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DECEMBER 2022

SKILLS DEVELOPMENT FOR INNOVATION AND GROWTH:

Insights from global initiatives

SHIFT insights

The Future Skills Centre (FSC) is a forward-thinking centre for research and collaboration dedicated to preparing Canadians for employment success. We believe Canadians should feel confident about the skills they have to succeed in a changing workforce. As a pan-Canadian community, we are collaborating to rigorously identify, test, measure, and share innovative approaches to assessing and developing the skills Canadians need to thrive in the days and years ahead. The Future Skills Centre was founded by a consortium whose members are Toronto Metropolitan University, Blueprint ADE, and The Conference Board of Canada, and is funded by the Government of Canada's Future Skills Program.

Shift Insights is a research and policy shop focused on the social, economic and technological challenges and opportunities facing Canada. We provide timely research and advice to enhance understanding and improve decision-making across a wide range of policy and strategy prioritie

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Skills development for innovation and growth: Insights from global initiatives is funded by the Government of Canada's Future Skills Program.

The opinions and interpretations in this publication are those of the author and do not necessarily reflect those of the Government of Canada.

Publication Date:
December 2022

Win-win: Boosting worker skills and regional economic sectors

In Canada, we often hear about a double dilemma: Firms want to innovate and grow but they struggle to find workers with the right skills and knowledge. Meanwhile, workers face challenges in finding and participating in education and training initiatives that would help them develop skills and knowledge.

This new report explores the skills for innovation from a broad perspective, focusing on skills development initiatives that aim to improve opportunities for workers and support innovation and growth in regional economic sectors. It examines three case studies – two in the United States and one in Europe – in specific sectors and regions that are tackling these twin challenges for workers and employers.

This is increasingly important work as economies continue to transform as a result of technological (and other) changes. The authors provide an in-depth look at the challenges and opportunities of sector-based and regionally-relevant opportunities, revealing that it's possible to create win-win scenarios based on trust between workers, workforce intermediaries, and employers. In particular, it sheds light on the importance of building trust, and how important that trust is to bringing about better outcomes for equity-seeking groups.

At the Future Skills Centre (FSC), we are committed to providing practical labour market information and responsive career pathways. This research will help FSC, together with our valued partners, to strengthen the country's skills development ecosystem and equip Canadians with the skills, knowledge and tools they need to thrive in the future.

Samir Khan
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Insights from international case studies

Summary

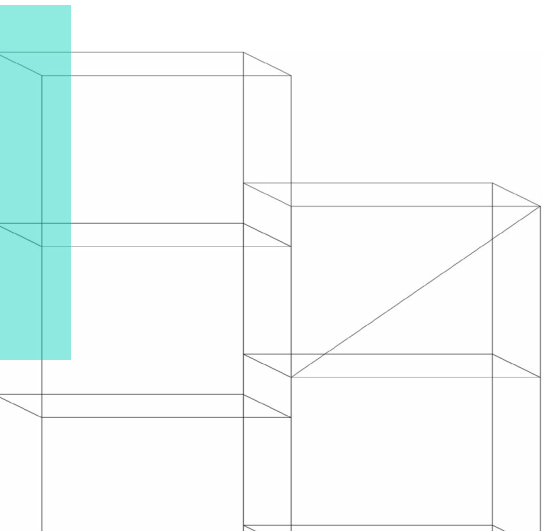
This report shares insights from three regionally-focused, sector-specific skills development initiatives that aim to equip people with the skills needed to contribute to innovation and growth.

Manufacturing Connect in Chicago and Project QUEST in San Antonio are long-running programs that prepare unemployed or underemployed workers for occupations in manufacturing, health care, and technology. MATES is focused on designing skills development pilot projects in the shipbuilding and offshore renewable energy sectors across the European Union informed by a multi-faceted economic and labour market analysis.

The case studies reveal that well-designed initiatives can improve the skills and well-being of workers and the strength and growth of dynamic regional economic sectors if they:

- focus on ***sector- and regionally-relevant opportunities***;
- conduct ***robust economic trend analysis focused on innovation and growth opportunities***;
- develop and draw on ***strong relationships*** among employers, training institutions, government agencies and not-for-profit agencies;
- establish a ***well-resourced intermediary organization*** that leads and manages the initiative and coordinates stakeholders; and
- provide ***substantial resources and wrap-around support for trainees*** to complete training while managing other aspects of their lives, including housing, childcare, transportation, and forgone income while in training.

This briefing discusses six key insights that emerge from the analysis. In-depth case studies on the three initiatives are included as appendices.



Introduction

Canada's innovation economy faces a dual challenge. Firms that want to innovate and grow often struggle to find workers with the right skills and knowledge, while many workers have difficulty finding and participating in education and training initiatives that would help them develop the skills and knowledge they need. Some firms address the challenge by working with training institutions to reskill their current workforce or develop programs to ensure that new hires have relevant skills and knowledge. Yet, too few pursue this strategy. Moreover, many conventional skills development and retraining initiatives struggle to align the needs of innovating firms and sectors with those of workers.[1] The result is missed opportunities and foregone growth in the innovation economy.

Many conventional skills development and retraining initiatives struggle to align the needs of innovating firms and sectors with those of workers.

Globally, there are examples of training programs that manage to address both sides of the challenge. Consortia of businesses, labour organizations, training providers, and post-secondary institutions in different regions and sectors have launched initiatives to connect and prepare job-seeking workers with unmet regional, sector-specific demand. Some of these initiatives - such as North Carolina's well-studied BioWork model - have generated substantial opportunities for firms and workers alike.[2] But there are models in other regions and sectors from which more can be learned. This report and accompanying case studies share insights from three skills for innovation training initiatives which can inform the design and operation of models in Canada.

As this briefing and the case studies reveal, well-designed and operated skills for innovation initiatives can improve the skills and well-being of workers and the strength and growth of dynamic regional economic sectors. How well they do that depends on:

- sector- and regionally-relevant design;
- robust economic trend analysis focused on innovation and growth opportunities;
- strong relationships among employers, training institutions, government agencies and not-for-profit agencies;
- a well-resourced intermediary organization that leads and manages the initiative and coordinates stakeholders; and
- substantial resources and support for trainees and workers to pursue and complete training and manage other aspects of their lives, including housing, childcare, transportation, and forgone income while in training.

Successful skills for innovation initiatives are highly attentive to the realities of the regional economies in which partner sectors and firms operate, and to the whole life experience of workers and trainees. They are deeply embedded in regional economic and social networks and provide much more support to participants than conventional training initiatives tend to offer.

Cases and approach

This report and accompanying case studies focus on three skills development initiatives that aim to improve opportunities for workers and support innovation and growth in regional economic sectors. The stand-alone case studies are included as appendices. This introductory briefing synthesizes and draws out insights from the cases to inform regional, sector-specific skills strategies and initiatives for innovation and growth in Canada.

Two initiatives - Manufacturing Connect in Chicago, and Project QUEST in San Antonio - are long-running programs that prepare unemployed or underemployed workers for occupations in manufacturing, health care, and technology. A relatively new initiative from the European Union - MATES - provides lessons about collecting and using skills intelligence and developing partner-driven pilot projects in the shipbuilding and offshore renewable energy sectors.

- **Project QUEST** in San Antonio, Texas, provides support to low-income adults to earn post-secondary credentials and access well-paying jobs in growing sectors of the local economy - namely, healthcare, advanced manufacturing, and information technology. It uses an industry-engaged process to identify high-demand occupations and skills requirements and facilitates training for candidate workers with substantial wrap-around services - including, financial assistance for tuition and training materials; counseling; referrals for assistance with bills, childcare, food, and transportation; weekly meetings and case management; and job placement assistance. Project QUEST has had substantial positive impacts on employment and income, with participants cumulatively earning, on average, $31,395 USD more than a control group of those who do not complete the program ten years after completing the program.

- **Manufacturing Connect** is a Chicago-based initiative that encourages and supports youth from low-income neighbourhoods to pursue training and careers in applied engineering and manufacturing through a tailored curriculum. The initiative works with over 100 small and medium-sized regional manufacturers to identify skills needs, design curriculum, and offer work-based learning experiences. Program instructors, trained in social work, focus on each student's background, life circumstances, interests, and challenges, and enlist dozens of social service agencies to provide participants with resources and support throughout the program and into employment.

  From 2011 to 2021, more than 60% of participants earned credentials recognized by manufacturing employers; a quarter found employment in local manufacturing; and others pursued university and college pathways after completing the program. For their part, local firms have reinforced interest in and skills for manufacturing and have learned concrete strategies to be more inclusive and supportive employers for primarily Black, low-income workers - all of which contribute to better long-term.

- **MATES** (Maritime Alliance for fostering the European Blue Economy through a Marine Technology Skilling Strategy) is a multi-country European initiative launched to develop a skills strategy for the shipbuilding and offshore renewable energy industries - industries that are adopting digital and green technologies at an accelerating pace and need new and advanced skills to support innovation and growth. MATES brings together leaders and experts in industry, academia, education and training institutions to understand industry trends, identify skills shortages, and develop and study pilot projects focused on addressing industry needs. Through a rigorous, mixed-methods approach, MATES conducted a detailed analysis of sector-specific economic trends to inform the development of training programs and recruitment strategies.

  As a relatively new initiative, MATES is in the early stages of designing, delivering and learning from pilot training programs and little is known about their impact. However, the initiative offers valuable insights about what to do - and what not to do - when conducting quantitative and qualitative analyses of skills needs, and working with partners across sectors and countries.

Approach

Each case study offers a rich account of the motivations, activities and results generated from the three initiatives and distills lessons that may be helpful in the Canadian context. To generate the case study reports, we conducted a comprehensive review of relevant literature and documents about the origin, design, operation and results of the program; collected and analyzed data about inputs, outputs, and associated results; and conducted semi-structured interviews with key individuals and organizations to help contextualize and further enrich understanding of the design, operation and impact of each case.

We then examined the three cases together to identify common themes and noteworthy differences, considered these alongside the results produced in each case, and assessed the extent to which features and activities might explain good - and bad - results. The analysis generated the key insights below.

Key insights

The case studies revealed a number of similarities and differences with respect to motivation, context, design, activities, challenges, strategies and results. Our analysis reveals some features and activities associated with success - and some associated with ongoing challenges - that provide lessons for designing successful initiatives elsewhere.

Insight 1: Skills strategies support innovation and growth in different ways

Innovation and growth in both existing and emerging regional industrial sectors depends on firms having access to sufficient highly-skilled workers who can fill a variety of roles. While a skills strategy alone will not spur innovation and growth, it is an important ingredient for regional economic success, and especially for regions and sectors in transition. The skills for innovation initiatives we examined contribute to regional innovation and growth in different ways, to different extents, and at different stages of regional economic development:

- Project QUEST's skills development initiatives are tied to regionally important and growing sectors - namely, advanced manufacturing, healthcare, and information technology. By contributing to skills development of workers who might otherwise face under- or unemployment in San Antonio, and directly tying the content and pathways of skills development to growing sectors, Project Quest anticipated and helped facilitate the growth of these sectors in the region, filling 8,418 full-time equivalent positions from 1993 to 2016, and generating an overall economic impact of $523 million for the San Antonio economy.[3] [4]

- Chicago's Manufacturing Connect plays a different role. As manufacturing in the Chicago region was on the decline, Manufacturing Connect helped develop a skills pipeline for struggling SME manufacturers thereby addressing one of their key challenges. In doing so, Manufacturing Connect helped these manufacturing firms sustain operations, stay in the region, and provide good jobs to Chicago workers who might otherwise be under- or unemployed. Manufacturing Connect's efforts did not so much spur innovation and growth in the manufacturing sector as it helped firms stay in business in order to begin to explore new and different ways of operating.

- Finally, MATES is directly focused on identifying skills needs and developing skill strategies to help the shipbuilding and offshore renewable energy sectors become more innovative. Both sectors have experienced substantial technological change and the offshore renewable energy sector in particular is engaged in constant research, development and innovation activities - all of which require advanced skills that are in short supply. While MATES' activities have so far had only a small impact on skills supply, their assessment of sector needs has identified the skills required to support innovation over the medium to long term.

The upshot is that there is an important role for skills initiatives to play in regional economies and innovation - whether to anticipate and provide support to growing sectors, actively drive technological change and innovation in legacy and emerging sectors, or help sectors in transition find new ways to survive and compete. Notably, all three initiatives focus on sectors with a future - some rosier than others, to be sure - but sectors where broader economic trends and changes offer opportunities for firms and workers alike.

Insight 2: Economic analysis should serve program design

Skills for innovation initiatives appear to be most effective when they focus on what labour markets and employers need. Many skills and job training programs are supply-push models built on the assumption, from human-capital theory, that once an individual has acquired specific skills they will be able to secure a job.[5] In practice, supply-push models often fail to connect with and respond to evolving labour market and employer needs. At the same time, building programs around what employers say they need, without taking a broader look at regional economic trends and drivers, can leave workers and firms ill-prepared for the future. Careful and critical assessments of what regional labour markets need to innovate and grow - both now and in the future - are essential to program success.

