INCLUSIVE INNOVATION IN ADVANCED MANUFACTURING:

MOVING FORWARD WITH SHARED GAINS

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Glossary of Terms

Additive manufacturing is a type of advanced manufacturing that typically refers to 3D printing, but generally means the process of layering a material to build an object.[1]

Advanced manufacturing is the use of innovative technologies to create existing products and the creation of new products. Advanced manufacturing can include production activities that depend on information, automation, computation, software, sensing, and networking.[2]

Computed tomography uses x-rays or other types of irradiation to create three-dimensional images. In advanced manufacturing, it is used for quality control assessments of materials or components of manufacturing processes.[3]

Manufacturing Extension Partnership (MEP) is a U.S. Department of Commerce program within the National Institute of Standards and Technology (NIST). This program supports a national network of public-private partnerships with U.S. manufacturers that supports their needs, especially those of small- and medium-sized companies.[4]

Acronyms

BMW - Buffalo Manufacturing Works
MEP - Manufacturing Extension Partnerships
NIST - National Institute of Standards and Technology
NWTC - Northland Workforce Training Center

TABLE OF CONTENTS

A COLLABORATIVE PARTNERSHIP FOCUSED ON ADVANCED MANUFACTURING

In the East Side of Buffalo, NY, a manufacturing regeneration is underway. Supported by a flourishing institutional partnership, the community is now home to a thriving advanced manufacturing hub that explicitly creates pathways for residents of color into advanced manufacturing careers. This effort offers one model for other legacy manufacturing regions seeking to build an inclusive manufacturing sector.

When Buffalo's manufacturing industry declined during the second half of the 20th century,[5] the East Side of Buffalo – formerly home to much of the city's manufacturing activity[6] – was hardest hit. Today, the community struggles more economically compared to the region, state, and country, and its residents are more likely to experience poverty.[7] For residents of the East Side of Buffalo, the loss of manufacturing businesses and jobs exacerbated longstanding disparities caused by policies that systematically isolate and exclude communities of color from wealth building opportunities.

But the East Side of Buffalo's struggles also reflect inter-related challenges felt across the manufacturing industry: underinvestment by smaller-sized firms in productivity-enhancing technology; truncated career pathways with limited advancement for frontline workers, particularly those of color; and high worker turnover, made worse by the COVID-19 pandemic and a fast-aging manufacturing workforce. The sheer complexity of these interconnected issues makes it difficult for any single organization to address them alone.

In response, three non-profit organizations are leading a coordinated response to rebuilding manufacturing strengthens in Buffalo's East Side: the Northland Workforce Training Center, Buffalo Manufacturing Works, and Insyte Consulting. Since 2011, these state- and federally-funded organizations have joined forces to align resources and reinforce services, paving the way for a better manufacturing future by offering residents of Buffalo's East Side the chance to reclaim their industrial legacy – this time with an explicit goal of promoting racial and economic

inclusion. By offering coordinated support to increase access to high quality jobs while also helping firms become more innovative, this partnership offers a forward-looking, equitable regional development strategy.

In this report, we feature the strategies that this constellation of partners uses to foster investments in workforce development alongside investments in technology – something we call *inclusive innovation*. While the partnership is still young relative to the East Side's manufacturing history, their accomplishments over the past decade have been notable and inspiring. This report first introduces these anchored organizations, then describes their strategies.

CORE INSTITUTIONS

In the East Side of Buffalo, three non-profit organizations are at the center of a more expansive network of support organizations buttressing the region's manufacturing resurgence:

The Northland Workforce Training Center (NWTC) is a workforce and economic development initiative that builds quality career pathways into the advanced manufacturing and clean energy industries. First opened in 2018, NWTC offers associate's degree and for-credit certificate programs that are designed and taught in partnership with Alfred State College and SUNY Erie Community College. The training programs teach technical and soft skills that are applicable across entry- and mid-level occupations in advanced manufacturing and clean energy. NWTC identifies "in-demand" skills and growth occupations through conversations with local advanced manufacturers and from research in the 2011 Western New York Regional Economic Development Council plan.

Buffalo Manufacturing Works (BMW) is a membership-based consulting organization that fosters collaboration between industry, research, and academic partners to support a variety of technological solutions, from additive manufacturing and robotics to computed tomography. In addition to fee-for-service consulting, BMW supports local manufacturers through its state-of-the-art laboratory, research, and training center. BMW partners with local manufacturers, economic development organizations, and others to assess industry needs, guide research, and bring together multi-stakeholder working groups. The organization recently identified workforce development as an important component of successful technology implementation and responded by developing courses to upskill incumbent workers. One emphasis of this training is the design and implementation of job-enhancing forms of automation that relieve workers of tedious, repetitive, or potentially dangerous tasks.[8] BMW opened in 2015 as a local chapter of the technology and engineering non-profit EWI, which provides applied research and development

