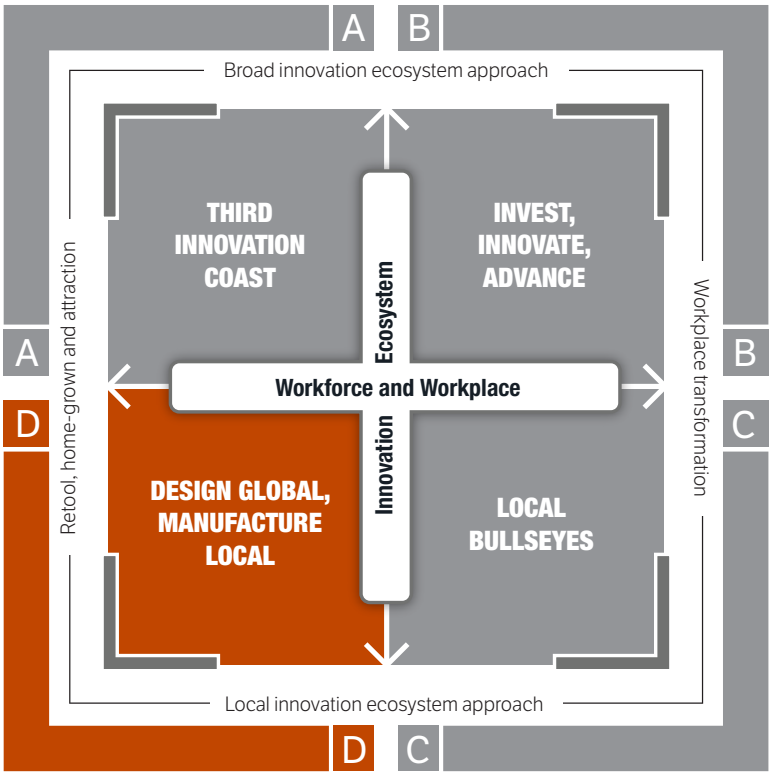
"Illinois recognized for workforce transformation."

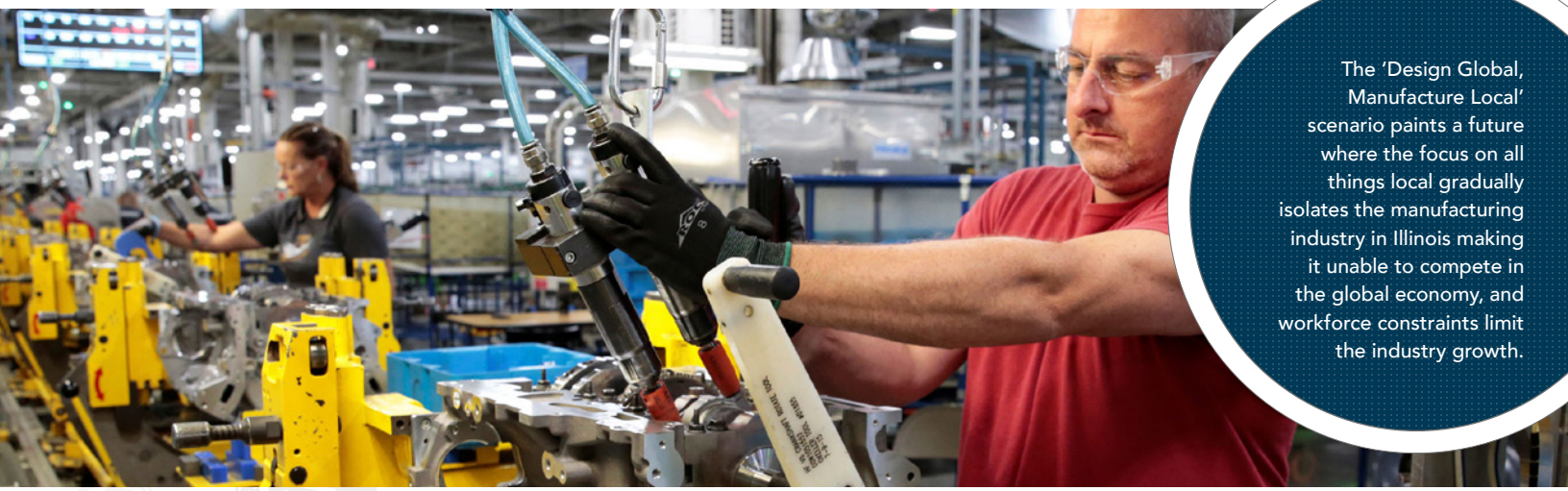
2040 HEADLINE NEWS:

