LevelUp: Skills Evolution

Cross-sector collaboration on micro-credentials

Final Project Report

July 2024

EMC

CANADA'S LARGEST
MANUFACTURING CONSORTIUM

This report was produced as part of a project funded by the Future Skills Centre (FSC), with financial support from the Government of Canada's Future Skills Program.

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

LevelUp: Skills Evolution Project by

EMC CANADA'S LARGEST MANUFACTURING CONSORTIUM

Founded on a commitment to collaboration, trust and innovative leadership, **Excellence in Manufacturing Consortium (EMC**) stands out today as an inclusive and diverse not-for-profit organization supporting the growth and success of more than 16,000 manufacturing companies representing over 1,000,000 of their employees across Canada. For more than a quarter-century, now as Canada's largest and most active manufacturing consortium, EMC is responsible for contributing significant knowledge, expertise and resources towards advancing the Canadian manufacturing sector.

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Table of Contents

Executive Summary

In a first-of-its-kind cross-sectoral collaboration, the LevelUp: Skills Evolution project by Excellence in Manufacturing Consortium (EMC) and five sectoral partners have developed a shared industry-led methodology and framework to design and deliver micro-credentials that are need and competency-based to address gaps in training and the supply of skilled labour. The project involved research into the state of micro-credentials, frameworks and best practices, consultations with employers and learners across several industries, pilot-testing, and evaluation of micro-credentials tailored to the current skills needs of each of the participating sectors.

Background

Employers across many sectors face significant challenges due to the rapid pace of technological change and a shortage of skilled personnel. Employers need to hire entry-level employees who can carry out foundational and fundamental job tasks. They also need to promote supervisors and managers with strong technical skills to lead teams, interact with clients, manage deadlines, adopt new technologies and processes, and innovate to ensure companies remain competitive. Retaining talent, once they do fill vacant positions at any level, is also a challenge.

Micro-credentials are poised to become a mainstream rapid training solution that can address these urgent training needs. However, as micro-credentials are still relatively new in Canada, there is significant confusion among employers, learners, educators and training organizations on what micro-credentials are, how best to design them, how to award them, and what their benefits are to each stakeholder.

The findings of Phase 1 of Level-Up: Skills Evolution provide new insights for scaling up sectoral micro-credentials through the identification, validation, and prioritization of in-demand skills and training so that employers in all sectors can be ready for sustainable growth and future challenges.

About the project

EMC's Level Up: Skills Evolution project is a national, industry-driven initiative to provide insights for scaling up sectoral micro-credentials. Level Up: Skills Evolution involved the design, pilot-testing, and evaluation of micro-credentials tailored to the current skills needs of each of the participating sectors. The findings provided EMC and its sectoral partners with the knowledge and experience to develop a roadmap (methodology) for developing needs and competency-based industry-led rapid skills training and micro-credentials.

The project brought together multiple sectors to build a critical mass of industry stakeholders who will drive forward this validated training approach. Sector partners on the project involve varied industries – manufacturing, aviation and aerospace, bioeconomy and biotechnology, agriculture, tourism, and information and communications technology – to enable the project team to jointly discover, design, pilot and assess the utility and feasibility of micro-credentials as a training tool in a variety of industry contexts.

EMC's partners on this project are:

- **BioTalent Canada**
- **Canadian Agricultural Human Resource Council (CAHRC)**
- **Canadian Council for Aviation & Aerospace (CCAA)**
- **Information and Communications Technology Council (ICTC)**
- **Tourism HR Canada**
- **Social Research and Demonstration Canada (SRDC)**

The project represents an essential step in EMC's ongoing efforts to standardize and promote industry-led micro-credentials and address the gap between the upskilling and reskilling needs of employers in small—and medium-sized enterprises (SMEs) for skilled workers and the skills training currently being provided by post-secondary education (PSEs) and other training providers.

Objectives

The project seeks to apply a multi-sector approach to developing industry-driven needs and competency-based micro-credential training that will help employers to more rapidly and effectively onboard new workers and upskill and reskill their workforce to match the rapid pace of change. Particularly, we aim to achieve the following overarching objectives:

1. **Design:** Design and develop an industry-driven, multi-sector micro-credential framework to empower employers to upskill and reskill their workforce and onboard new talent.

2. **Proof of concept:** Implement pilots to test the feasibility of micro-credentialing across participating sectors.

3. **Validation:** Validate with employers to ensure the micro-credential framework aligns with their skill and competency needs.

4. **Evaluation:** Collect data to evaluate the implementation success of industry-led micro-credentials, drawing on lessons learned and promising practices across sectors.

5. **Knowledge dissemination and mobilization:** Share project findings with sectoral stakeholders to advance micro-credential initiatives, encouraging further uptake and broader adoption, and building toward a sustainable micro-credential ecosystem.