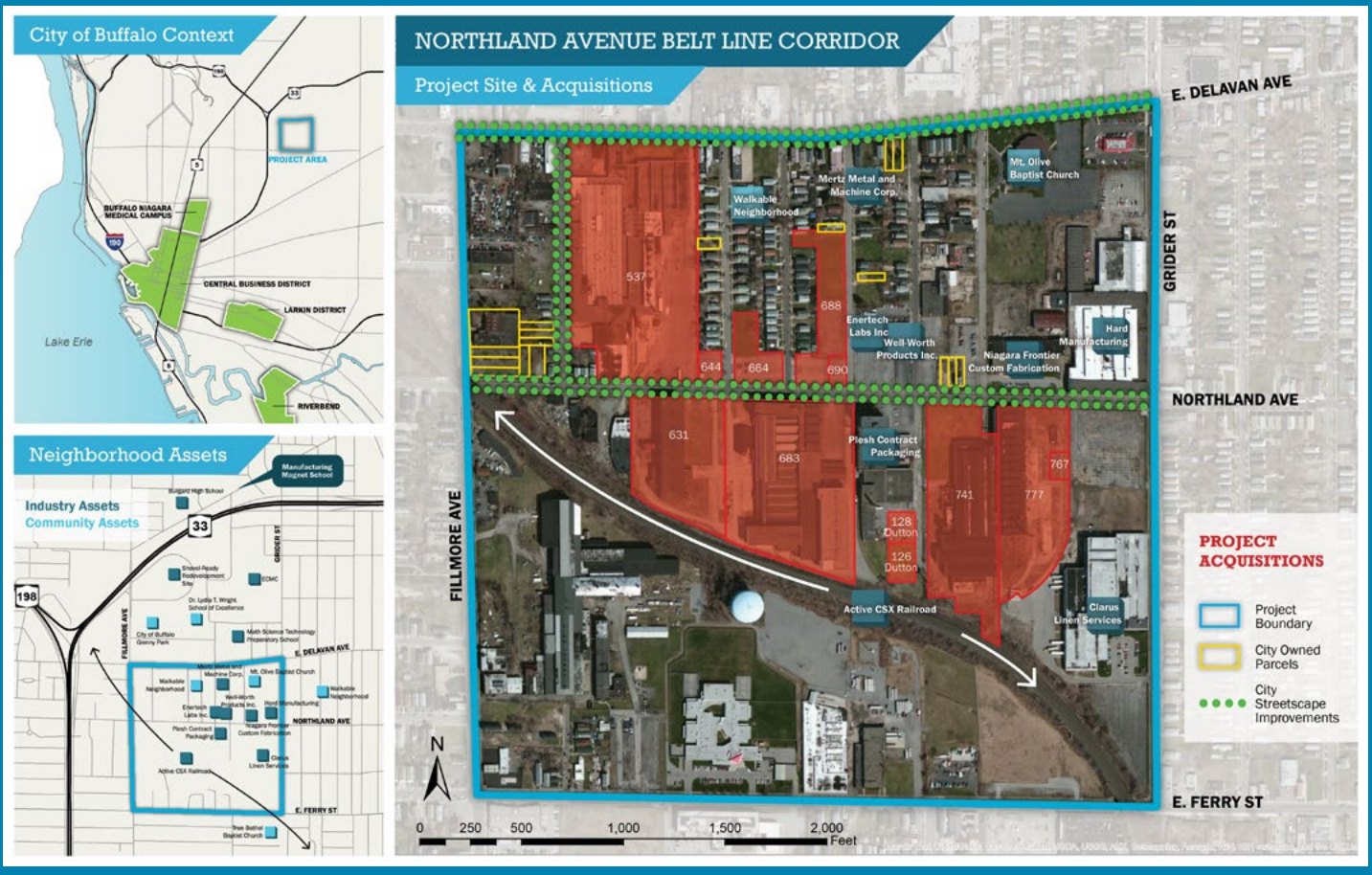
services for innovative technologies in advanced manufacturing.[9] BMW moved into the same building as NWTC within the Northland Corridor Redevelopment area in 2019.[10]

Insyte Consulting is a non-profit corporation that has provided business strategy and process improvement advice to small- and medium-sized manufacturers in Western New York since 1982.[11] The organization moved to the Northland Beltline Corridor business park in 2019 to be closer to NWTC and BMW. As a regional Manufacturing Extension Partnership (MEP) Center for Western New York, it helps small- and medium-sized enterprises with materials and machinery strategies. Instye's experts also support manufacturing clients with process improvement, marketing and business planning, quality system implementation, and information and technology development.

The Buffalo Billion

In 2012, the state of New York committed to investing $1 billion in the Buffalo area to support job creation and spur economic growth in line with Western New York Regional Economic Development Council's Strategy for Prosperity. The funds, known as the "Buffalo Billion," aim to enhance existing economic conditions while setting the stage for further investments in a sustainable future. Since 2012, four rounds of funding from the Buffalo Billion have supported 49 projects for commercial district revitalization and public transit corridor development.[12] Advocacy by the Buffalo Niagara Manufacturing Alliance positioned advanced manufacturing as an important opportunity industry for meeting these goals, resulting in the selection of advanced manufacturing as one of eight sectors to receive Buffalo Billion funding.

In 2014, $29 million of the Buffalo Billion was directed towards the remediation and redevelopment of 35 acres of vacant and former industrial land. The Northland Beltline Corridor Redevelopment Project created a business park with resources to catalyze a resurgence in advanced manufacturing, including workforce development programming, research and development support, process improvement consulting, technology development, and industry collaboration.[13, 14] The Northland Workforce Training Center (NWTC) is located within the business park, providing workforce services in advanced manufacturing with a particular emphasis on racial equity and inclusion. Buffalo Manufacturing Works (BMW), Insyte Consulting, the Buffalo Niagara Manufacturing Alliance, local manufacturers, and a mix of other support organizations and services are also co-located in the business park.



HOW DO THEY SUPPORT THE EAST SIDE OF BUFFALO'S MANUFACTURING INDUSTRY?

The three core organizations pursue their individual missions in an interconnected way to engage and address multiple reinforcing challenges in advanced manufacturing. Together, their efforts contribute to a positive, reinforcing cycle of *inclusive innovation*, producing mutual benefits for workers and their employers alike. Within this virtuous cycle, investments in new worker training build a workforce pipeline that extends career opportunities to populations previously left out of wealth-building opportunities. There is additional support for the incumbent manufacturing workforce; exposing workers to new technologies and related skill advancement opportunities that also move them from the margins to the center of manufacturing innovation. Combined, these improvements contribute to better workplaces, helping firms retain talented workers while advancing their overall business performance. As the cycle completes, it begins again: prospective workers are drawn to high-quality workplaces offering stable jobs at innovative companies.