"Manufacturing GCP quadruples in 2030."

6.4 SCENARIO D: DESIGN GLOBAL, MANUFACTURE LOCAL

This scenario forecasts a future where local policy supports are coordinated and measured to support a 'Think global, act local' approach. The Illinois manufacturing innovation ecosystem is focused on investment in building local capacity through technology and competency in priority areas. There is increased investment in broadband statewide to develop deeper connectivity, and more small start-up manufacturers are created. Epicenters of core manufacturing emerge with strong local connections and local manufacturers seek to innovation solutions from within the local ecosystem. Workforce development is reimagined (K-20) through academic programming to counter the need for outsourcing, but over time talent supply is in danger of becoming limited and growing manufacturers are forced to relocate or look out of state for talent. The local orientation of this scenario has the potential to become siloed and isolated from global supply chains.





The 'Design Global, Manufacture Local' scenario paints a future where the focus on all things local gradually isolates the manufacturing industry in Illinois making it unable to compete in the global economy, and workforce constraints limit the industry growth.

In the 'Design Global, Manufacture Local' scenario, Illinois manufacturing gradually becomes unable to compete with a rapidly interconnected and global manufacturing ecosystem.

SCENARIO D: 2030 CHARACTERISTICS – DESIGN GLOBAL, MANUFACTURE LOCAL

The characteristics of this future paint a future where manufacturing continues its current trajectory and systems remain comfortable and familiar. This inward focus over time curtails Illinois manufacturers' ability to compete in an increasingly global ecosystem.

Industry Innovation & Collaboration Profile

Industry collaborates on a local level and innovation is limited to local solutions.

- More risk taking occurs on a local level, within the local ecosystem.
- High levels of local support create a positive environment for small start-up manufacturers.
- Local innovation is tied to limited access to global supply chains.

Technology Application & Adoption

Technology adoption lags as manufacturers have difficulty competing globally.

- Increased robotics are used while local workforce is upskilled.
- Local infrastructure is developed (broadband) to support local manufacturing.
- Use of AI and 3D printing increase in local manufacturing.

Geographic Distribution & Concentration

Existing local concentrations of manufacturing continue, and more clustering occurs.

- Strong local connections create a cohesive approach to workforce development.
- Growing epicenters of manufacturing occur with a focus on local supply of talent and resources.
- Manufacturing centers become increasingly siloed by lack of global connections.

Supply Chain Configuration & Behavior

Manufacturing relies on local supply chains for goods and services.

- Over time, local manufacturers are forced to relocate to access changing supply needs.
- Local supply chains strengthen in the short term but become obsolete over time.
- With limited access to global supply chains, manufacturers become isolated and uncompetitive.

Workforce System and Profile

K-20 training provides local manufacturers with a limited but highly trained workforce.

- The local talent pipeline is reimagined K-20 to support local manufacturing workforce demands.
- Policy settings focus on reducing workforce outflow and increasing retention.
- The need for capable workers is connected to the large pool of local unemployed, low-skilled people.

2025 HEADLINE NEWS:
"Manufacturing struggles to find talent."

2030 HEADLINE NEWS:
"Manufacture it. They will come. Maybe."

2040 HEADLINE NEWS:
"High quality of life, but limited growth potential."

The Expected Future results show that stakeholders view the ecosystem as primarily locally orientated and has a mixed approach to workforce and workplace. Manufacturers felt they were being pulled to 'Workplace Transformation' due to unsolved skills shortages.