All three initiatives examined here began with an examination of economic conditions in key sectors to determine where the sectors might be headed, what jobs were in demand, and what skills and competencies are required to perform these jobs. The analyses varied in approach and intensity - from moderately resourced, continuous assessments in the Manufacturing Connect and Project QUEST cases, to a highly-resourced multi-stage, multi-year, European-wide research program in the MATES case. All three started their assessments with aggregate statistics, but enriched understanding through engagements with employers and industry associations to validate and generate additional observations.

MATES' analysis was much better resourced than Manufacturing Connect and Project QUEST, but this might have contributed to a drift away from analysis that served program design. Analysts with MATES - largely from academia - generated reports that could have, but did not always explicitly, draw out the implications for design. By contrast, with limited resources for formal analysis beyond an initial report, Manufacturing Connect and Project QUEST supplemented their understanding of skills needs through ongoing, regular interactions with employers and used that to inform program design and revision in real-time.

Insight 3: Have a narrow regional and sector-specific focus

Skills for innovation initiatives appear to be most successful when they are focused narrowly and strategically on just one or two sectors in a relatively small regional or local economic geography. While monitoring and responding to national and global economic realities is important, successful initiatives put their best efforts into helping a manageable number of people and firms in sectors and regions they understand.

Initiatives appear to be most successful when they are focused narrowly and strategically on just one or two sectors in a relatively small regional or local economic geography.

Like BioWork's focus on the biotechnology industry in the North Carolina region, Manufacturing Connect focuses on manufacturing in Chicago and Project QUEST focuses on healthcare, manufacturing, and information technology in the San Antonio region. A narrower region- and sector-specific focus means program leaders are operating on a scale that enables them to build the strong partnerships and networks necessary to stay abreast of, and respond to evolving skills demands, offer meaningful and effective work-integrated learning opportunities, collaborate with other social service providers, and develop pathways to employment that benefit trainees and local firms.

With its narrow focus on manufacturing in Chicago, Manufacturing Connect developed relationships and information channels that delivered critical insight into the specific kinds of technologies being used - and thus skills needed - by local manufacturing SMEs that could not have been gained through higher-level analysis and aggregate statistics. This allowed them to incorporate this equipment into their machine shop and tailor skills training according to the needs of local manufacturers. Moreover, Manufacturing Connect's local focus facilitated the emergence of trusting relationships which have allowed for difficult conversations and constructive engagement with primarily white employers to address racism and racist barriers that impede the success of primarily Black trainees and new employees.

By contrast, a broad focus on multiple sectors and large regions may impair opportunities to gather granular, practically relevant labour market intelligence and can make the design and operation of skills development initiatives more challenging. For example, MATES was tasked with developing insights and pilot programs that cover two industries across multiple countries in the European Union. While numerous employers were invited to contribute to and validate the skills intelligence findings, a high-level EU focus meant that granular insights on employer skills needs and strong operation-level relationships were not likely to emerge.

Insight 4: Build and draw on strong relationships among regional actors

Building and leveraging strong relationships among regional actors and institutions is essential to success. In all three cases, the program organization and staff serve as connectors and intermediaries, bringing together and building partnerships among employers, training providers, social service agencies and others. While each stakeholder has its own interests and institutional goals, connecting them and facilitating collaboration generates benefits that exceed the sum of the parts. The relationships and associated communication contribute to better understanding of economic trends and skills needs; more concrete opportunities for participants to pursue work-integrated learning and land good jobs when finished training; and more resources and support for learners and the training programs themselves. Engagement with educational and training institutions is obviously important, as is ongoing communication with governments who are often key funders of initiatives. Yet, success appears to depend critically on how well skills intermediaries can generate and nurture relationships with employers and local social service agencies:

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- **Relationships with employers.** Ongoing engagement with employers generates nuanced insight into economic and technological trends and, as a result, a clearer picture of local skills needs. This helps to focus training on areas where there is existing or emerging need and thus concrete employment opportunities for those who complete training. Employer partners also contribute to the design and execution of the skills training itself - ensuring that participants acquire skills and knowledge that are practically relevant and prepare them for immediate employment. Employers engaged by Manufacturing Connect in Chicago, for example, helped to design an industry-ready training facility and provided a variety of work-integrated learning experiences, from plant tours to formal internships. As noted above, strong functional and trusting relationships with employers can also make it easier to address difficult issues, such as racism in hiring and workplace culture. When criticism and guidance come from a trusted partner, employers are more likely to take action, as many did in Chicago.

- **Relationships with social service agencies** are important in the Manufacturing Connect and Project QUEST initiatives. While both programs aim to provide full wrap-around support for participants - including financial support for tuition, transportation, housing, food, and childcare; counseling and psychological services; and education and training itself - neither has sufficient internal resources to provide all these services. To ensure that participants receive what they need to successfully complete their programs and launch better careers, Manufacturing Connect and Project QUEST work with local social service agencies to provide or locate necessary support.

Insight 5: Provide robust wrap-around, whole-of-life support to trainees

Skills training programs are only effective if participants finish. But many face substantial barriers to completion that have nothing to do with their desire or the curriculum. Participants may be unable to attend and complete training due to challenges with tuition and other educational costs, transportation, childcare, housing, food and mental well-being. Finding ways to help participants overcome these challenges is just as important as delivering training itself.

> Skills training programs are only effective if participants finish.

Both Project QUEST and Manufacturing Connect designed their programs with a view to meeting the complex needs of the low-income, underserved, and racialized learners with whom they work. Considerable attention is paid to identifying and providing wraparound support to help people overcome financial, academic, and emotional barriers that might otherwise prevent them from successfully completing training. Program staff meet regularly with participants to identify and develop plans to address their needs. In many cases, program staff draw on carefully maintained networks of local social service agencies to provide support in line with the plans developed for participants.

- Project QUEST, for example, provides direct financial support for tuition and other training expenses (such as books, equipment and uniforms) as well as licensing exam fees, transportation, utilities, and medical- and child-care expenses. It also coordinates and enlists social service agencies to help with other expenses and psychological support for participants.

- Manufacturing Connect provides similar support and goes a step further by working with employers to make workplaces more welcoming to program graduates - including removing racist barriers to recruitment and retention. Additionally, Manufacturing Connect has developed a peer support group to help graduates navigate some of the professional and personal challenges that affect their career success. As one interviewee observed, “the easy part is getting these youth a job; the hard part is keeping them in the job.”

Insight 6: Have a well-resourced intermediary organization

As successful initiatives require substantial network building and coordination, having an organization dedicated to leading and managing - and ensuring that it has sufficient resources - is essential. A successful intermediary is focused as much on connecting the various participants and organizations in regional economies to generate mutual benefits as it is on providing or coordinating training. Intermediaries are well-positioned to take a supportive, but critical view, of what employers and workers need in regional economies, motivate existing organizations to change how they operate to benefit learners and employers, and coordinate resource identification and allocation to ensure program success. They are champions and facilitators of relevant training and wrap-around support even when they do not directly provide the training and support themselves.

Interestingly, while intermediaries often face unstable and unpredictable funding and resource streams - which is partly a function of their tendency to remain small and regionally-focused - solving the resource challenge by scaling and gaining operational efficiencies could be a solution worse than the problem. Growing an intermediary organization beyond a certain size risks undermining its ability to develop and maintain strong personal relationships with employers, training organizations and social service agencies. As noted above, Chicago employers' trust of Manufacturing Connect staff allowed for difficult conversations about racist employment practices to take place. It's not clear that a larger intermediary with thousands, rather than hundreds, of partner organizations could have developed those kinds of relationships.

Growing an intermediary beyond a certain size risks undermining its ability to maintain strong personal relationships with employers, training organizations and social service agencies.

While MATES is still in its early years, it may provide a cautionary tale against scaling intermediary organizations to solve other problems. With a focus on 17 countries in two sub-sectors, MATES faces a constituency of thousands of employers and tens of thousands of trainees and workers. While operating at that scale has enabled it to attract stable and substantial resources, it has not developed the kinds of relationships with employers or workers that one sees with Manufacturing Connect and Project QUEST. Those kinds of relationships will likely have to emerge at the pilot program level in local economies, rather than at the European-wide level.

Skills for innovation intermediaries: Next steps

The three skills for innovation initiatives examined here provide useful lessons. Sector- and regionally focused initiatives that incorporate demand-side trends and insights into program design, and focus on the whole-life needs of participants, can generate substantial benefits, as both the Project QUEST and Manufacturing Connect initiatives reveal. Intermediary organizations that effectively coordinate resources, build strong relationships, and support participants from enrolment to employment and beyond help provide the skilled workers needed to drive regional innovation and growth. While there are incentives to scale intermediary organizations to harness more resources and have a larger impact, the relationships required for success recommend keeping intermediaries regionally-focused small to medium-sized organizations.

Drawing firm lessons from just three initiatives is risky. Each case has unique features and context which might explain as much of its performance as the decisions and behaviour of those involved. But by examining fewer initiatives in depth, as we have done here, we uncover insights from experience that can provide at least initial guidance to others. Ideally, future research will add to the inventory of skills for innovation cases allowing for additional analysis - whether to confirm or challenge existing insights, or generate new ones. In the meantime, there are many lessons that can be learned from examining the Project QUEST, Manufacturing Connect, and MATES skills for innovation initiatives profiled here.

Project Quest

Summary

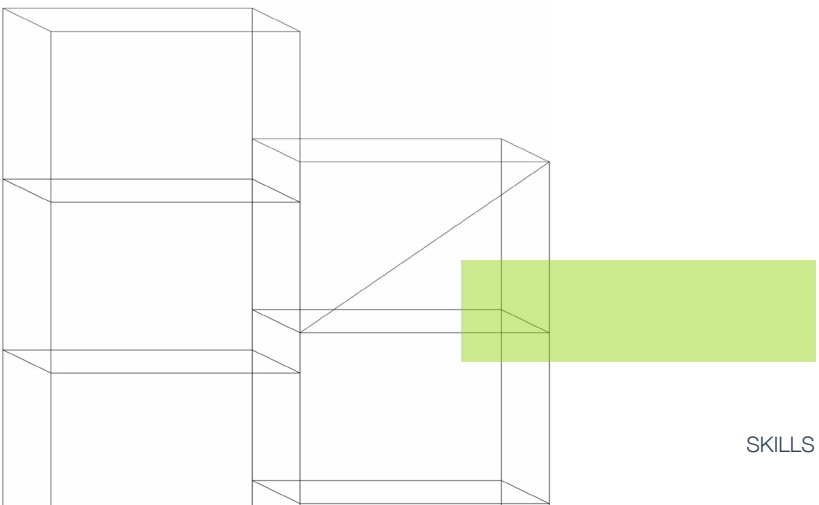
- Project QUEST is a San Antonio, TX based program that helps low-income, less-educated residents move into higher quality and better-paying jobs in growing regional sectors, including healthcare, information technology, trades and advanced manufacturing.

- The initiative is informed by an intimate understanding and ongoing analysis of labour market and economic trends in the region - ensuring that client workers move into long-term opportunities and employers have the people and skills they need to grow.

- While Project QUEST initially played a direct role in developing employer-relevant training programs and curricula, it has shifted towards a more indirect role leveraging deep partnerships with existing training institutions, such as local community colleges, and playing a mediating role between trainers, workers, and employers.

- Project QUEST provides financial assistance and robust wraparound support to help participants complete training and employment successfully. Direct financial support is provided for tuition and other training expenses (such as books, equipment and uniforms), licensing exam fees, transportation, utilities, and medical- and child-care. Additional support is facilitated through partner agencies that help with food, bills, and individual and group counseling to help participants overcome myriad challenges.

- Project QUEST has had positive and substantial impacts on employment and income. Ten years after completing the program, participants have earned, on average, $31,395 USD more than a control group of those who do not complete the program.



Overview

Project QUEST was designed as a two-year skills development demonstration project funded by the city of San Antonio as well as state and federal agencies. Its initial goal was to train 600 individuals for higher quality, higher paying jobs in growing regional industries and function as a pilot to test whether a larger skills training program could be designed to simultaneously benefit employers, participants and funders. Nearly thirty years later, Project QUEST has served over 8,200 people and has clearly demonstrated its value.[6]

QUEST focuses on three primary areas where there is a strong local demand for skilled labour: healthcare, information technology, trades and advanced manufacturing, although the vast majority of participants (over 80 percent) enter the healthcare stream, many becoming registered nurses. Programs run from 1 to 3 years[7] and typically focus on people who are older than traditional students; unemployed or underemployed; meet federal poverty guidelines; and/or are on public assistance.[8] [9]Most Project QUEST clients are women (75 percent) and Hispanic (61 percent), with a large share of single parents (34 percent).[10]

> These are not the kids coming out of school looking for a job. These are people looking for a second chance.