Each organization leverages three strategies to build an ***inclusive innovation cycle***: *centering*, *visioning*, and *bridging*.

Centering

Centering strategies focus on the unique challenges and needs of a particular set of individuals and organizations within Buffalo's manufacturing economy: NWTC centers individuals seeking to land a first-time manufacturing job; BMW supports incumbent workers within manufacturing businesses that are incorporating new technologies; and Insyte Consulting drills deeper into manufacturing firms, assisting them in making a broad range of organizational and managerial improvements. While each partner organization develops and deploys deep expertise to meet the specific needs of a given stakeholder group, the objective is not to isolate stakeholder groups or interests, but rather to create a holistic and interconnected scaffolding from which to draw out and resolve ongoing challenges.

NWTC centers its support on recent high school graduates, unemployed residents, single parents, and historically underrepresented populations such as women, people of color, veterans, refugees, immigrants, and those involved in the justice system.[15] The program has enrolled more than 700 students, 58% of which are people of color and 8% of which are female. Most are residents of the East Side of Buffalo. The average student age is 26 years old. NWTC works with a host of community organizations, especially churches, to connect with these populations and familiarize them with the opportunities NWTC provides.

NWTC programs are designed to introduce these prospective manufacturing workers to entry- and mid-level jobs in secure or growing occupations with strong wages and career progression opportunities. To make this happen, NWTC collaborates closely with manufacturers and partners like the Buffalo Niagara Manufacturing Alliance to identify growth occupations and desirable skills. Currently the organization offers associate's degrees in Welding Technology, Electrical Construction and Maintenance Electrician, CNC Manufacturing and Machining, and Mechanical Engineering, as well as a certificate in Mechatronics. The Buffalo Niagara Manufacturing Alliance is also co-located with NTWC, BMW, and Insyte Consulting. The Alliance is an active group of over 180 small- and medium-sized manufacturers in Western New York that advocates for manufacturing's inclusion in regional economic development plans and the Buffalo Billion funding strategy.

In addition to skills training, NWTC coordinates wraparound services, including childcare, substance abuse and mental health counseling, and housing, food, and transportation support. This personalized support helps students overcome barriers to completing a course or certificate program. NWTC also provides extensive career counseling to assist students in identifying job opportunities that they find interesting and a good fit. This may involve helping the student translate their experiences on their resume and interview, but also extends to helping manufacturers identify which skills are essential and which can be taught on the job. Career coaching services extend for three years after students finish their training at NWTC, setting the stage for further career success. As a result of these student-centered services, manufacturers also benefit immensely when well-suited and informed applicants are steered toward their openings.

BMW centers on incumbent workers in their broader efforts to push technology and innovation adoption within existing manufacturing facilities. BMW staff work with senior managers and frontline operators at manufacturing companies to plan for new technology, including workplace reorganization in response to new technology implementation. In some cases, technology-enabled automation is introduced to resolve worker shortages by reducing difficult-to-fill roles. But new technology implementation also enables better use of incumbent workers' skills – a socially responsible approach to automation that aims "never to take away jobs, never to replace human capital, but to make … employees more productive."[16] With this in mind, BMW has designed collaborative robots, or cobots, to absorb the "dull, dirty, and dangerous" responsibilities of CNC machine tending. With the help of a cobot, machinists can cover critical and more interesting tasks like writing programs, performing changeovers, and training junior staff members, rather than focusing on routine and repetitive tasks.

BMW also uses its Skillform Center to provide training programs to incumbent workers in welding, automation, and additive manufacturing. These training options are designed to be short (week-long at most) and stackable, such that an incumbent worker might take a one-day overview on applications and general protocols for robots and then progress to a five-day intensive course to understand how to program and operate a robot. BMW learned of this training need through their frequent interactions with small- and mid-sized manufacturers. By opting to focus on incumbent workforce development, BMW also complements rather than competes with NWTC new employee training options, doing their part to strengthen channels for continuous learning.

Insyte Consulting focuses on small- and medium-sized manufacturing firms. In its capacity as a local Manufacturing Extension Partnership Center, Insyte works closely with BMW to provide an integrated approach to adjusting products, processes, markets, and business models alongside new technology adoption. Insyte Consulting's comprehensive approach to organizational change reaches beyond workers immediately affected by technology investments to address wider recruitment and retention challenges. Support services range from decreasing burnout (eliminating unnecessary tasks) and frustration (making clearer protocols for quality standards) to identification of tasks that are good candidates for job-enhancing combinations of automation and workforce upskilling.[17] While enhancing manufacturer performance is Insyte Consulting's central focus, workers benefit from process and training improvements that are embedded in firm-level improvement strategies. As an illustration, Insyte will help client firms identify gaps in manufacturing processes and standards that prevent a company from attaining new production certifications; from there, they will help train management and personnel to upgrade skills to achieve those certifications.

Together, these organizations address various component parts of the advanced manufacturing industry in Buffalo: recruiting new workers into exciting and well-compensated careers, supporting career progression for incumbent workers, and facilitating firm-level improvement and innovation. The centering strategies generate deep wells of engagement and expertise to address individual stakeholder group needs while acknowledging the broader industry and regional context in which challenges manifest.