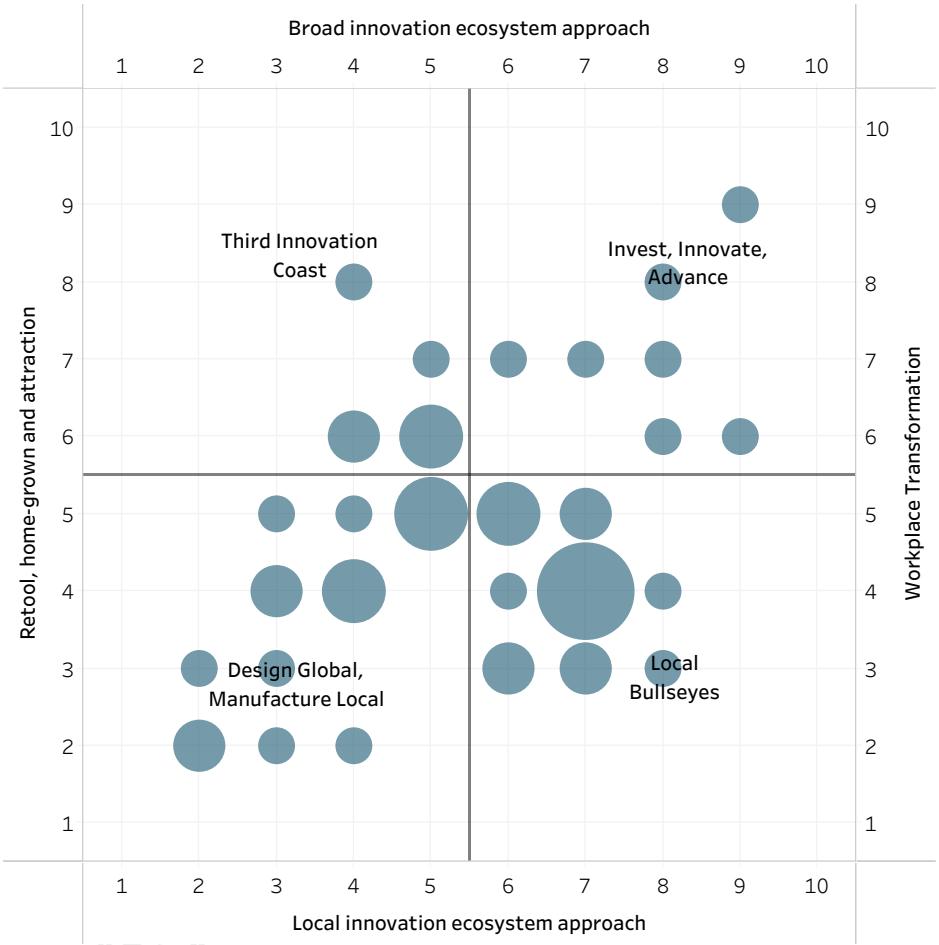
7.0 EXPECTED AND PREFERRED FUTURES

At the conclusion of the Think-Tank workshop, and during the statewide stakeholder discussion group meetings, participants were asked to consider what they believed would be the 'Expected Future' and the 'Preferred Future' for manufacturing in Illinois looking out to 2030.

7.1 EXPECTED FUTURE

The results for the expected future are outlined in the following heatmap. For the Expected Future, the concentration of responses was somewhat dispersed, but generally towards the bottom quadrants of the matrix.

Expected Future Heatmap *(X Axis = Workforce and Workplace; Y Axis = Innovation Ecosystem)*