Barriers to micro-credential adoption

Limited time and resources for training

Extensive consultation with SMEs showed that employers have limited time available for training, so they prioritize only legislative/mandatory training, with limited investment into work-based training unless there is high confidence it will meet their immediate needs. They want training that is up to date with the skills needed now, rather than what they see as outdated or irrelevant training. Employers also want training that is flexible, rapid, and easy to implement. They do not believe there is an adequate supply of high-quality upskilling or reskilling training available that can meet their needs.

Confusion about the consistency of micro-credentials

SMEs were largely unaware of micro-credentials. As a result, only a small number of SMEs had used micro-credentials in HR processes. Among those SMEs who understand the concept of micro-credentials, most say they are more interested in the quality of the training. Without an effective understanding of the benefits and drawbacks of micro-credentials in general, as well as the ability to easily compare and evaluate both the relevancy and quality of individual micro-credentials, employers do not have a basis for assessing job candidates who list micro-credentials on their resumes—and may discount such micro-credentials entirely during the hiring process.

With no current standardized definition of a micro-credential, the current national and provincial frameworks for developing micro-credential programs lack consistency, leading to a wide variety of program characteristics, including their delivery, focus, and use. In our consultations, employers expressed concern that with so many different models of micro-credentials currently on the market, it is confusing for employers to understand what a micro-credential represents. Indeed, without establishing common definitions and frameworks, the term “micro-credential” may lose its meaning for employers.

Disconnect between training providers and evolving sectoral needs

Micro-credential providers, such as post-secondary institutions, private training institutions and sectoral or industry associations, struggle to effectively communicate with employers and individual learners the benefits of micro-credential programs when compared to other sources of vocational education and training. There was considerable consensus from SMEs that the traditional post-secondary educational systems may not adequately keep pace with evolving skills needs and, moreover, may not be able to provide industry-specific examples for learners to build their skills within an industry context.

The Potential for micro-credentials and development

Micro-credentials present an opportunity for a flexible and responsive skills development approach more systematically aligned with industry needs. For micro-credentials to be most effective as a workforce development tool, they should be designed and delivered in a way that imparts learners with practical, in-demand skills that are needed and can be applied in the workplace. Training providers should regularly update and renew micro-credentials to stay relevant as industry and employer needs evolve.

In this report, EMC and its sectoral partners have recommended a cross-sectoral framework and methodology to standardize industry-led micro-credential design and delivery in Canada. The proposed framework requires micro-credentials to be competency-based, connected to the current labour market and industry needs, and validated by credible industry employers, small, medium, and large. A range of delivery and assessment options to validate skill gain and/or proof of mastery provides flexible training options for learners, training providers, and employers.

This report and its conclusions were developed through an environmental scan of Canadian and international approaches to micro-credentials and program delivery, and in-depth interviews with micro-credential subject matter experts, post-secondary institutions, and a wide range of employers. EMC and our Sectoral partners conducted employer roundtables, interviews, and focus groups with over 500 individuals to discuss perceptions of micro-credentials and labour market needs and proof of concept testing with almost 1000 learners. As a result, this project was able to define and apply an industry-driven, multi-sector methodology to micro-credential development and adoption.

Part One

Level Up: Skills Evolution Sectoral Report

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1. Project Overview

This report outlines the findings of the *Level Up Skills Evolution* project which aimed to pilot and test the feasibility of industry-led micro-credentials. This national, industry-driven initiative brought together multiple sectors to foster an environment of cross-sectoral collaboration and build a critical mass of sectoral stakeholders to be the champions and driving force behind this training approach.

Employers across many sectors face significant challenges due to the rapid pace of technological change and a shortage of skilled personnel, such as:

- **Technological Changes:** Rapid advancements require continuous upskilling.
- **Shortage of Skilled Personnel:** There is a critical need for entry-level employees with foundational skills and supervisors with advanced technical skills**.**
- **Talent Retention:** Retaining skilled workers remains a significant issue
- **Access and perceptions of training -** Traditional post-secondary education systems may not adequately meet these evolving needs, underscoring the potential of micro-credentials to fill these gaps.

Employers emphasized that the most in-demand skills include problem-solving, communication, collaboration, time management, planning and organization, stress management, leadership, and creativity and innovation. The traditional post-secondary educational system may not adequately keep pace with evolving skills needs and, moreover, may not be able to provide industry-specific examples for learners to build their soft skills within an industry context. Micro-credentials present an opportunity for a flexible and responsive skills development approach more systematically aligned with industry needs.

Micro-Credentials as a solution

Micro-credentials offer several advantages:

- **Flexibility**: They provide a flexible approach to skills development, tailored to industry needs.
- **Responsiveness**: Micro-credentials can rapidly adapt to changing skill requirements.
- **Competency-Based**: They focus on specific competencies required by employers, ensuring relevance and practical applicability.

The findings of *Skills Evolution* provide new insights for scaling up sectoral micro-credentials through the identification, validation, prioritization, and updating of occupational competency framework. Lastly, the processes and lessons learned from this feasibility study also allow the

project to develop a sharable roadmap for workforce capability growth through a competency-based micro-credential approach.