As Project QUEST president, David Zamiello, puts it “These are not the kids coming out of school looking for a job. These are people looking for a second chance.”[11] A randomized controlled-trial study conducted with Project QUEST graduates over an eleven year period after graduation showed that participants in the program have earned, on average, $31,395 (2019 $USD) more than the control group over the period. Those who earned a health-care certification saw their annual earnings quadruple over the eleven years after the study, reaching an annual average of nearly $50,000 (2019 $USD).[12]

Motivation and context

In 1990, Levi Strauss closed its San Antonio factory, displacing 1,000 workers - the latest in a regional trend of manufacturers closing shop leaving fewer well-paying jobs available for people without higher levels of education. In 1990, due to the economic downturn at the time, the unemployment rate in San Antonio reached a high for the decade, hovering around 7 percent – these levels were only seen again in the city during the great recession.[13]

To understand and address the challenge, two community organizations - the Communities Organized for Public Service (COPS) and the Metro Alliance - launched a careful examination of local economic trends. Despite the apparent trend in manufacturing closures, and contrary to popular public narratives at the time, the organizations found that job creation was surpassing job loss in the region as a whole, with many new jobs commanding high salaries.[14]

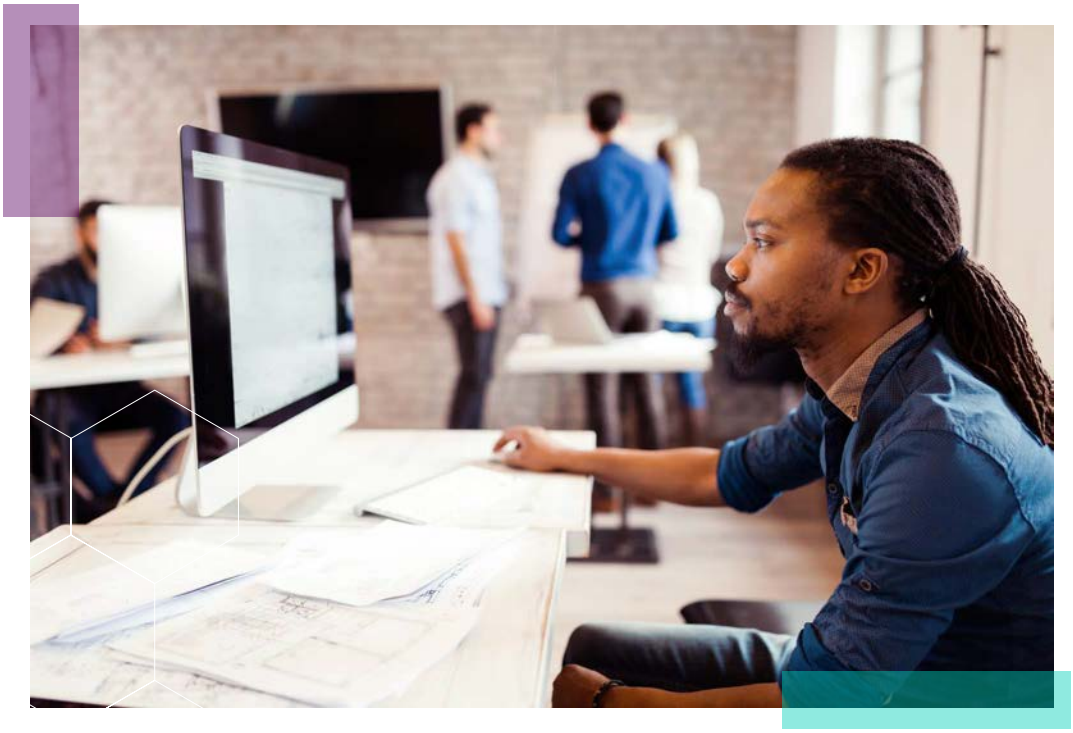
Communities Organized for Public Service (COPS) and the Metro Alliance

COPS and the Metro Alliance are a coalition of faith-based congregations, schools and unions that build local partnerships to address local community needs. COPS and Metro Alliance are a part of the Industrial Areas Foundation (IAF) network. The IAF is a network of local faith-based and community-based organizations, helping them to develop structures to engage in broad-based organizing projects and citizen-led action. In 1974, COPS became the first IAF member in the SouthWest network. The Metro Alliance formed in 1984, through a merger of two other IAF organizations – East-Side Alliance and the Metropolitan Congretional Alliance, which were both composed of various Black and Hispanic low- and middle-income churches. Today, COPS and the Metro Alliance share many resources and work collaboratively on many community projects.This includes, securing $15.6 million in city funding for after-school programs since 1992, directing $25 million in federal infrastructure funding to street, drainage and housing needs in critical neighbourhoods in the city, and working with city, county, hospital and school districts to require living wages to be paid to all employees.[15]

Still, while new jobs were emerging, a number of barriers were preventing those people who had been displaced from other industries from acquiring them, the organizations' study revealed. COPS and Metro Alliance conducted extensive interviews with hundreds of people in the region and learned that many people lacked the time, information, and financial resources to pursue the training required to take on one of the emerging jobs. Many interviewees spoke of poor experiences with past jobs training programs, which were both prohibitively expensive and often failed to connect them with gainful employment.[16] COPS and Metro Alliance concluded that a successful jobs training program - which would later become Project QUEST - needed to built around four key principles:

1. Training should be tied strongly local employer demands;
2. Training should be targeted exclusively at careers that offer good pay and advancement opportunities;
3. Participants should have access to intensive support services to help them overcome financial and personal barriers to pursuing training and better employment;
4. Existing community skills training resources and support services should be leveraged to contribute to success.[17]

QUEST initially formed a partnership with Alamo Community College District (ACCD) to provide the training component of their program. The relationship was mutually beneficial: QUEST needed training infrastructure and the ACCD was under pressure to be more responsive to the needs of the local community. Project QUEST worked with the ACCD to develop training standards that met the needs of local employers, which included revamping curricula based on employer feedback. Over time, Project QUEST's direct role in curriculum design has diminished, but its influence remains: The ACCD remains in contact with employers and responsive to their needs.[18]



Design and activities

Project QUEST's model is built on a robust understanding of local economic and employment trends, the needs and opportunities facing prospective employees in the region, and a commitment to making training and employment services work for both participants and regional employers. All of that requires sophisticated and ongoing economic research, and generating and nurturing relationships with regional employers, educational and training institutions, service organizations, labour and workers. The design and activities of Project QUEST over more than two decades reflect these commitments.

Trend identification and analysis

At the foundation of all Project QUEST programming are comprehensive analyses and intimate understandings of local labour market and industry-specific employment trends, which has directly informed their current focus on healthcare, advanced manufacturing, and information technology. Occupational analysts monitor economic and employment trends and their observations inform the industrial and occupational focus of subsequent Project QUEST programming.[19] Project QUEST also benefits from having many staff who are involved in different committees, local chambers of commerce, and state and nationwide research organizations. These organizations also provide Project QUEST with local, state and national economic trends and forecasts to help guide programming. But critically, these insights are always supplemented by feedback from local employers.

Project QUEST analyses also adds value for employers by developing and sharing insights about the factors driving change, occupational and industrial trends, and local market trends in labour supply and demand.[20] In short, Project QUEST uses data and analysis to ensure that training and employment programs contribute to good employment opportunities for workers and to regional innovation and growth.

Comprehensive intake to identify and support vulnerable workers

Project QUEST focuses on workers who are often overlooked by employers but who, with the right training and support, can make valuable contributions to innovation and growth. To identify qualified candidates, QUEST conducts an intensive intake process. In general, applicants must be unemployed or underemployed residents of the San Antonio region seeking occupational training and willing to commit to an 18 month program. They must be at least 18 years of age and in possession of a highschool diploma/GED, but have less than a bachelor's degree.[21] With a pool of qualified candidates identified, Project QUEST's intake process shifts to introducing the program to participants, and determining eligibility for and tailoring supports to meet participants' specific needs and interests. The process has six steps:

1. ***Orientation:*** Prospective participants are required to attend an orientation session that provides an overview of the program, its requirements and expectations.

2. ***Application:*** Prospective participants then submit a formal application outlining their education and employment history, as well as details about their current family circumstances. They are asked to write an essay about their potential career trajectory, and take reading and math assessment tests. Using all of the information, counsellors determine whether a particular candidate is ready for Project QUEST, or needs additional skills upgrading, or simply isn't able to participate for a variety of personal reasons. Project QUEST tries not to outright reject people from the program, instead will steer them towards partner organizations, or their own internal skills upgrading curriculum, to make sure they are prepared for the program.

3. ***Career and college testing:*** Continuing candidates complete a career aptitude test to identify their skills, goals, and interests with a view to tailoring the program to their specific needs and interests. Candidates also take a college placement test to identify remedial education and training needs.

4. ***Academic and financial planning:*** A counsellor works directly with each candidate to map an appropriate educational journey - including courses and timelines - and to prepare a financial plan and budget to support them through the journey. Together, the candidate and counsellor identify challenges and barriers they may need to overcome to complete the program.

5. ***Submit documentation:*** Candidates submit documentation as proof of income and family size to assess eligibility for funding.

6. ***Final intake interview:*** In the final intake stage, candidates attend an interview with Project QUEST senior staff to review the results of their tests, their academic and financial plans, and other documentation. Following the interview, senior staff decide whether a candidate is suitable for and accepted into the program, determined largely by commitment, whether Project QUEST is the right vehicle to help them on their career trajectory (i.e. do they want to enter a field that Project QUEST doesn't work in), and do they meet the basic prerequisites required for various programs (i.e. reading and math scores, highschool diploma etc.).[22]

Basic and occupational training

For most participants, training begins with a program focused on specific occupational requirements and paths. For some, however, Project QUEST also offers basic skills instruction - QUEST Prep - in math and reading to ensure that participants have sufficient levels of literacy and numeracy to pass college placement exams. QUEST Prep classes are provided to participants free-of-charge and run for 25 hours per week.[23]

For those who pass the placement exams - with or without QUEST Prep support - training tends to focus on one to three year occupational certificate programs delivered by a local community college or professional training institute, such as a professional nursing certification.[24]

In its early days, Project QUEST played a much more hands-on role in curriculum design to ensure that it would produce graduates with skills and knowledge that fit regional employer needs. For example, after examining local labour market dynamics, Project QUEST analysts found strong local demand for diesel mechanics that employers could meet only by recruiting people from outside of the region. At the same time, a local community college was in the process of closing its diesel mechanic course. There was a clear opportunity that the college and employers were missing. Project QUEST brought the college and relevant local employers together to redesign the diesel mechanic curriculum to meet employers' specific skills and knowledge needs. The result was a pipeline of employment-ready graduates to fill regional employers' occupational needs. [25]

Over time, as Project QUEST has built an ecosystem around itself, with educators and employers in the mix, this role requires a less hands-on approach. While Project QUEST staff often broker relationships between educators and employers regarding evolving skills demands, these conversations often occur more naturally, sometimes without Project QUEST staff even needing to intervene.[26]

Wrap-around supports and services

Project QUEST recognizes that barriers to training and job placement are not related to skills and knowledge alone, but include financial, personal, motivational and other challenges which are often ignored by conventional programs. Along with community partners, Project QUEST provides or organizes a variety of supports to ensure all qualified participants are well-positioned to pursue and succeed in their training. This includes:

Barriers to training and job placement are not related to skills and knowledge alone, but include financial, personal, motivational and other challenges which are often ignored by conventional programs.