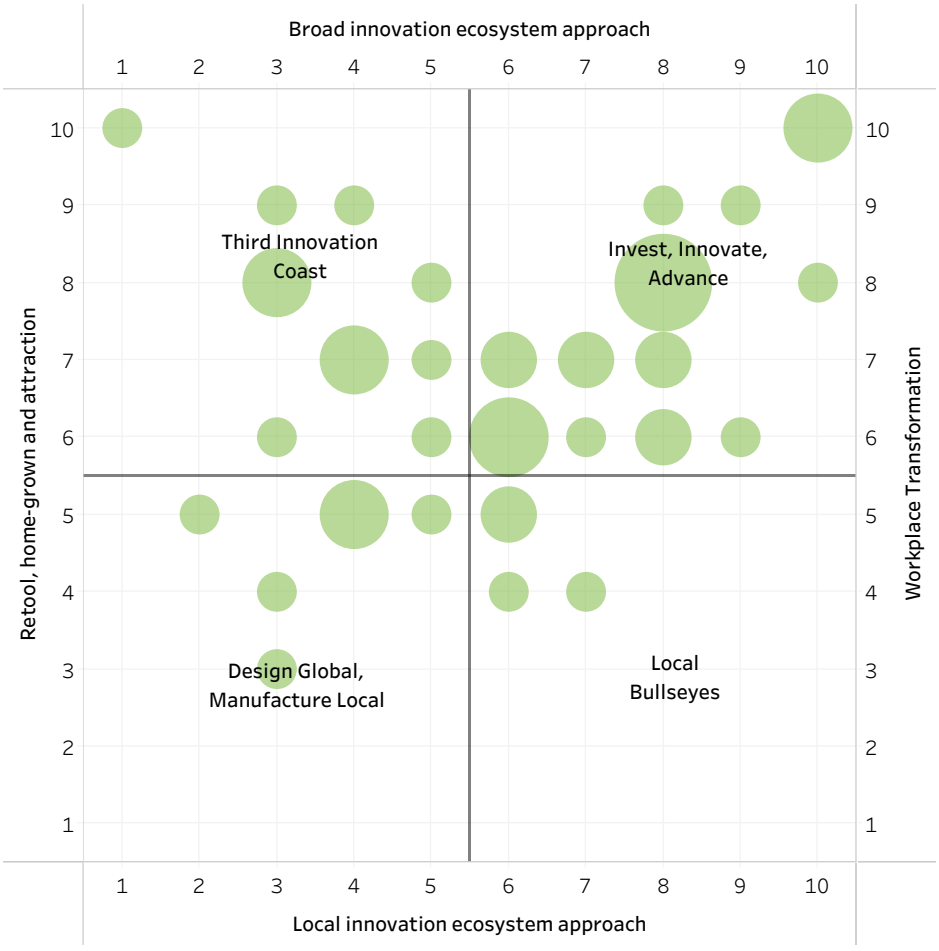
The Preferred Future results show a significant appetite to move to a more outward looking and broad innovation ecosystem approach. There is a desire to lean more into workplace transformation, while retaining a strong local workforce.

7.2 PREFERRED FUTURE

The results for the Preferred Future are outlined in the heatmap below; created by compiling the individual responses from the workshop and stakeholder group participants. The results show a significant shift in responses, with most people being toward the 'Broad Innovation ecosystem approach' end of the vertical axis.

Preferred Future Heatmap

(X Axis = Workforce and Workplace; Y Axis = Innovation Ecosystem)



The Expected and Preferred Future heatmaps, coupled with the workshop discussions have produced significant strategic insight. This work helps set the stage for more detailed discussions on strategy development.

7.3 FUTURE INSIGHTS - EXPECTED TO PREFERRED FUTURES

The Expected and Preferred Future heatmaps have been generated with the input of over 60 key stakeholders across the state, including from the Think-Tank participants and the 11 stakeholder group sessions. This group collectively represents a broad cross section of the overall manufacturing ecosystem, and a wide geographic spread across Illinois. The responses across the heat maps are relatively diffuse. In large part this reflects the geographical and sector variations, as would be expected in a State where there is the extremity of settings, from rural areas through to a major global urban metropolis.

FutureInsight

FUTURE INSIGHTS

Key insights to draw from the Expected Future heatmap include:

- The average of the responses was X-Axis = 5.6 and Y-Axis = 4.7. The Expected Future responses for Workforce and Workplace (X Axis) is driven by an historic investment in developing local talent. However, the combination of the acceleration of advanced manufacturing and automation, and the workplace disruption triggered by the pandemic, is rapidly driving the manufacturing sector towards workplace transformation. This is also influenced by the overarching persistent skills and workforce shortage being experienced in the manufacturing sector and supply chains.
- The Expected Future responses for the Innovation Ecosystem (Y Axis) reflects a view that investment and focus is currently more orientated toward the local innovation ecosystem approach.