The East Side of Buffalo and the Northland Corridor

Manufacturing has a long history in Buffalo, and sparked much of the city's early growth. The *Northland Corridor*, a north-south commercial district which is now home to NWTC, was at the heart of its success.[18] After the completion of the Beltline Railroad in the late 19th century, the neighborhood became a vibrant center of manufacturing activity. Residential units to house manufacturing workers sprung up as companies succeeded, like the Niagara Machine and Tool Works company which opened in 1879.

As American manufacturing experienced growing international competition, Buffalo's industry also struggled. Outsourcing to lower-wage countries and regions, along with shifts away from rail transport, contributed to economic decline for the Northland neighborhood. By 2000, Niagara Machine and Tool Works and many others had closed their doors.

This simmering economic challenge was further compounded by historically-rooted systemic racism. Racial segregation had long existed in Buffalo, reinforced over the decades through exclusionary financing, restrictive covenants, and urban renewal. For example, the construction of the Kensington Highway in the late-1950s physically separated the East Side of Buffalo's Black residents from neighboring white communities, which also resulted in plummeting property values, businesses closures, and overall neighborhood disinvestment.[19, 20]

PHOTO: Exterior view of the Niagara Machine & Tool Works building, built in sections beginning in 1910 to house a sheet metal business that fabricated equipment, appliances, and automotive materials that closed in 1999. The preserved and rehabilitated building is now home to the Northland Workforce Training Center.

The legacy of these policies can be seen today: Buffalo is the 18th most segregated city in the country[21] and many East Side zip codes are among the poorest in the nation. As the East Side of Buffalo struggles more economically compared with the rest of the region, state, and country, these economic disadvantages fall primarily on Buffalo's residents of color.[22] The region continues to feel the impacts: the neighborhood has fewer food establishments, banking institutions, and other infrastructure, further limiting economic activity.

After remaining vacant for almost two decades, the Niagara Machine and Tool Works building has become the new home for NWTC, which anchors the Northland Beltline Corridor Redevelopment Project. This decision reflects the desire to strategically re-use former industrial land and infrastructure, and to include the East Side of Buffalo residents in a vision for shared prosperity. As the first major investments in the neighborhood since the decline of manufacturing, the project's goal is to spark an advanced manufacturing and clean energy corridor that draws additional investment and activity from private firms. The project is picking up steam: manufacturing businesses from outside the area, including Viridi Parente, SparkCharge, and Retech Systems, have relocated to the East Side of Buffalo, and the area now includes a bank and a restaurant, providing much-needed services in the corridor.[23]

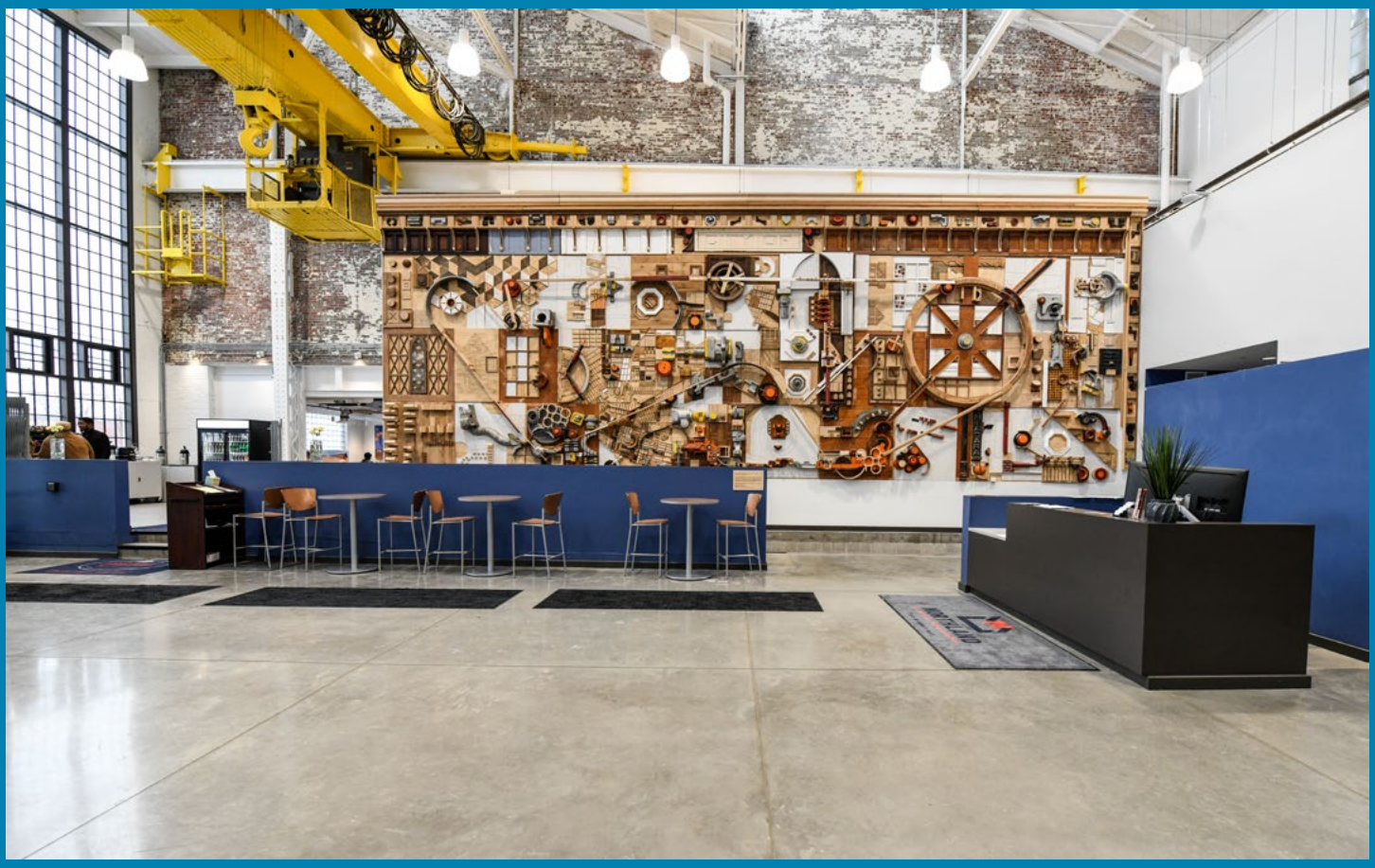


PHOTO: The lobby of the 100,000 square foot Northland Workforce Training Center building, which opened in 2019.