1. ***Financial Support.*** Project QUEST provides financial resources to participants to cover training tuition and fees. Participants receive support to cover all academic expenses for the first year, and half in subsequent years. Project QUEST also covers other expenses, such as books, equipment and uniforms, licensing exams, transportation, utilities, medical and childcare. Where its own resources are insufficient, Project QUEST refers participants to outside agencies to help with other basic needs such as housing costs, bills and food.[27] Client services staff at Project QUEST are dedicated to meeting any and all of the financial needs of participants to ensure they can complete their studies and certification.[28]

2. ***Counseling.*** Recognizing the stress that often comes with intensive training programs, as well as its impact on participants' lives more generally, Project QUEST provides a range of counseling services. Weekly "Vision, Initiative and Perseverance" (VIP) group meetings with Quest coaches help participants identify and deal with academic and other professional challenges related to basic skills training, time management, critical thinking, conflict resolution, study and test-taking, and workforce readiness. Participants also meet individually on a weekly basis with a counselor who devises custom support strategies for each participant. These sessions focus on academic advice, emotional support, and referrals to other social service agencies as needed. The counselors also advocate for participants throughout the training and job placement components of the program.[29]

Job placement assistance

Unless training programs lead to successful job placement for participants, it will lack value for workers and employers alike. As such, Project QUEST is committed to ensuring that they take participants that last mile to good quality, well-paying employment through a suite of job placement supports. In particular, Project QUEST provides individual participants with:

- application and resume building support;interview preparation and training;
- referrals to employers looking for workers; and
- access to placement specialists who work with participants months before graduation to discuss placement requirements and develop individual placement plans.[30]

In addition, employment coordinators and occupational developers maintain relationships with local employers to help place participants following graduation.[31] This includes working with local employers to achieve clarity about the specific skills, competencies, and certifications they need for a given position, while overcoming various recruitment, hiring and retention barriers facing participants.[32]

For example, a large regional electrical contractor, Bexar Electric, was having difficulty recruiting qualified electrical assistants. Project QUEST worked with Bexar and a local community college to design a customized training course and helped Bexar improve its recruitment practices. QUEST staff determined that Bexar's grade 12 reading requirement for new recruits was both prohibitive and not needed for the actual tasks of the job so it was lowered to a grade 9 comprehension level. Similarly, Project QUEST helped Bexar recognize that requiring applicants to have their own cars was a significant barrier and they removed it from their pre-screening process. Both changes have made the recruitment process better for applicants and Bexar alike.[33] Given that most Project QUEST participants go into the healthcare field, they also maintain strong relationships with hospitals and allied health providers to understand how demand for certain nurse practitioners for example is evolving.

Impact

Project QUEST has facilitated training and job placement services for more than 7,000 participants over 25 years. How effective have they been in placing people in good quality, well-paying, long-term occupations? What impact has the program had on local innovation and growth? Three robust studies of the program have been conducted which reveal some important insights. One study in particular - a randomized control trial conducted between 2006 and 2008 - is especially revealing.

Between April 2006 and October 2008, 410 individuals interested in health-care careers, but not currently attending college, participated in a study of Project QUEST's effectiveness. Study participants were from low-income households (average annual earnings of $13,323 USD in 2019 dollars). Most were women, Latino, over 25 years of age, and held only high school diplomas. All applicants went through the first few stages of the standard Project QUEST intake process, including an initial screening to determine eligibility, identification of interests and abilities, training and career pathways mapping, and design of customized academic plans. Individual budgets were also produced to understand each applicant's financial position and whether assistance would be needed to complete the program.

Of the initial 410 participants, 207 were randomly assigned to receive Project QUEST programming while the remaining 203 were placed in a control group and did not receive QUEST programming, although they could access other training and job placement assistance programs.[34] The training programs were selected to take 2 years or less to complete and, upon completion, participants were required to take a certification exam in their field.[35] The distribution of participants (both treatment and control groups) by training and career track is shown in Table 1 below.

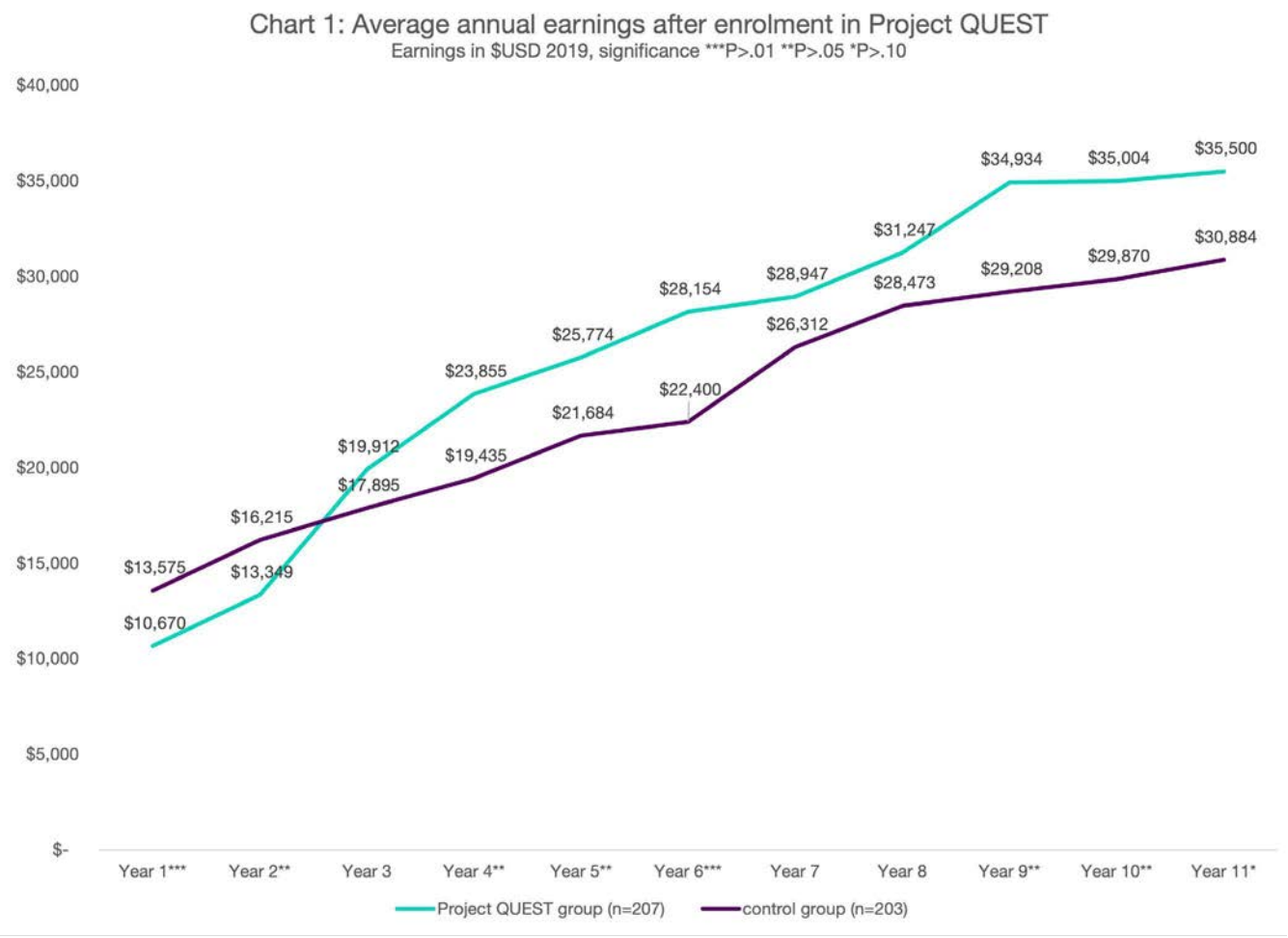
TABLE 1:
Project QUEST participants overview, 2006-2008

Career track	Participants (and % of total)	Program length and prerequisites	Certification
Licensed vocational nurse	243 (60 percent)	7-month program	Certificate level 2
Medical records coder	101 (25 percent)	1-year program 3 prerequisite classes	Continuing education certification of completion
Registered nurse	30 (7 percent)	2-year program 7 prerequisite classes	Associate of Applied Science
Radiography, respiratory therapy, and sonography technicians	26 (6 percent)	2-year program 3 prerequisite classes	Associate of Applied Science
Surgical technician	10 (2 percent)	1-year program 3 prerequisite classes	Associate of Applied Science

Roder & Elliott. (2021).

Impact on earnings

By year three following the start of the program, Project QUEST participants were earning an annual premium over those in the control group who did not participate in Project QUEST. The premium was more than $4,000 annually in more than half of the 11 years over which participants were tracked, see Chart 1. Cumulatively, participants in the Project QUEST treatment group earned, on average, $31,395 (2019 $USD) more than the control group. Those who earned a health-care certification saw their annual earnings quadruple over the eleven years after the study, reaching an annual average of nearly $50,000 (2019 $USD). The largest impact on income was for workers in the 35 to 64 age group who earned, on average, $92,000 more than the control group, of the same age, over eleven years.



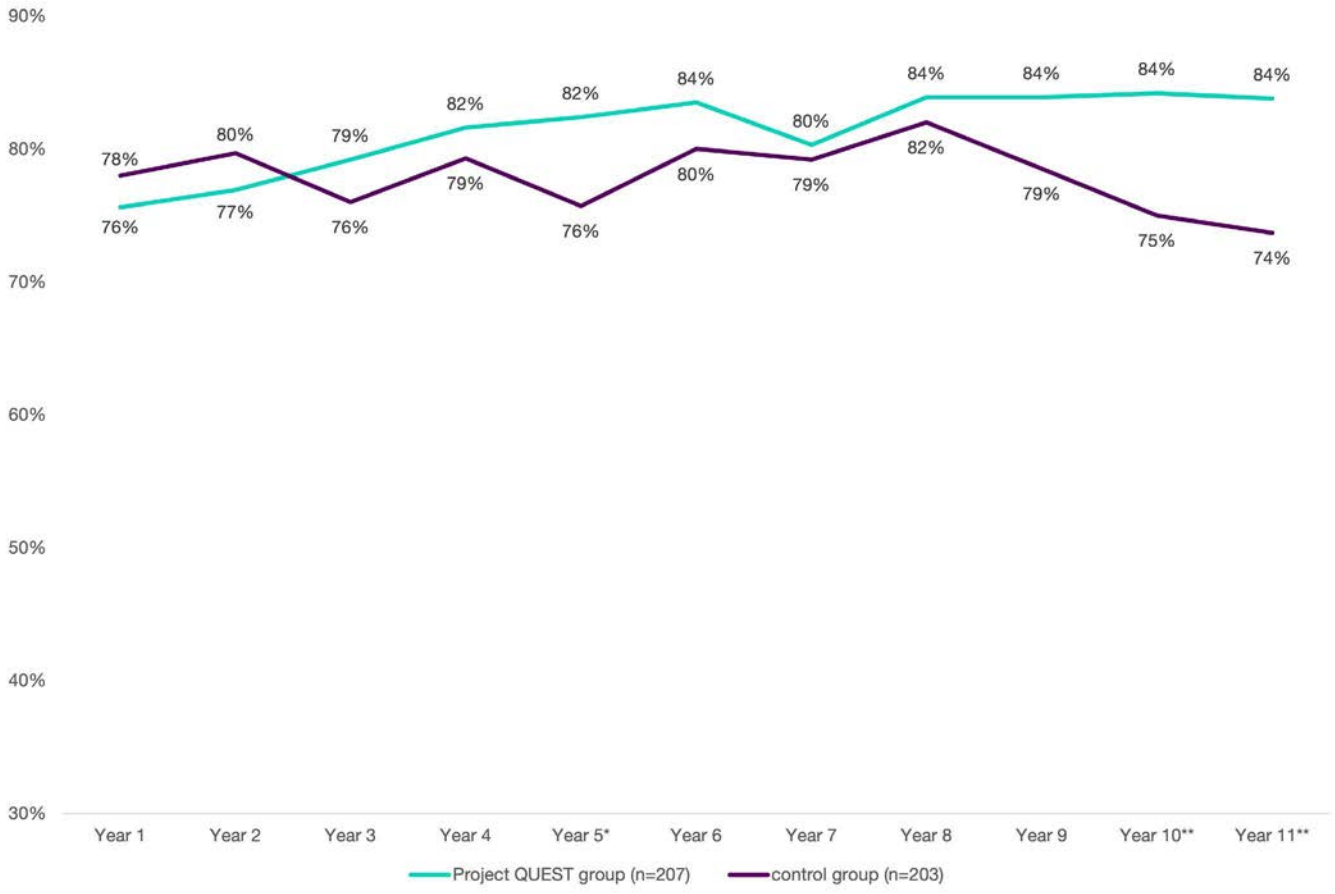
Roder & Elliott. (2021).

Impact on employment

The impact of Project QUEST on employment in general is less clear. While overall employment levels of those who went through the Project QUEST program exceeded the control group each year after year three, the differences were only statistically significant in years 10 and 11. In these two years, participation in Project QUEST increased employment levels by nine and ten percentage points, respectively (see Chart 2).

Chart 2: Proportion of study participants employed each year after Project QUEST

significance ***P>.01 **P>.05 *P>.10



Roder & Elliott. (2021).

Job relevance and job quality

While employment status can be a helpful indicator of success, it does not tell us whether people are employed in jobs related to their training. Throughout the course of the study, an average of 67.8 percent of Project QUEST participants were employed in the health-care industry - the intended sector focus of the study and participants. This is higher than the 61.6 percent of control group participants employed in healthcare, but the difference is not statistically significant. In the eleventh year, however, Project QUEST participants were 11.3 percentage points more likely to be employed in health-care than those in the control group.

In 2021, the What Works Clearing House (WWC) under the US Department of Education evaluated the existing evidence on Project QUEST. Three studies met WWC standards, including the aforementioned RCT study. Overall, they concluded that Project QUEST has a positive and statistically significant impact on industry-recognized credential, certificate, or license completion, and has potentially a positive effect on credit accumulation. However, due to the fact that only one study (aforementioned) demonstrated impact, they were unable to conclude that Project QUEST has an impact on short-, medium-, and long-term employment and earnings gains.[36]

Challenges

While Project QUEST has demonstrated positive impact over its 25 year operation, it has faced and had to overcome some key challenges - as have its participants and partners.