FutureInsight

FUTURE INSIGHTS

Key insights to draw from the Preferred Future heatmap include:

- The average of the responses was X-Axis = 5.9 and Y-Axis = 7.1, which is primarily a shift upwards on the Innovation Ecosystem (Y-Axis). The Preferred Future responses draw in key elements from both the 'Third Innovation Coast' scenario, and the 'Invest, Innovate, Advance' scenarios.
- The most dramatic outcome on the Preferred Future heatmaps is a significant pivot to focus on a broad innovation ecosystem approach. This suggests there is an immediate need to make a deliberate investment in developing a wide-reaching approach to building innovation capacity within the state, and a focus on building greater global ecosystem connectivity.
- The responses on the Preferred Future for Workforce and Workplace (X Axis) show the need for a dual strategy. This was reinforced in the stakeholder group discussions. There was a recognition that a focus on developing and reskilling local talent was critical; however, this had to be supported with a rapid investment in exploring new workplace approaches and reinventing work patterns. These dual strategies are complementary, and with the right balance can help manufacturing boost productivity and its competitive position.

The key insights have created an enticing picture of the future, where Illinois becomes a 'go-to' national and global innovation hot spot, drawing in new ideas, talent, and investment. This is deemed by stakeholders as a preferred and plausible future.

8.0 KEY FUTURE INSIGHTS - WHAT WE HAVE LEARNED SO FAR

This initial strategic foresight work has identified a range of critical insights about the future of manufacturing in Illinois. This work is especially important in our post-COVID world, where underlying trends are being accelerated and amplified, and new trends are emerging. These insights reflect the desire of industry partners and stakeholders to take manufacturing to a new level in Illinois. Key insights gained from this first step of the foresight research process have included:

KEY BENEFICIAL TRENDS ARE CONVERGING

Key accelerating macro trends are converging that will amplify the importance of Illinois's food and energy resource base, and the existing strong manufacturing capability.

- **Opportunity:** Illinois can lead in the next industrial revolution and leverage its resources to build new competitive opportunities.
- **Challenge:** To continually embrace and deploy advanced manufacturing and automation as the speed of change accelerates, and workforce remains constrained.

VERY REAL POTENTIAL TO BECOME A 'GO-TO' GLOBAL INNOVATION HOT SPOT

The industry stakeholders have identified the very real potential for Illinois manufacturing to emerge as a global innovation hot spot.

- **Opportunity:** Illinois has proximity to resources, strong global connectivity, and a concentration of existing manufacturing innovation efforts.
- **Challenge:** The basic building blocks exist; but need to be pulled together into more cohesive and dynamic technology innovation ecosystems, that distribute benefit across the state.

WORKFORCE AND WORKPLACE TRANSFORMATION IS A GOLDEN OPPORTUNITY

The workforce and workplace are undergoing profound change, and workplace transformation is accelerating.

- **Opportunity:** Stakeholders have identified the need to develop dual workforce strategies, that simultaneously develop a highly skilled local workforce, and pivot to embrace workplace transformation, by applying innovative thinking to the workforce challenge.
- **Challenge:** To understand how workplaces of the future will function, and how to build new flexible workforce models and systems that provide critical functions in novel ways.

STRONG APPETITE TO TACKLE GRAND CHALLENGES AND CREATE A 'SYSTEMS-CHANGE'

Stakeholders have identified the need for bold and transformational thinking, and new ways of working together.

- **Opportunity:** Industry stakeholders want to create a broad 'innovation ecosystem' approach, that is at the forefront of technology and workforce innovation.
- **Challenge:** This will require new thinking and investment in how to rapidly build a highly connected and technically excellent innovation ecosystem, that has global reach and influence.