Visioning

A *visioning strategy* creates low-stakes experiential opportunities for various stakeholders to envision themselves in an inclusive and innovative advanced manufacturing industry. This second strategy directly confronts the outdated perception of manufacturing as an unstable and dying industry. By providing opportunities to see how a modern advanced manufacturing industry functions, manufacturers can imagine how investments in a diverse workforce and new technology come together to improve equity, productivity, and retention. And workers can imagine themselves in well-paying, high-quality careers that were previously unavailable as a result of biased and segregated labor markets. When experiential processes are "low-stakes," they create opportunities for consideration, iteration, and collaboration before substantial resources are expended, also encouraging participants to stay engaged and learning.

NWTC, BMW, and Insyte Consulting all use visioning to show youth the potential of exciting, well-paying, and satisfying jobs in advanced manufacturing. As one stakeholder put it:

> "You talk to a teenager [about manufacturing], and they think you're going to come home dirty. Especially in places here in Buffalo, and the Rust Belt, [or] anywhere around Great Lakes, you still have those old images of the steel factories and steel plants. You have to shift that image. We have to get away from traditional manufacturing to advanced manufacturing, to the clean, more updated manufacturing…"

Reconstructing the image of manufacturing starts as early as middle school with a video contest sponsored by NWTC to show "what's so cool about advanced manufacturing" (uncoincidentally, the name of the video contest). The program was designed to "improve the image of manufacturing as a career choice with the objective of recruiting more young people to vocational and technical schools."[24]

In high schools, after-school programs and summer internships create meaningful opportunities for students to actually learn to use exciting new technologies, while further encouraging them to see themselves in a manufacturing career, especially if they have a background not typically represented in the industry. In 2019, an after-school program co-hosted by BMW and Buffalo Public Schools enrolled 50 students, the majority of which were low-income students and from minority groups or women.[25]

Buffalo Public School students may also enroll in summer internships at NWTC to learn about manufacturing skills and workplaces. Internships culminate with a field trip to a local manufacturer to see the work environment. To support this visioning, programs also engage parents and encourage counselors to showcase satisfying and well-paid careers in advanced manufacturing.

NWTC offers enrolled students additional opportunities to imagine themselves in advanced manufacturing careers through site visits to local manufacturers, hands-on learning labs and even paid work experiences. Students earn-while-they-learn at NWTC's Northland Manufacturing facility, a social enterprise non-profit that also functions as a full-scale contract manufacturing operation. Northland Manufacturing connects student teams to local firms that need a manufactured product or part. This experiential approach emphasizes the importance of hands-on, tactile learning for skill development. It also helps NWTC students better understand what it's like to work in an advanced manufacturing setting before they apply for a first-time industry job.

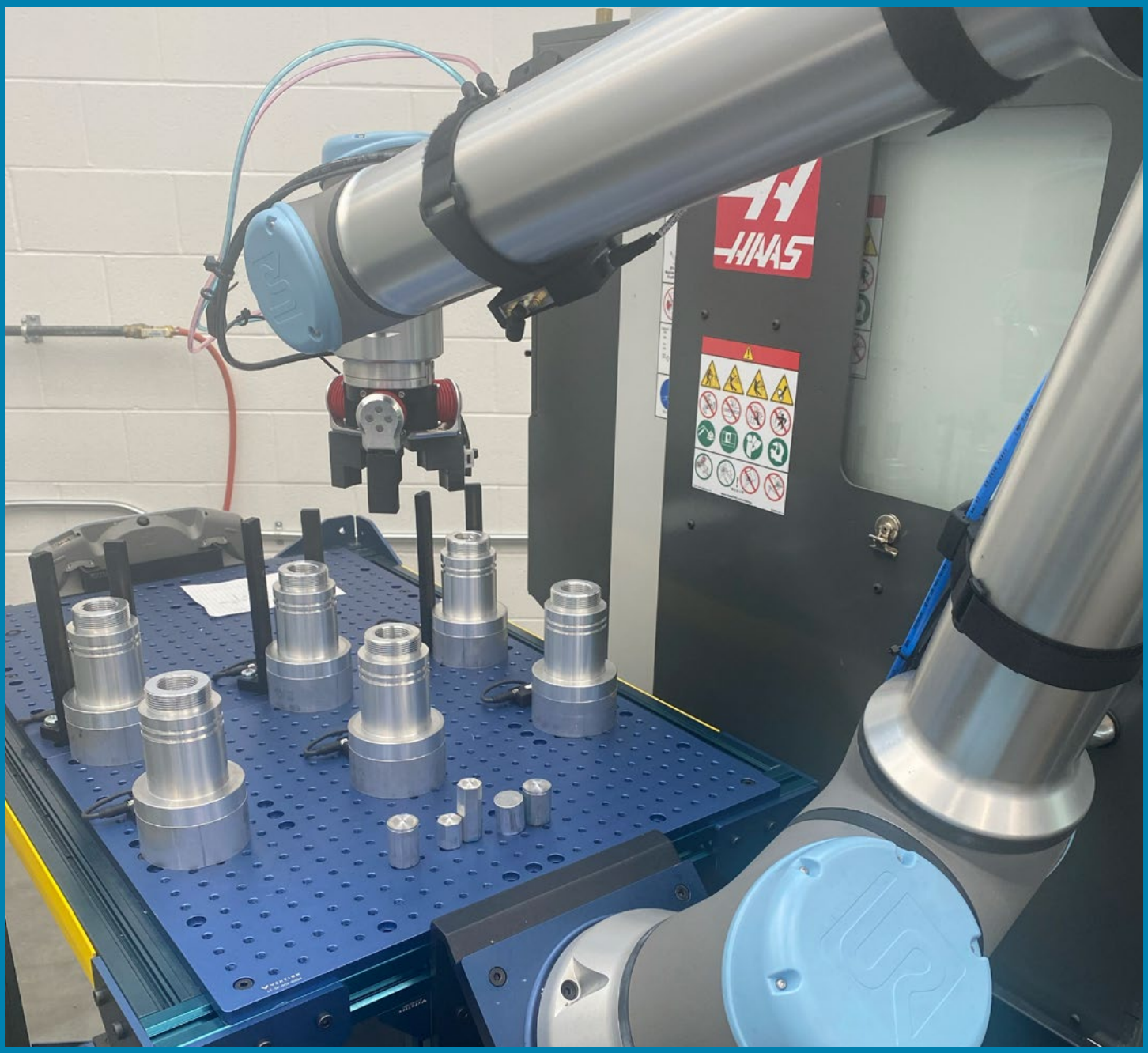
BMW reinforces this insight by helping manufacturing employers also envision the power of new technology in the hands of next generation workers. BMW places collaborative robots, or cobots, within the Northland Manufacturing facility. This enables NWTC students to use cutting-edge technology and deepen their appreciation for a new, safer, and cleaner advanced manufacturing workplace. But BMW uses the opportunity to host tours and demonstrations of Northland Manufacturing for company owners and managers, enabling them to observe first-hand how new technologies are incorporated by students into actual production processes. This low-stakes,