Financial resources and uncertainty

Project QUEST is an intensive program that requires substantial financial resources to support participants. Securing the necessary resources on a long-term, sustainable basis has proved difficult. According to a 2018 report, the average per participant cost of a Project QUEST program is roughly $10,500 USD (over an average 22 month period).[37] Staff costs account for 41 percent of the overall budget; 23 percent goes to non-tuition financial support for participants; 22 percent to tuition; and fundraising and administrative costs consume 13 percent of resources. While $10,500 seems like a reasonable investment for a return to participants of more than $30,000 in additional cumulative earnings over 10 years, the initial investment is not insubstantial for organizations that want to replicate the Project QUEST model.

Project QUEST receives between $2 and $2.5 million USD annually in foundational funding from the City of San Antonio, with the remaining $5 million budget raised through piecemeal public and private sector grants and donations - including, in previous years, $1 million grants from the Rockefeller Foundation and Chan Zuckerberg Initiative.[38] The effort and ability to secure the additional funding is substantial and costly, and has limited the number of participants the program can serve. When a federal labor department grant expired in 2019, Project QUEST was forced to serve 20 percent fewer participants than it did in 2017.[39] In a 2020 interview, Project QUEST President and CEO David Zammiello noted that “every year is a period of uncertainty. 2020 isn’t totally mapped out yet. We’re laying the tracks and running at the same time.”[40]

Adapting to regional economic trends

To stay relevant, Project QUEST has to stay abreast of growth opportunities - and areas of decline - in the local economy. This requires constant observation and analysis of changing employer needs, and an ability to quickly adapt programming to those changing needs. Project QUEST has to inform training providers and educators of new and emerging trends, and help them devise new training modules and participant supports.

As nimble as Project QUEST has been in the face of changing circumstances, many factors are out of their control. Economic downturns, such as that associated with COVID-19, can directly impact the ability to find jobs for participants as employers pause hiring. Further recovery from these downturns is also uneven, and some sectors where Project QUEST focuses efforts might not recover as quickly, or at all. While healthcare jobs are bouncing back in San Antonio, for example, manufacturing employment continues to decline, leaving Project QUEST and its partners challenged to find opportunities for participants in the short- to medium-term.[41]

Adapting to ever-changing client needs

Project QUEST is constantly adapting to the different and changing needs of its client participants. This can be a challenge for staff, as participants are often under- or unemployed, come from low-income backgrounds, and require a variety of financial, academic, emotional, or other support and resources – and these needs are constantly changing. Project QUEST staff have to maintain regular touch points with participants to identify and respond to challenges that arise. This often means forging entirely new relationships with outside organizations who can address the needs of clients. While a wrap-around, client-centered approach is at the core of what Project QUEST does and defines its success, it is labour-intensive, requires dedicated staff, and generates new challenges almost daily.

Keys to success

Despite the challenges, Project QUEST has successfully supported thousands of participants - providing training, wrap-around support, and job placement services that improve employment and earnings prospects. Two strategies have been especially helpful in contributing to that success and provide lessons for other initiatives.

Extensive and customized support for participants

The relatively high completion rates and notable impacts of Project QUEST owe much to the strong support system at the center of the program. As noted above, not only do participants receive tuition support, they are eligible for a range of additional supports and services to help with housing, transportation, food, and childcare - all expenses that leave people in other jurisdictions unable to pursue training opportunities. In a 2008 survey of participants in six US sector training programs, including Project QUEST, the most frequently cited reasons for leaving training programs was to "obtain a job to support themselves and their families" and "dealing with personal issues." Project QUEST is designed to address exactly that barrier. Of the three programs in the survey that lasted a year or more, Project QUEST had the strongest support system in place to ensure participants remain in their training and, not surprisingly, achieved a substantially higher completion rate.[42]

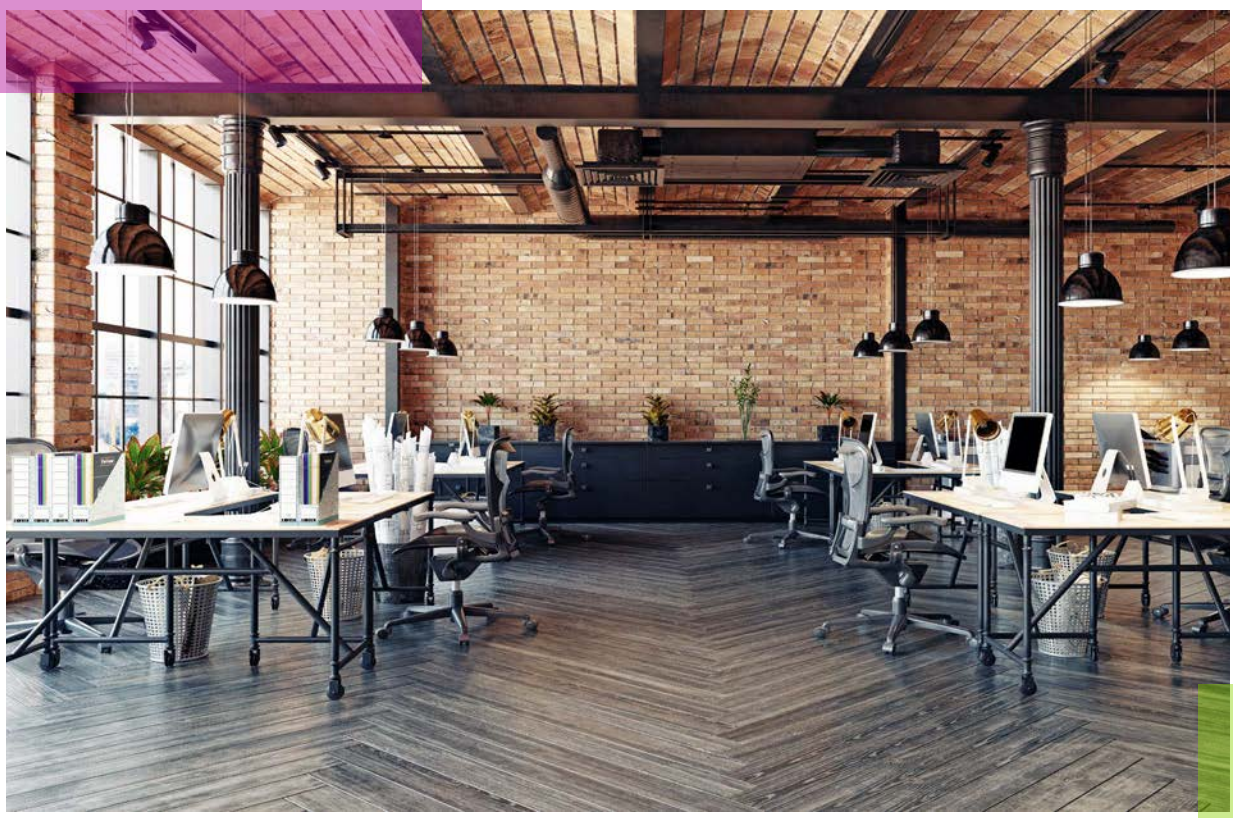
Fostering and nurturing mutually beneficial relationships

Project QUEST succeeds in virtue of many relationships and partnerships - from its founding to its ongoing operation. It owes its origin to the extensive organizing capacities, existing relationships, and political clout of two strong community organizations in San Antonio: COPS and Metro Alliance. Drawing on their existing relationships with training and educational institutions, employers, other community organizations and local, state, and federal agencies - and building new networks - COPS and Metro Alliance demonstrated the power of relationships.

Project QUEST's relationship building and nurturing culture has served it well for decades. Ongoing efforts to connect with and understand employers' needs and challenges has contributed to curriculum design and improvements in recruitment - to the benefit of both participants and employers. Moreover, Project QUEST knows when to establish relationships and networks, and when to get out of the way. After connecting colleges and training organizations with employers to support curriculum design and talent pipelines, Project QUEST often moves into the background to allow those relationships to develop their own unmediated strength. Contributing where it believes it can add value, Project QUEST has arguably had as much positive impact on local and regional economic networks as it has had on participants in its programs over the years.

Next steps for Project QUEST

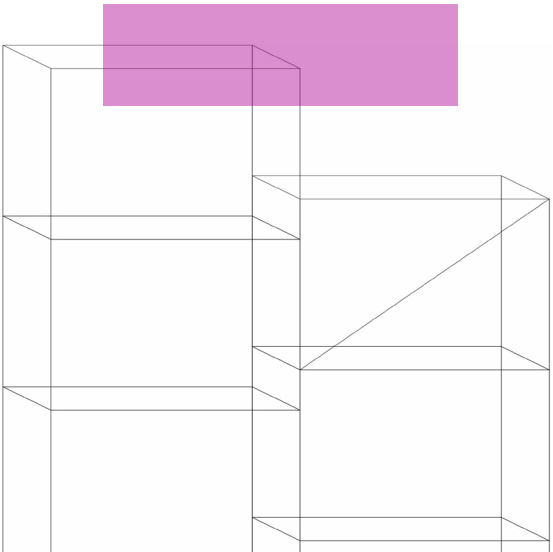
Project QUEST is nearing its 30th anniversary, and looking ahead to the next 30 years to ensure that they can continue playing their role in supporting the San Antonio community. The organization wants to continue to be nimble in identifying emerging occupational and skills needs in the region and in helping underserved and under- or unemployed residents of the city fill these positions. Over time this will likely mean entering into whole new areas of the economy as the region continues to develop. Project QUEST has expanded participation over time and had success in placing people in growing sectors of the economy, but the labour- and resource-intensive nature of their activities will put pressure on their ability to adapt to new and emerging occupation trends in the region. The extent to which Project Quest can expand and succeed will depend on their ability to attract new funding and new partners.



Manufacturing Connect

Summary

- Manufacturing Connect is a Chicago-based program, initially partnered with the Chicago Public School system, that offers manufacturing and applied engineering courses and work-based learning opportunities to help youth from low-income communities secure local manufacturing jobs.
- The initiative was prompted by labour market analyses that showed that underserved youth in Chicago would benefit from career pathways into the local manufacturing industry which would, in turn, provide a much needed supply of workers for small and medium-sized manufacturers.
- Participants take courses over 12 to 14 weeks, participate in work-integrated learning opportunities, and earn industry-recognized credentials which provide a good foundation for employment in the manufacturing sector.
- Manufacturing Connect works closely with employers who help design the curriculum, provide work-integrated learning placements, and offer factory tours, job shadowing opportunities, and paid internships. Employers develop relationships with potential future workers while Manufacturing Connect helps them improve their onboarding and HR practices.
- Program instructors are trained in social work, and work closely with students to understand their backgrounds, life circumstances, interests, and the challenges they face. Manufacturing Connect has also built relationships with dozens of social service agencies to help connect students with various supports throughout the program and into employment.



Overview

Manufacturing Connect provides opportunities for underserved youth to acquire the skills, experience, and relationships needed to pursue manufacturing careers in the Chicago area which, in turn, helps local manufacturers secure the skilled talent they need to innovate and grow. The program is run by Manufacturing Renaissance, a non-profit organization founded in the 1980s to address the loss of manufacturing companies and jobs in the Chicago region. It focuses on helping youth in historically Black, high-poverty neighbourhoods in Chicago gain skills and knowledge to pursue applied engineering and manufacturing education and careers, while helping the region's predominantly white, male, middle-aged employers interact and engage more constructively with Black youth and employees for mutual benefit.[43]

The program has had a positive impact on the lives, educational attainment, and career prospects of hundreds of participants while making Chicago manufacturing more competitive and inclusive.

Motivation and context

Manufacturing Renaissance was born from decades-long efforts to protect and maintain Chicago's manufacturing sector and the jobs it creates. Founded in 1982 by Dan Swinney, a notable labour activist in Chicago's manufacturing sector, Manufacturing Renaissance analyzed and reported on the decline of manufacturing jobs and developed strategies to help retain manufacturing firms in the city. Neighbourhood and firm-level data were collected, and supplemented with insights from local manufacturers, to help uncover the reasons why plants were closing in the region.[44] Notably, while conducting the analysis, Manufacturing Renaissance developed strong relationships with many plant managers who were fighting corporate pressure to move operations to lower-cost jurisdictions.[45] These relationships would later provide the foundation for Manufacturing Connect.

In its 1989 report, Manufacturing Renaissance reported that 40 percent of manufacturing companies in the region risked closure and an insufficient supply of skilled workers.[46] The analysis also revealed that Black and LatinX youth in Chicago would benefit greatly from expanded educational opportunities and career pathways, including in the manufacturing industry.[47] The targeted research campaigns did not stop the flight of manufacturers who had already made the decision to leave, but it identified an opportunity to connect youth who needed better career prospects with small and medium-sized manufacturers who needed skilled workers.