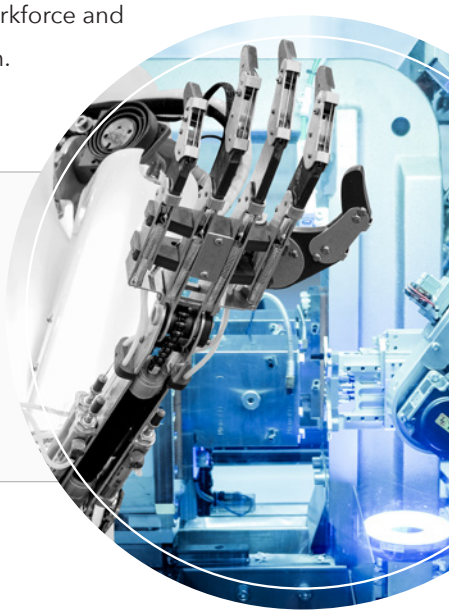
Stakeholder discussion groups explored the perceived sense of urgency to implement actions that move the manufacturing ecosystem toward the preferred future. The results indicate a strong desire to move with urgency.

9.0 OUTCOMES AND NEXT STEPS

This Foresight Research work is the first part of a larger process. This strategic foresight work has been undertaken to explore, at a high level, the future of manufacturing in Illinois. This is especially important in our post-COVID world, where underlying trends are being accelerated and amplified, and new trends are emerging. It has aimed to explore future plausible scenarios, and understand what needs to be the future trajectory, and how fast we need to act.

Key outcomes include:

- The high-level strategic insights offer a tantalizing view of the future. There is the very real opportunity for Illinois to redefine itself as a national and global innovation hot spot, that propels manufacturing into its next industrial era.
- The exploration of macro trends suggests there are favorable conditions being created, that offer a unique opportunity for the future of manufacturing in Illinois. Capturing the benefit of these trends will require embracing systems change approach, and execution of strategies aimed at the preferred future.
- This strategic foresight work has helped identify the desired future direction of manufacturing in Illinois, as identified by industry stakeholders. There remains significant work to chart a detailed future roadmap and develop specific targeted strategies.
- There is a need to develop a high-level strategic roadmap for manufacturing in Illinois, to achieve the preferred future. This will need to lay out how to simultaneously tackle the workforce and workplace transformation needs; and to build a globally connected innovation ecosystem.



NEXT STEPS - This process has played out a decade long, high level trajectory. The next step is to develop and refine strategies and actions that convert the aspiration into action on the ground. This would ideally happen at a regional and sector level within the state, to allow customized strategy development that reflects specific needs and context. This planning then needs to be unified into a coherent state-level strategic framework, supported by policy settings.

10.0 ACKNOWLEDGEMENTS

The IMEC Board, staff and stakeholders engaged in this project's activities with great enthusiasm. Their passion and interest ensured the discussions were thoughtful, and the outcomes reflective of the myriad of perspectives that exist within the Illinois manufacturing sector. This dedication is reflective of the deep commitment participants have to the future of manufacturing in Illinois. Future iQ would like to acknowledge the substantial support from the IMEC staff, Board and key stakeholder groups. Their outstanding support, time and effort were greatly appreciated.

Think-Tank and Stakeholder Group Sessions

- Future of Illinois Manufacturing Think-Tank (August 5)
- Champaign County Economic Development Corporation (August 18)
- Chicago Department of Planning and Development (August 27)
- Chicagoland Food and Beverage Network (August 17)
- Chicagoland Workforce Funders Alliance (August 16)
- DCEO Team Red (August 17)
- Greater Peoria Economic Development Council (September 2)
- Southern Illinois Now (August 16)
- P33 (September 8)
- Somercor (August 19)
- State Commerce DCEO (August 18)
- TEC Services Consulting, Inc. and Fera Consulting Group (August 16)

11.0 FOR MORE INFORMATION

For more information on IMEC's Future of Manufacturing in Illinois project, please contact:

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Report prepared by Future iQ, in collaboration with the IMEC team.

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