free demonstration exposes manufacturing firms to alternate arrangements – both with respect to technology and talent – before committing resources.

BMW also designs its incumbent worker training to support reimagination by enabling existing workers to understand the potential of automation to move workers into new occupational and organizational roles, when implemented alongside skills training. BMW does this through a mix of programming, including at its Automation Flexibility Lab, which is a space for manufacturing firms and their incumbent workforce to simulate potential investments in software, robots, vision systems and related automation to test processes and inspections before making a final investment decision.

Collaborative Robots or “Cobots”

Manufacturers use advanced robotics for assembly, machining, and warehousing tasks. Robots may create new and better jobs within manufacturing, as workers are needed for their engineering and operation, while at the same time robots may be used to replace more dangerous roles and responsibilities or those that require a high level of precision.[26] However, traditional industrial automation cannot cover most manufacturing tasks. Cobots can. Cobots are more flexible and easier to program. They also can work next to humans safely, unlike traditional robots. Finally, they are more affordable than traditional robots. Cobot sales are expected to grow to $12 billion by 2025.[27] BMW uses their Automation Feasibility Factory floor to allow manufacturers to simulate cobot systems before they invest.



Insyte Consulting plays an equally critical visioning role through their appropriately named Shift Program, which they co-created and manage with BMW and another organization called Next Street to expose small and medium-sized enterprises to relevant new technologies and innovations. As Shift providers can attest, smaller firms often struggle more than their larger sized counterparts with new technology adoption due to a lack of understanding of a technology's potential or a gap in technical expertise needed to implement it. Additional challenges at the company or regional level can arise from a lack of sufficient workforce skills needed to utilize the technology.[28, 29, 30]

Shift staff address these and related challenges by establishing more concrete visions of solutions and opportunities. They do this in a number of ways, including assessing the risks and opportunities of automation. Participants in Shift are invited to workshops that help ground the assessment process by giving them exposure to multiple technological possibilities. A staff member calls this phase a "world of pure imagination," because "small manufacturers generally have no idea what kinds of advanced manufacturing technologies are out there."[31] Reiterating this point, another stakeholder noted that "when we show them [the firm owner] the automation and how it is being used, suddenly they get it. They start thinking about their own process and are able to envision what might be possible in terms of improving efficiencies."

The Shift Program has engaged 250 small- and medium-sized manufacturers in Western New York since it began in 2017.[32] One example is Astronics Luminescent Systems Inc., which is a manufacturer of aircraft lighting that employs approximately 300 people but has struggled to find additional workers. With help from the Shift Program, Astronics identified an opportunity to automate certain tasks and reallocated existing workers to higher value-add tasks. They automated the application of light filters in plane cockpits to alleviate workers from a lengthy and tedious process of using tweezers and superglue. This enabled the company to improve jobs while increasing throughput.

Bridging

Each core organization engages different facets of a complex, interconnected set of challenges facing manufacturing, but they also collaborate to create something more cohesive than any individual organization's mission. This *bridging strategy* reflects how partners link their respective expertise to mobilize collective resources and advance a common vision of regional economic inclusion and resilience for manufacturing.

Two bridges were intentionally established early on: location and leadership. All organizations are co-located in the same business park. This makes collaboration and resource-sharing between partners convenient. Proximity allows staff from different institutions to informally consult each other daily. The organizations have also established shared spaces, such as demonstration labs, that enable cross-cutting programming and better use of physical and financial resources; for example NWTC's contract manufacturing space is also used as a demonstration space for BMW. Co-location facilitates resource sharing.