Design

In 2001, Swinney partnered with the Chicago Federation of Labour to advocate for a city-wide career pathway program for the manufacturing sector, which recommended updating manufacturing career pathways programs in highschools.[48] The result was a plan to create a manufacturing-focused high school program to train the next generation for the current and future skills needs of local manufacturers, with a strong emphasis on traditionally underserved youth in the region. The program would eventually become Manufacturing Connect.

The Austin community of Chicago was selected for a pilot. Austin is a low-income, predominantly Black neighbourhood, with nearly 40 percent of households with children living below the poverty line. It also has a long manufacturing history.[49] Swinney explained that "rebuilding manufacturing in Chicago should begin in those communities hit the hardest by deindustrialization like Austin. We [Manufacturing Renaissance] believe that these communities need to be prioritized in promoting development despite the many difficulties".[50]

Working directly with key stakeholders from Chicago Public Schools, including the Chicago Teachers Union, Manufacturing Renaissance helped to design and open the Austin Polytechnical Academy in 2006, which eventually became the Austin College and Career Academy (ACCA). Manufacturing Connect launched with the ACCA in 2007 as a series of manufacturing and applied engineering courses and work-based learning opportunities designed for youth (aged 14 to 18) from low-income communities. In 2017, the program was replicated in two additional Chicago public high schools: Browen and Prossner.[51] Until 2019, the Manufacturing Connect program operated as an optional elective for students in the ACCA. They have since left the school, but continue to provide their programming as a community-based career pathway service.[52]

Activities

Manufacturing Connect includes a combination of applied coursework, college advising, leadership training, industry-recognized technical credentials, and direct employer matching services - all designed to help disadvantaged youth launch careers in the local manufacturing sector.

Skills training

The Manufacturing Connect curriculum offers applied coursework designed to help participants acquire industry-recognized credentials through the National Institute for Metalworking Skills (NIMS). Students meet two to three times per week over the course of 12 to 14 weeks with a credentialed instructor. Lessons include training on applied mathematics, measurement tools, reading and understanding blueprints, and shop and machine safety.[53]

Manufacturing Connect participants have the opportunity to earn up to five NIMS credentials, the most popular being Materials, Measurements and Safety, and Computer Numerical Control Turning Operator. NIMS credentials are widely recognized not only by Chicago-based employers, but manufacturing employers nationwide. By building its program around requirements to acquire widely recognized credentials, Manufacturing Connect ensures that participants are able to demonstrate their skills and competencies to a wide range of employers - thereby improving their career opportunities.[54]

Manufacturing Connect staff also work directly with students on a range of employment preparation, human skills and leadership development. The program helps students prepare for the job search process by providing resume and job interview support, while helping them understand what to expect with regards to pay, job requirements, and work culture. Additionally, Manufacturing Connect helps build leadership and management skills through extracurricular activities such as MECH Creations - a cooperative to make custom trumpet mouthpieces run by students, with assistance from a machining instructor and jazz musician. These kinds of activities are intended to help students prepare for the realities of the workforce, ready them for leadership roles in a company, and help them embark on an entrepreneurial career path if they choose.[55]

Staff also work directly with students on a range of employment preparation, human skills and leadership preparation.

Work-integrated and practical learning

Work placement is a key component of the Manufacturing Connect program, directly informed and supported by an employer partner advisory committee (described below). Work-integrated learning is essential in helping students understand and apply the key concepts, explore potential career pathways, and get a foot in the door with local employers. Partner organizations offer factory tours, job shadow opportunities, and paid internships either during summer break, or during shorter breaks such as spring breaks. Some partner organizations also provide work-study opportunities, which typically involve paid after-school opportunities to senior students, with the opportunity to bridge into full-time positions following graduation.

Between 2011 and 2018, partner organizations offered close to 500 work-based learning experiences. In many cases, students who started with a simple factory tour would enrol in the program and subsequently participate in a work study placement or paid internship.[56] All of these activities help students get a sense of what manufacturing employment is like, what skills are required, understand the work culture, and build and foster their professional network.[57]

Participant advocacy and wrap-around supports

Manufacturing Connect is built not only around skills and employment, but around supporting participants as whole human beings. Social service activities and supports are embedded in the program to contribute to participants' well-being and success. Instructors have backgrounds in social work and work with students to understand their backgrounds, life circumstances, interests, and the challenges they face. Many participants live in extremely challenging circumstances - including poverty, vulnerability to violence, and racism - which complicate efforts to prepare them for careers in a local manufacturing industry dominated by white, middle-aged, middle-class workers.

In addition to having instructors with social work background work with participants, Manufacturing Connect has built connections with dozens of social service agencies in the neighbourhoods they serve to engage prospective students, encourage participation in the program, and provide support services throughout the process.[58]

Instructors often call on program alumni to work with current participants and act as advocates for the program. Manufacturing Connect has found that participants need to see that people with similar backgrounds, and who have faced the same challenges, have achieved success after participating in the program.

Recognizing that many participants needed ongoing support even after graduation, Manufacturing Renaissance created a Young Manufacturers Association (YMA) in 2016. It began as a peer support group for individuals 18 to 19 years old, but has since developed into both a network and program for young adults pursuing careers or already working in manufacturing. YMA holds regular meetings and social events to provide peer-to-peer support and advice on professional and personal challenges, and provides technical training tied to certifications, wrap-around supports, and career coaching and job resources. It also has an employer liaison on staff to help members address issues that arise at work.[59] As one interviewee observed: "the easy part is getting these youth a job; the hard part is keeping them in the job." In 2019-2020 there were 42 participants in the YMA program, all of whom received individual career coaching and 17 received professional training.[60]

College counseling

Manufacturing Connect counsellors help participants interested in additional college education - particularly in applied engineering - map out future education pathways. Critically, counsellors ensure that students understand college education in the context of a future career pathway. That is, they emphasize that college enrolment is not an end in and of itself, but a means to initiate a career in applied engineering and provide a foundation for future advancement.

Counsellors ensure students understand college education in the context of a future career pathway.

Over time, Manufacturing Connect has formalized its program-to-college pipeline and reports college enrollment as a key indicator of the success of the program. Every student in the Manufacturing Connect senior class of 2018 applied to and was accepted by at least one college; one-third received a scholarship offer; and all applied for financial aid. Among graduating cohorts since the program-to-college program was formalized, two-thirds have enrolled in a college program, with 60 percent entering 4-year bachelor's degree programs and 40 percent entering 2-year applied associate's degree programs.[61]

Employer relationships and participation

Local employers are essential to the program. Manufacturing Connect built a network of over 140 small- and medium-sized local employer firms who are closely involved in program governance, curriculum design, work placements, and the NIMS certification process.

- ***Advisory Committee.*** 30 firms are core, ongoing partners, some of whom serve on an advisory committee that meets quarterly to discuss curriculum, opportunities, challenges, and to ensure the continued relevance of the Manufacturing Connect program.[62]

- ***Curriculum Design.*** Industry partners advise on curriculum design and development, including the kinds of equipment that should be included and used in the classrooms. Partner employers helped design the Manufacturing Connect machine shop at the ACCA, which is largely focused on computer numerical control (CNC) machinery. Rather than bringing in state-of-the-art equipment, input from employers let Manufacturing Connect to incorporate and use the kinds of machinery actually used in local manufacturing workplaces.[63] When Manufacturing Connect was required to vacate the ACCA, losing access to its machine shop, the partner advisory committee helped redesign the curriculum to ensure graduates could continue to meet local employer skills needs. This included emphasizing "shop math" (e.g., fractions, decimals, multiplication and division); using and reading rulers and gauges, micrometers, calipers and other devices commonly used in manufacturing; hand-powered tools and eye-hand coordination for assembly positions; shop safety procedures; blueprint reading; and industry recognized credentials.

- ***Certification.*** Industry partners play an important role in certification. Some NIMS credentials require competency-based tests to demonstrate proper use of various machinery. Employers are often called upon to assess the various parts and components the students create to ensure they meet proper specifications.[64]

- ***Work Placements and Engagements.*** As Manufacturing Connect involves a range of real-world experiences - including work-integrated learning, internships, workshops, and tours - close relationships with employers have made it easier to provide these opportunities for students.

Impact

Between 2011 and 2021 Manufacturing Connect graduated 439 students, 288 of whom received at least one NIMS credential. Most students earned two or more credentials. As of August 2021, participants have earned a total of 402 NUMS credentials. Over the 10-year period, 172 participants found employment in manufacturing and 117 students received permanent placements. Manufacturing Connect noted in their progress report that many students chose to go directly to college or non-manufacturing jobs after the program.[65]

TABLE 2:
MC cumulative outcome summary: 2011- 2021

MC/YMA Outputs & Outcomes Cohorts 2011-2021		As of August 2021
Outputs	Total participants who completed program/ graduated high school	439
	Total work experiences	699
	Total participants who have earned industry credentials	288
	Total industry credentials earned	402
Outcomes	Total individuals placed in permanent manufacturing jobs	117
	Total manufacturing job placements	172
	Average retention across individuals currently emplooyed	3 years
	Average wage of those currently employed	$16.11

Manufacturing Renaissance (2020).

Challenges

Manufacturing Connect's success has been as much about addressing challenges as building and expanding its core model. Arguably, being nimble in identifying and overcoming challenges is a core part of Manufacturing Connect's model. A few have been especially prominent during its tenure.

Cultural gaps in the workplace

Partnerships with employers are essential to the success of Manufacturing Connect, but the relationships are not without friction. The majority of employers and their workforces are made up of middle-aged, white men with limited understanding of the challenges facing Black youth from low-income communities. Bridging and managing the gaps between the life experiences of participants and employers is an ongoing challenge for Manufacturing Connect.

The internship component of the program, for example, has highlighted many of the difficulties employers experienced in engaging youth, showcasing how unprepared many companies are to take on young, relatively inexperienced workers from many different backgrounds. Manufacturing Connect staff often work directly with employers and students to assess challenges as they arise and devise strategies to improve the overall experience and rate of success from both an employer and student perspective. One company developed a transparent onboarding policy where new employees were asked to read and sign a document that outlined expectations, while explaining consequences for failing to meet them.[66]

Manufacturing Connect has also encouraged employers to establish mentorship and buddy systems to help acclimatize new hires to the environment and work culture. Mentors advocate for new employees, help them understand and fit into the work culture, discuss what a potential career trajectory might look like, and help identify and seek out training and advancement opportunities.[67] One interviewee noted how essential it was that the students could relate on a personal and cultural level with their mentor. Given the culture shock many Manufacturing Connect participants experience when entering primarily white, older working environments, having someone that understands and can help them overcome the challenge is essential. In line with this, Manufacturing Connect works to connect graduates of the program with current participants, even if it's as simple as getting graduates to lead the plant tours so participants can see themselves in the position and better understand the challenges.

Communication gaps in the workplace

Many Manufacturing Connect employer partners have limited HR policies and procedures, which reduce opportunities for clear communication and can generate misunderstandings. For example, many employers lack well-structured feedback mechanisms about job performance, and unclear criteria and procedures to participate in additional training and job advancement. In the case of feedback, the onus is often on employees to request feedback about their job performance. But because new hires and interns are often reluctant to seek out feedback, they receive very little and assume that they are performing poorly, leading to discouragement and alienation. In the case of training and advancement, again because new hires are reluctant to ask for more than what is presented to them, many miss out on opportunities for which they are well-suited.

Recognizing the communication and policy challenges, Manufacturing Connect staff now work directly with willing employers to formalize performance evaluation criteria and procedures, and ensure that managers offer interns and new hires regular and constructive feedback – including, where they are excelling, what needs improving, and finding opportunities to develop new skills. Manufacturing Connect staff have also encouraged employers to facilitate rotation of interns among various positions in the company to boost interest and motivation, and to provide participants with opportunities to gain a wide range of skills which can be used in different settings. Finally, Manufacturing Connect encourages employers to involve interns and other staff in some management meetings to enhance communication and engagement by creating an atmosphere where participants feel valued and empowered to contribute to innovation and improvement on the shop floor.

Unreliable relationships with school staff and facilities

Manufacturing Connect was integrated with, and reliant on, the Chicago Public School system to function. This allowed them to engage directly with students and create a training space within the school that would benefit participants and employers. However, because the program was not formally written into the policy of the district, continued operation relied on the ongoing informal support of staff and school administrators. With constant staff turnover and administrative restructuring, the lack of formal agreement left Manufacturing Connect vulnerable. One interviewee observed that during the 12 years Manufacturing Connect operated in the ACCA, there were eight different principals. With each new change in administration, Manufacturing Connect had to develop new relationships with new principals, convince them of the program's value, and teach them about its operation and their role. These proved to be significant challenges.