Leadership roles are also intertwined, creating a second relational bridge. Insyte Consulting's Board of Directors includes both the President and C.E.O of BMW's parent organization EWI and of Northland Workforce Training Center. NWTC's Board of Directors includes the President and CEO of Insyte Consulting, and Buffalo Manufacturing Works' Founders Council includes NWTC. Another important partner that is co-located at the business park – the Buffalo Niagara Manufacturing Alliance – is also a crucial part of this embedded leadership network. Buffalo Niagara Manufacturing Alliance's Executive Director sits on the board at both NWTC and Insyte Consulting, and an NWTC representative sits on Buffalo-Niagara Manufacturing Alliance's board. These formal connections help partners stay aligned and able to continue to center their respective economic stakeholders in mutually supportive ways.

Beyond leadership and space, each institution also connects with the others to ensure cohesive efforts to resuscitate the regional manufacturing economy. Various manufacturing stakeholders—from owners to workers—are brought together through bridging partnerships that extend the impact and reach of each institution's individual ability. The goal is to forge connections between each organization's centralized stakeholders—an illustrative example of which is the use of the Northland contract manufacturing facility by NWTC and BMW to assist students and local firms. Students gain work experience with cutting-edge technology. Manufacturers can see the impacts of investing in new technologies alongside a newly skilled workforce, thus boosting their interest in hiring NWTC

graduates and investing in incumbent worker training internally to enhance technology investments. In this way, bridging allows participating institutions to transform overlapping specializations into connections of mutual responsibility, rather than reinforcing territorially isolated projects or strengths.

And it is not just relational connections between NWTC, BMW, and Insyte Consulting that matter most. Other bridges are being forged in support of residents in the East Side of Buffalo, using NWTC and the Northland Beltline Corridor Redevelopment Project as an anchor to draw resources together. In discussing how NWTC partners with local partners, like the University of Buffalo's Educational Opportunity Center, to provide free services that help students overcome barriers, NWTC's Stephen Tucker stressed, "We don't do everything ourselves. We leverage some of the resources that are available and we just make that connection better…we make those handoffs more successful." These types of bridges enhance the reach and impact of support services by making them more attainable, while also enabling more East Side of Buffalo residents to enroll in NWTC programming. Further, by connecting with partners in the East Side of Buffalo, these bridges support community revitalization more holistically: the East Side development project also houses an affordable, healthy food restaurant, banking institutions, and other useful infrastructure. One of the conditions of bringing Bank One Buffalo into the business park was the provision of "second chance" bank accounts for NWTC students and the East Side of Buffalo community members. Commitments such as this enhance the

scaffolding of support across institutional partners that build back wealth and equity in the East Side of Buffalo as a result of a resurgence in advanced manufacturing.

The importance of bridges with industry partners cannot be overstated. Reflecting this, the Buffalo Niagara Manufacturing Alliance is also co-located with NTWC, BMW, and Insyte Consulting. The Alliance is an active group of over 180 small- and medium-sized manufacturers in Western New York. In addition to advocating for manufacturing's inclusion in regional economic development plans and the Buffalo Billion funding strategy, the Alliance supports strategic and day-to-day connections between training and hiring activities. Their connection with local manufacturing firms enables NWTC to cater their training programs to the needs of industry, while also helping manufacturers to realize and articulate their own skill needs, and commit to their on-going development through on-the-job training. In deciphering what skills and roles are actually needed, qualified candidates, especially those from non-traditional groups (women and minorities) are not passed over because they lack easily-trainable skills. BNMA connects NWTC students and prospective employers through career fairs, networking events, and sponsored field trips, but the Alliance also directly fields job openings for its members and works with NWTC to connect students to these employment prospects. Finally, the Alliance has also been proactive in supporting the extension of DEI into the work site. For example, when a local manufacturing company hired its first workers of color (also NWTC graduates), the Alliance and NWTC worked together to provide weekly on-site support to foster an inclusive work environment.

Maintaining Connection: The Western New York Regional Economic Development Plan

With all of these connections being forged across myriad partners, how does institutional coordination get sustained? A key resource is the Western New York Regional Economic Development Plan, which offers a shared vision.

In creating an initial plan in 2011, Western New York Regional Economic Development Council solicited input from community partners, including the Buffalo Niagara Manufacturing Alliance. The Alliance helped The Council see the opportunity to leverage advanced manufacturing assets in the East Side of Buffalo by implementing initiatives that connect manufacturers to research and expertise to deepen their competitive advantage and develop a highly skilled and educated workforce.[33] As a result, The Council's plan recognized that, despite declining employment in manufacturing in Buffalo, there are sub-sectors which are poised for growth and renewal. In 2010 the Buffalo metro area had a higher concentration of people (11.3%) employed in manufacturing than the state and the country (5.7% and 10.6% of the working population, respectively).[34] Advanced manufacturing was found to be a particular strength for the Western New York region. Wages in these sectors were higher than the regional average wage. A second asset was the underutilized industrial land and former industrial plants along several major rail corridors. Despite the underlying potential though, the Alliance's members struggled to find enough skilled workers, and advocated for an organization like NWTC to focus on inclusive workforce development. The Council created a plan with commitments to bolster advanced manufacturing and training for its workforce as essential pieces of regional economic development strategy.

The Council's commitment to community economic development was also essential for tethering Buffalo Billion funding to advanced manufacturing and for selecting the East Side of Buffalo as the right neighborhood for on-going investment. Support for the East Side of Buffalo honors the area's manufacturing legacy, while giving current residents a stake in future prosperity from an advanced manufacturing resurgence.