With sensitivities rising about non-school personnel based in Chicago Public Schools and the relentless need to re-convince new principles of the program's value, Manufacturing Connect was evicted from their space in the school in 2019. Without a formal lease, Manufacturing Connect was given two weeks to leave. They no longer had access to their machine shop and interactions with participants would be more difficult. Manufacturing Connect moved their operations to a small storefront close to the school, and have continued to run the program through the community. However, as most funding and support was tied to the provision of training in the school with access to a machine shop, Manufacturing Connect has faced new challenges to its financial support and ability to maintain relationships with employers and participants. Many employers still find value working with the program, but the change in location and relationship with the school has been difficult. Despite losing access to the ACCA and operating entirely remotely since COVID-19, 21 manufacturers continue to work with the program providing advice and financial support, hosting virtual tours and work experiences, and hiring program participants.[68] However, the long-term implications remain unclear.

Keys to success

While Manufacturing Connect's future is uncertain, it has had a substantial impact on the lives of participants, connected workers with employers who need skilled staff, and contributed to better workplace practices among employers - including cultural sensitivity, better communication, and further training and development. Two strategies have been especially helpful in contributing to that success and provide lessons for other initiatives.

Strong, trusting relationships with employers

Manufacturing Connect's extensive network of employer partners, including an actively engaged employer advisory panel, has helped differentiate the program from other skills and job training initiatives and has significantly contributed to its success. The engaged employer advisory committee has helped shape a curriculum that contributes to skills development that is relevant to local labour market needs. Furthermore, plant tours, job shadowing, internship and job placements have been essential in providing students with the experience, relationships, and networks they need to secure employment and help them shape their future education and career decisions.[69]

The engaged employer advisory committee has helped shape a curriculum that contributes to skills development that is relevant to local labour market needs.

Because the relationships are close and long-term, Manufacturing Connect and the employers have developed a critical level of trust that has provided space for difficult conversations and genuine progress on creating more inclusive and supportive work environments. Manufacturing Connect has been in a unique position to help employers enhance HR practices, management behaviour, and a workplace culture more welcoming and accommodating for graduates of the program.[70]

Circumstance-sensitive support for participants

Another key to the success of Manufacturing Connect has been the alignment of social service agencies, educators, trainers, and employers to support participants, not merely as students, interns or employees, but as whole people facing numerous challenges and circumstances. Deep connections with local social service agencies helps in promoting the program and connecting with youth who would benefit but might not otherwise have considered enrolling in a manufacturing career pathway program. Manufacturing Connect also involves graduates of the program in the recruitment process to ensure that prospective participants can see themselves in the program and understand the value it can provide.

Recognizing that prospective participants may need more than just education and employment assistance, Manufacturing Connect develops relationships with social service agencies that can help students with a range of challenges, such as financial support and counseling. Additionally, the trauma-informed approach adopted by instructors and administrators of the program also helps students receive the care and support they need to be successful in and after the Manufacturing Connect program.[71] Staff build close relationships with students and support them at each step of their journeys - even after they secure jobs - to ensure that they succeed.

Next steps for Manufacturing Connect

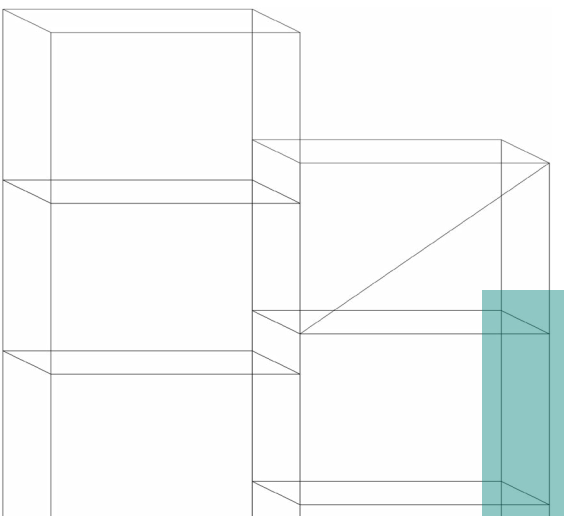
Despite losing access to the ACCA, Manufacturing Connect will continue to offer core programming to serve and build connections among underserved youth and manufacturing employers in Chicago. Over the past three years (since 2019 and through the pandemic), 342 youth have attended orientation events and more than 70 have signed up for programming. Twenty-four of those participants completed the program and, of those, 16 enrolled in college and 8 went into manufacturing employment.[72] The program continues to generate good education and employment outcomes for many participants.

However, the Manufacturing Connect program has always been a proof-of-concept initiative - never quite settling into stable, sustainable operation. Manufacturing Renaissance plans to enhance impact by developing programming both within and outside the school system, while also helping to shape and inform key policy decisions. If they can convince more key decision-makers of the importance of manufacturing as a sector that generates both sustainable regional growth and inclusive employment, then Manufacturing Connect may be able to better secure its future and support education and employment pathways for more Chicago youth.

MATES - The Maritime Alliance for fostering the European Blue Economy

Summary

- MATES is a European Union (EU) program, made up of a consortium of 17 partners who collectively aim to develop a skills strategy that responds to the main drivers of change in the shipbuilding and offshore renewable energy industries.
- Through a rigorous, mixed-methods approach, MATES conducted an analysis of sector-specific economic trends and skills requirements to inform the development of training programs and recruitment strategies for innovation, growth and good jobs.
- Partnerships are key to the MATES model. Building a strong network of experts and directly engaging them throughout the research process (e.g., through workshops, questionnaires, and interviews) has been critical to MATES' efforts to identify specific skills gaps and guide future programming.
- MATES discovered that rich analysis is necessary to understand skills trends and needs, but that an overly broad and complex approach in some ways can impair rather than improve understanding and draw attention away from the practical need to build meaningful strategies and programs for skills development.
- MATES is a relatively new initiative that is only now beginning to use insights from analysis to design and deliver training pilots. As such, nothing is yet known about impacts on skills and innovation, but it offers valuable insights about conducting analysis of skills needs and working with partners across sectors and countries.



Overview

The Maritime Alliance for fostering the European Blue Economy through a Marine Technology Skilling Strategy (MATES), was created to develop a skills strategy that responds to the main drivers of change for the shipbuilding and offshore renewable energy industries. These industries are adopting digital and green technologies at an accelerating rate and require new capacities and skills to support innovation and help them grow. MATES brings together leaders and experts in industry, atcademia, education and training institutions to understand industry trends, identify skills shortages, and develop and study pilot projects focused on addressing industry needs.

As a relatively new initiative, MATES has not yet generated insights about the pilot programs' performance, but the initial research and analysis that provided the groundwork for building programs provides insights for other skills initiatives. MATES' approach to industry analysis has revealed the importance of ensuring that analytical rigor is proportional to the complexity of the ecosystem, partners are engaged throughout the analysis, and long-term, trusting relationships necessary to operate effective skills development programs are nurtured from the outset.

Motivation and context

The 2016 Skills Agenda for Europe, established by the European Union, reflects a shared vision among member states about the "strategic importance of skills for sustaining jobs, growth and competitiveness."[73] The agenda prompts member states and partner organizations to work to:

1. improve the quality and relevance of skills formation,
2. make skills and qualifications more visible and comparable, and
3. improve "skills intelligence" and information to enable better career choices.[74]

As part of the "skills intelligence" theme, members committed to a "Blueprint for Sectoral Cooperation on Skills" to mobilize key players, better understand sector skill needs and gaps, and develop programs to address the gaps across critical sectors.[75]

One of the critical sectors is maritime technology. In recent decades, the maritime technology sector has become a mix of legacy sub-sectors - such as shipbuilding - and leading edge sub-sectors - particularly, renewable offshore energy technology. Strategically important for both economic growth and meeting sustainability goals through renewable power generation,[76] the European maritime sector has become increasingly technologically advanced and focused on more high-value added activities.[77] At the same time, the sector faces fierce international competition and is highly sensitive to global economic forces: European shipbuilding output, for example, has been in decline since the 2008-09 recession. Additionally, technological change has rapidly increased demand for more highly-skilled personnel in the sector.[78] A skills strategy for the maritime sector needs to focus on skills required for both a conventional, but increasingly digitized, subsector (shipbuilding) and an emerging, innovative clean-tech sub-sector of global importance (offshore renewable energy).

MATES was established to collect "skills intelligence" and develop skills strategies for both sub-sectors. The hope of MATES' creators and partners is that the initiative will identify and help develop the skills needed to support critical maritime industries across Europe, contribute to innovation and growth and help create and fill good, well-paying jobs.

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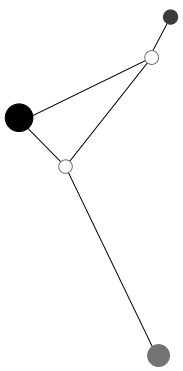

Design and activities

MATES was established is a consortium of 17 partners from eight countries coordinated by the Centro Tecnológico del Mar (Fundación CETMAR) in Spain and overseen by ERASMUS+ - the EU's long-standing program to support education, training, youth and sport in Europe. Funding from ERASMUS' Sector Skills Alliances (SSA) program provided MATES with a budget of €4.9 million to complete its initial activities (from January 2018 to April 2022). With a long term goal of ensuring that education and skills program are aligned with the needs and direction of employers in the shipbuilding and offshore renewable energy sectors, MATES decided to commit substantial time and energy to observing and analyzing the state and future of the two sectors and the precise constellations of skills that they would need as they innovate and grow.

Skills gaps research and analysis

To develop a skills picture which would inform the development of training pilot projects, MATES employed a complex, mixed-methods analysis that unfolded in four major steps.

Step 1: Characterizing the current and future states of the sectors

To reach a common understanding of the current state and future trajectory of the two industries, MATES launched an extensive review of existing literature (390 publications) and relevant projects (150 projects), and conducted an economic analysis. A key activity at this stage was a forecasting and foresight exercise to identify likely drivers of change which could be monitored to help track the trajectories and needs of the sectors.

While much of the work was completed by MATES analysts, engagement with experts and practitioners was critical to validate data and ensure the analysis resonated with on-the-ground perspectives. Five workshops with approximately 150 practitioners and experts were held in 2018 (in Greece, Portugal, the Netherlands, the United Kingdom and Spain) to explore possible future scenarios and validate insights about the state of and trends in the industries.[79] Attendees shared their perspectives on the evolution of shipbuilding and offshore renewable energy sectors, developments in digital and green technologies that might influence skills needs, and the extent to which training and education systems appear to meet the needs of the industries.

Results of the step 1 analysis were published in a report in August 2019 and findings were presented to the experts in two additional rounds of regional workshops in five countries.[80]

Step 2: Mapping skills requirements and training infrastructure

With better views of the current states and future trends in the shipbuilding and offshore renewable energy sectors in hand, MATES moved in Step 2 to achieve more clarity on the occupations and skills required within each sector, and the extent of alignment with existing education and training infrastructure.

MATES staff examined and mapped the value chains in each industry - identifying their composite parts, functions and activities - which provided more granularity about the specific occupations needed in the sectors. Using the European Skills, Competencies, and Occupations (ESCO) framework and assessing the industry value chains maps,[81] MATES analysts identified 35 primary occupations (i.e., those with the greatest importance for the value chain) for the shipbuilding sector and 23 primary occupations for the offshore renewable energy sector. Researchers used the ESCO framework to identify and catalogue the essential skills, competencies and educational requirements associated with each occupation. MATES again turned to expert advice, hosting 72 experts at three workshops to examine and refine the value chains, occupational profiles, and skills and education needs for each sector.[82]

With a better picture of the receptor capacity in hand, MATES mapped and assessed the extent to which programs and courses in the existing educational and training ecosystem would be able to meet the specific requirements of the industry. They analyzed 1033 educational and training programs in 18 EU countries that are focused, in one way or another, on the occupations and skills identified in the value chain analysis. Assessment involved analysis of the extent to which a program prepared students for any of the primary occupations in each industry, the level and nature of certification provided (i.e. bachelors, masters, vocational certificates, etc.), and the length of the program.[83] Again, the analysis was supported and validated through three expert workshops and a baseline validation workshop at which 61 experts reviewed and discussed findings to date.[84]

Step 3: Quantifying and qualifying skills shortages

In steps 1 and 2, MATES analysts produced a general picture of the economic state and trajectories of the key sectors, maps of the value chains and specific kinds of occupations and skills required across those value chains, and analyses of existing educational and training programs' contributions to the skills needed. But exactly how many people would be needed? And which specific occupations and skills are employers struggling to find? Step 3 aimed to provide answers to those questions and characterize the "skills shortages" in shipbuilding and offshore renewable energy through a supply and demand analysis of job vacancies, an industry questionnaire, and targeted interviews. This involved:

- *Job vacancy analysis:* From May to June 2019, MATES gathered 259 job ads from key job portals (e.g., Indeed, LinkedIn) that fit occupational profiles relevant to the shipbuilding and offshore renewable energy sectors. While the number of available ads limited MATES' analytical ambitions, the postings revealed a general idea of where hiring for specific positions is taking place, and what skills employers are looking for.[85]

- *Industry questionnaire:* MATES distributed a questionnaire to small and medium-sized companies in the shipbuilding and offshore renewable energy sectors to gather their perspectives on skills needs. 107 survey responses from 13 countries were collected (for a response rate of 28 percent). Despite receiving few responses, the survey provided some useful signals about employers' views on:

    - skills needs and skills assessment protocols;
    - specific skills and occupational shortages;
    - general challenges in finding workers; and
    - perceived deficiencies in educational and training programs. [86]

- *Expert interviews*: MATES conducted 31 interviews with experts and practitioners from both sectors with regional representation, focusing on candidates with knowledge about the entire value chain in one or the other sector, and a minimum of 10 years experience in the industry. The interviews focused on six themes:

    1. competitiveness of the industry and workforce writ large;
    2. occupations in greatest need of up- or re-skilling;
    3. occupations with greatest demand and most difficulty filling;
    4. demand for specific skills and knowledge;
    5. gaps in the current suite of education and training programs; and
    6. mismatches between supply and demand.[87]

Together, these research activities provided MATES analysts with quantitative and qualitative data to help them flesh out the picture of skills supply and demand across each sector's value chain, as well as additional detail about the extent to which education and training programs are helping industry meet specific occupational and skills requirements.

Step 4: Identifying priorities for intervention

Drawing on insights and data collected in the first three stages, MATES summarized skills gap findings for each industry and identified priority areas for intervention. Ten priorities for the shipbuilding industry and 12 for the offshore renewable energy industry were developed to help guide the selection and design of pilot skills training and development projects. The prioritization was accomplished in collaboration with people and experts that had participated in earlier stages of the analysis.

For each priority, MATES identified a skill need or shortage that required attention, its scope, possible instruments to address it, expected impact, relevant indicators, and actors and stakeholders of importance. The accuracy and relevance of the priorities were validated through a workshop with 52 experts from industry, education, public administration and research centres. Participants were asked to assess each line of action according to a set of seven criteria - including, sector relevance, geographic relevance, political support, urgency, cost to address, impact on employability, and their ability to make the industry more appealing to young talent, potential employers and future investments.[88]

Results

The four-stage analysis generated a detailed picture of the major challenges and opportunities facing each subsector, which skills are critical and strategies to meet their needs. As part of the process, MATES staff were able to develop relationships with key stakeholders in industry, education, and government which provide a foundation for the development and operation of pilot programs and future skills development activities. That said, more would need to be done to mobilize the partner network to action on the priorities given that, so far, they have been engaged as part of an analytical process rather than with the intent to design and deliver programs.

The four stage analysis generated a detailed picture of the challenges and opportunities facing each subsector, which skills are critical and strategies to meet their needs.

Insights and strategies for shipbuilding

The process developed a number of important insights and strategies for the shipbuilding sector. The sector faces five key challenges: an aging workforce, a talent drain to other sectors, lagging technology adoption, frequent outsourcing of activities, and neglecting to set standards for many key activities. In terms of occupational needs, the analysis showed that engineers, managers and technicians with strong skills and practical experience are required, while welding and sandblasting, project management, and the ability to read, write and communicate in English are the technical skills most needed for the shipbuilding industry.[89]

The analysis also revealed an urgent need to better align training and education with industry. Few vocational training or degree programs are designed for the shipbuilding industry itself. Employers report that on-the-job training and considerable investments in skills development are required for new hires straight out of education. They also expressed a desire to improve engagement with educators and trainers to ensure better alignment with sector needs, and recommended the creation of an EU-wide accreditation process to certify the industry relevance of education and training curricula. Three priority lines of action to guide the design of pilot projects emerged from the analysis:

- training and reskilling/upskilling the workforce to use digital and data-driven technologies (e.g., big data, Internet of Things, cloud computing, 3D printing, artificial intelligence);
- training and reskilling/upskilling in the use of automation and robotics; and
- training and reskilling/upskilling the workforce to use technologies that minimize the environmental impact of shipbuilding.[90]

Insights and strategies for offshore renewable energy

With the exception of several programs in the U.K. that incorporate apprenticeships and renewable energy specific curricula, the European education and training system does not address the needs of the offshore renewable energy sector directly. There are programs to develop professionals in occupations that cut across sectors - such as engineers and managers - but the analysis found only a handful of programs focused on the sector directly. Like the shipbuilding sector, experts and employers in the offshore renewable energy sector recommended better alignment between education and training programs and industry needs, as well as a range of work-integrated learning initiatives to help students and young professionals gain practical experience.

In terms of specific skills and occupations, MATES' analysis uncovered needs for project management, engineering and digital skills, as well as skills and knowledge to work with sector-specific technology - including, installation and maintenance of renewable energy technologies, condition monitoring using drones, an ability to use offshore access systems, knowledge of metocean conditions, and a basic knowledge of vessel operations.[91] The analysis generated three priority lines of action to guide the design of pilot projects:

- a targeted focus on skills to use industry-relevant digital technologies (e.g., AI, mechatronics, 3D printing, Internet of things, cloud computing, big data);
- programs to enhance technical knowledge of energy storage; and
- improvements to ocean literacy and the appeal of maritime careers to graduates and early-career workers.[92]

Pilot programs

Based on its analysis and stakeholder engagement, MATES facilitated the design of eleven pilot programs aligned with priority lines of action from both industries. Among these are:

- *Online courses* to teach data literacy, data management, and data science to technicians and trainers.
- Freeboard – a course in which participants construct a boat model using a block assembly process in order to provide real-world experience to students in technical programs, such as welding, construction, and machining.
- *Magnus Effect* – a program in which participants helped build an offshore structure according to industry standards (including a prototype windmill turbine), using modern techniques such as automated robot welding and non-destructive testing.
- *Ocean Pro. Tec Lab* – a short-term course designed to facilitate knowledge transfer among existing workers in the maritime industry and early-career workers with adjacent skills sets. This pilot provided an environment where maritime professionals, trainers, and early-career workers could interact and learn from each other through various modules.[93]

MATES has completed their pilot experiences and conducted preliminary evaluations consisting primarily of output and participant satisfaction analysis. However, the overall extent of the impact of these and the other pilot programs remains to be seen. What is notable is that most have been co-designed with industry to ensure that they align with industry needs. At the same time, however, the pilot programs appear to be light-touch, short-term initiatives that provide participants with exposure to industry knowledge and activities, but not the kind of full pathway and wrap-around support for individual learners seen in successful training initiatives elsewhere.

Challenges

MATES' detailed and rigorous labour market and training ecosystem analyses generated some useful insights and strategies for key sectors. Indeed, the sector-specific focus and repeated engagement of leaders in industry, education and government provides a useful model for other sectors and jurisdictions trying to understand skills and innovation opportunities and gaps. Yet, MATES experienced challenges along the way and often generated results that were less relevant to action than intended.

Breadth over depth

Identifying insights about skills trajectories, needs, and gaps in both the shipbuilding and offshore renewable energy industries across all of Europe proved to be a very large undertaking for MATES. Indeed, the wide scope appeared to get in the way of MATES developing the kind of granular insights needed to develop regionally relevant and effective skills initiatives. The needs and challenges facing the two industries vary greatly across countries and regions, and the data needed to characterize the trends and opportunities were disparate and disjointed. Connecting with employers in different countries and in different languages also made data collection and analysis difficult.

Indeed, the wide scope appeared to get in the way of MATES developing the kind of granular inisghts needed to develop regionally relevant and efffective skils initiatives.

In short, while an EU-wide focus makes sense from the perspective of sharing resources and understanding how different institutions might be able to meet different skills needs in the larger ecosystem, the focus was arguably too broad to generate the kinds of insights needed to develop a clear understanding and foundation for promising pilot programs. The ambition was impressive, but the actual results are less useful than hoped for.

Complexity and opportunity costs

In addition to having too broad a scope, the complexity of MATES' efforts to generate comprehensive, detailed analyses of the trends and skills needs of two sectors throughout the EU may have limited its practical results - at least relative to investment of time and resources. The diagnosis and analysis involved a huge array of different organizations and stakeholders, multiple research streams with different project leads, and a tendency to try to squeeze more granular insights from data that were simply not up to the task. While the program produced some valuable research and insights, the opportunity cost - particularly in terms of developing better relationships with employers and putting insights to action in skills development pilots and programs - was significant.

MATES' analysis was pulled in many directions, often neglecting more fruitful lines of inquiry and activity. Time spent on understanding industry value chains and assessing existing education and training programs might have been better spent directly engaging employers and experts to understand specific regional skills gaps and developing targeted interventions to address them.

Gaps in research execution

Even as MATES emphasized comprehensive data collection and analysis, important kinds of labour market data - including, employment, wage and job vacancy trends over time - were largely neglected. As a result, the final analysis was less useful than it could have been had these kinds of conventional labour market data been collected.

For example, while job postings can be a useful tool for understanding demand for specific occupations and skills, MATES dedicated limited time and resources to this analysis, examining only 259 job ads posted over a two-month perdion (May to June 2019). Standard practice with these kinds of analyses is to examine millions of job postings over many years to generate useful pictures of the demand for certain occupations and skills. Similarly, while MATES' employer questionnaire had potential as a source of insights, it was in the field for only 3 months (April to June 2020) and received too few responses (107) to draw reliable conclusions. It appears that MATES prioritized too many research activities and, as a result, had difficulty completing any individual activity with the kind of depth and rigor needed to produce reliable results to guide policy and action.

Lessons

Despite the challenges, a great deal can be learned from MATES about engaging industry experts and using a mixed-methods analysis to identify and help address skills gaps in particular industries.

Stakeholder engagement

Before conducting any research, MATES identified and built relationships with key players in the shipbuilding and offshore renewable energy industries across Europe. This network of experts was helpful in the analysis and the connections made among industry and training institutions offer a good foundation for future training activities. Stakeholder input from industry and academia in the workshops, interviews and survey contributed useful insights about skills needs and challenges. Indeed, stakeholder input provided the most in-depth and precise understanding of where current and future skills shortages exist in the shipbuilding and offshore renewable energy industries.

What remains to be seen is how well the connections made among industry and education and training institutions through the research activities can be leveraged to design and operate skills development initiatives. At a minimum, key actors are aware of, and know how to contact, each other. Whether that is enough - or whether additional support from MATES is needed to nurture and derive benefit from those relationships - is an open question.

Staged, mixed-methods model of skills analysis

While not all of MATES' research activities generated fruitful results, the structure and mix of approaches to understanding skills needs and development opportunities are worth considering. The four stage approach to understanding each industry's trajectory, occupational make-up, specific skills and occupational needs, and the contribution of the education and training ecosystem to meeting needs is worth adapting in other contexts. Additionally, different data and insight collection tools - including literature reviews, surveys, interviews, and workshops - offer examples that might be emulated in other contexts to achieve a well-rounded picture of skills needs in an industry, as well as guidance on what interventions might help to address gaps.

Importance of a local focus and continual feedback loop

MATES was tasked with a broad and ambitious research undertaking – namely, to identify skills gaps and potential interventions for the shipbuilding and offshore renewable energy industries across the EU. Indeed, the scope and complexity of the research may have impaired analysts' ability to uncover specific skills gaps and targeted solutions to meet unmet demand. MATES and similar initiatives may benefit from adopting narrower, regional scopes and more intentional research design and planning processes to identify useful insights for regional actors.

In the Project QUEST and Manufacturing Connect cases also profiled as part of this research program, leaders and stakeholders adopted a local focus which enabled them to gather directly relevant insights more efficiently and effectively and to design programs to develop skills that identifiable employers would find valuable. With strong relationships and communication channels among regional stakeholders, these other programs were able to build and benefit from timely and robust feedback loops that have not yet emerged in the MATES case. That allows for real-time skills development program innovation to meet regional needs - a mechanism that MATES' broad and complex approach could not facilitate.

Next Steps

Following the completion of the pilots, MATES developed a roadmap and long-term action plan for the shipbuilding and offshore renewable energy sectors across Europe. Moving forward, MATES consortium members have committed to a number of actions including: facilitating and enhancing education-industry cooperation, increasing the attractiveness of maritime careers through ocean literacy, improving knowledge transfer between senior and junior employees, establishing a job and skills observatory, and continuing to promote the results of the MATES project in its entirety.[94] Additionally, many of the partners involved in specific pilot projects have indicated commitments to continuing, and even expanding programming into the future.[95]

MATES has a solid economic analysis and a promising network of partners with whom it can work. It remains to be seen how well the organization can use those strengths to design and deliver effective pilot programs and contribute to innovation, growth and good jobs in the European marine tech sector in the years ahead.

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