The plan has been updated (most recently in 2016), providing a living resource for continued coordination of community revitalization efforts alongside advanced manufacturing development; it is also a helpful touchstone for research on how to bring together the expertise of many partners, including the local community.

AN INCLUSIVE INNOVATION CYCLE

By intentionally co-locating and relaying state and federal funding into strategic, connected, and complementary programming, NWTC, BMW, Insyte Consulting, and their partners are laying the groundwork for a resurgence in manufacturing in Buffalo. Through their use of the core strategies of centering, visioning, and bridging, they connect those foundations into an *inclusive innovation cycle*, shown in Figure 1.

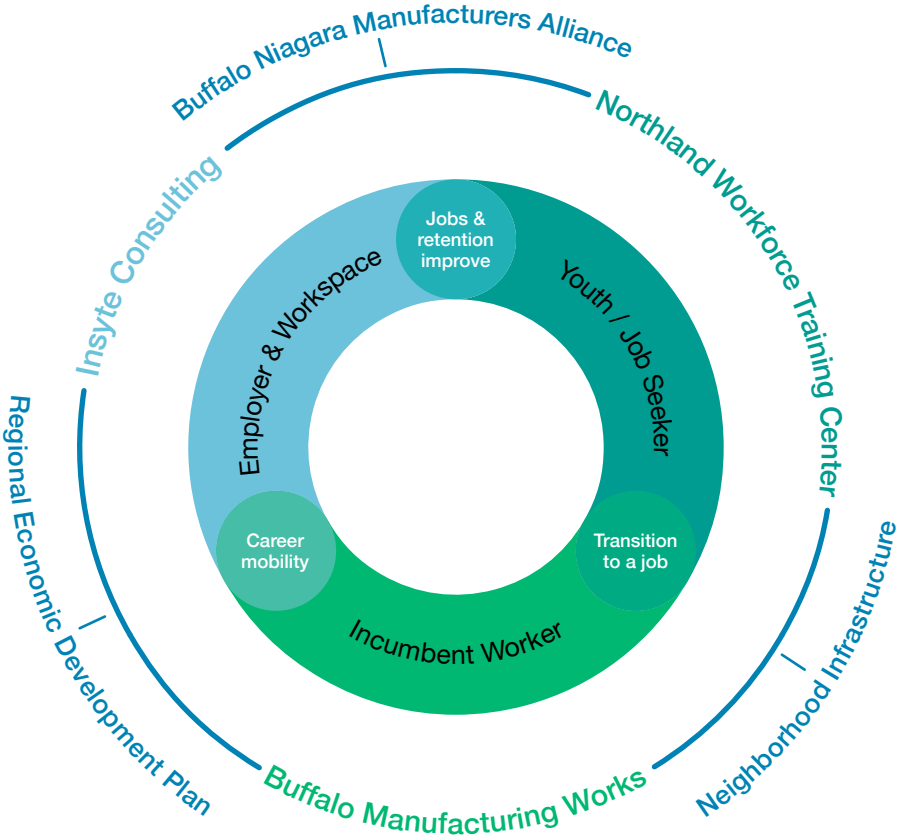


FIGURE 1: INCLUSIVE INNOVATION CYCLE

First, each institution centers a different economic actor that they design services and support around. This *centering strategy* enables partner organizations to provide a high level of tailored engagement and support to a particular manufacturing stakeholder. NWTC centers prospective entry- and mid-level advanced manufacturing workers from the East Side of Buffalo by offering credential and degree programs that create career pathways for the next generation of advanced manufacturing workers. BMW centers innovation and technology adoption within advanced manufacturing firms, and provides incumbent worker training programs that emphasize investments in technology and workforce as two sides of the same coin. Insyte Consulting centers smaller sized manufacturers, supporting holistic business strategy improvements that allow the entire firm to benefit from coordinated investments in technology and workforce development.

Their *visioning strategy* uses low-stakes experiential processes to help workers and businesses alike see a future for themselves in advanced manufacturing. This strategy engages the community through programs in middle and high schools that create opportunities to see production floors and learn advanced manufacturing skills in after-school programs or summer internships. Further, NWTC organizes site visits and networking events to bring students to manufacturers, while BMW brings manufacturers to NWTC's contract manufacturing enterprise to showcase the newest technologies. These experiential spaces and programming allow people to understand what it would be like to invest in learning new skills or technologies, but in a way that is not risky. Further, it creates opportunities for prospective workers to learn from existing workers, and manufacturers considering purchasing new technologies to learn from firms that have already implemented them.

A *bridging strategy* reflects how the partners establish clear linkages and transitions between their respective areas of expertise, while also working to garner collective resources and advance a common vision of regional economic inclusion and resilience. Bridging activities can be as simple as co-locating in the same business park and sharing financial resources, but also includes co-creating programs that respond to the evolving needs and capabilities of the network, and incorporating additional partners with the help of an overarching economic development plan.

These reinforcing strategies come together to provide important lessons for how institutions create an *inclusive innovation cycle*. While each partner organization centers a particular stakeholder group, they contribute to a more holistic system which is embedded in additional community resources and feedback loops. The bridging between partners creates ramps for workers to progress from new entrants to incumbent workers in companies that increasingly recognize workforce as an essential part of innovation and technology strategies

that enhance productivity and product quality. Partners come together to improve workplaces and worker retention overall, which can be used to recruit more new employees to the industry.

This work is still in early development, with some of the organizations operating for two years or less. Experimentation around new programming and institutional bridging is ongoing. But that also means new lessons will emerge from Buffalo's East Side in years to come, thus creating the possibility for other regions to continue to learn from them as well.

Urban Manufacturing Alliance

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ENDNOTES

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