Project objectives

The project applied a multi-sector approach to developing industry-driven needs and competency-based micro-credential training that will help employers to more rapidly and effectively onboard new workers and upskill and reskill their workforce to match the rapid pace of change. Particularly, we aim to achieve the following overarching objectives:

1. **Design:** Design and develop an industry-driven, multi-sector micro-credential framework to empower employers to upskill and reskill their workforce and onboard new talents.
2. **Proof of concept:** Implement pilots to test the feasibility of micro-credentialing across participating sectors.
3. **Validation:** Validate with employers to ensure the micro-credential framework aligns with their skill and competency needs.
4. **Evaluation:** Collect data to evaluate the implementation success of industry-led micro-credentials, drawing on lessons learned and promising practices across sectors.
5. **Knowledge dissemination and mobilization:** Share project findings with sectoral stakeholders to advance micro-credential initiatives, encouraging further uptake and broader adoption, and building toward a sustainable micro-credential ecosystem.

Research questions

The project's research questions first focused on the implementation of the micro-credential pilots: the method(s) and extent (length, depth) of the training, the characteristics of the participants and employers, and any adaptations or customizations to the curricula. Features associated with successful implementation were analyzed, and findings included lessons learned to support future delivery and potential expansion.

Key questions include:

- How was each pilot implemented, and were they implemented according to plan?
- Was there any **adaptation or modification**, and if so, what and why?
- What were key **best practices and lessons learned** to ensure future iterations will be successful?
- What are the key factors to ensure **sustainable design, development, delivery, and evaluation** of micro-credentials in the future?

For assessing the effectiveness of the micro-credentials, analyses focused on the learning outcomes achieved by learners, the capacity-building of stakeholders to design, develop, and deliver micro-credentials, and the effects on cross-sector partnerships and collaboration. Key research questions related to effectiveness included:

- Did learners achieve the intended **skills gains and other learning outcomes**?
- What change in capacity to design, develop, and deliver micro-credentials did project **stakeholders** achieve?
- Did the project contribute to an increased capacity for **collaboration across sectors**? What were the tangible outcomes to increased collaboration?

Project partners

Sector partners on the project were selected based on their experiences in work-based training and connection to industry, their interest in micro-credentials and their openness to collaborate with other sectoral organizations. Each partner represented industry sectors that included a range of company types and sizes, which allowed the project team to assess the utility and feasibility of micro-credentials as a training tool in a variety of industry contexts. Skills Evolution brought together the following:

Excellence in Manufacturing Consortium (EMC)

The Project Lead, **Excellence in Manufacturing Consortium (EMC**), is a non-for-profit founded on a commitment to collaboration, trust and innovative leadership stands out today as an inclusive and diverse organization supporting the growth and success of more than 16,000 manufacturing companies representing over 1,000,000 of their employees across Canada. For more than a quarter-century, now as Canada's largest and most active manufacturing consortium, EMC is responsible for contributing significant knowledge, expertise and resources towards advancing the Canadian manufacturing sector.

Canadian Council for Aviation & Aerospace (CCAA)

CCAA focuses on helping the Canadian aviation and aerospace industry attract and develop workers with the skills needed to meet the demands of the current and future workplace. With expertise in labour market intelligence, certification and accreditation, innovative strategies to raise public awareness of the industry, all while bringing together industry, academia, and government to work together on workforce development challenges.

BioTalent Canada

BioTalent is trusted as the go-to source for labour market intelligence, and guides bio-economy stakeholders with evidence-based data and industry-driven standards. They work on bridging the gap between job-ready talent and employers, and ensuring the long-term agility, resiliency, and sustainability of the industry.

Canadian Agricultural Human Resource Council (CAHRC)

CAHRC is a national, non-profit organization focused on addressing human resource issues facing agricultural businesses across Canada. The Council represents farming in all its forms: raising traditional and non-traditional livestock; producing, cultivating, growing, harvesting or collecting conventional and non-conventional agriculture commodities; and any practices performed as an integral part of an agricultural operation.

Information and Communications Technology Council (ICTC) ICTC is a national center of expertise on the digital economy. With over 25 years of experience in research and program development related to technology, ICTC has the vision of strengthening Canada's digital advantage in the global economy. Through forward-looking research, evidence-based policy advice, and creative capacity building programs, ICTC fosters innovative and globally competitive Canadian industries, empowered by a talented and diverse workforce.

Tourism HR Canada

An advisory-level partner, Tourism HR has a 30-year history with competency-based credentials for their sector and have done projects with several other industries both in Canada, elsewhere and seek to embark on a new series of micro-credentials. Tourism HR brought experience in creation of a competency framework —a comprehensive and sustainable collection of competencies and essential skills—for the tourism sector, with EMC looking to adapt and incorporate common elements for the manufacturing sector, as a better way to align the skills of individuals in the Canadian labour market, minimizing gaps and mismatches.

Social Research and Demonstration Corporation (SRDC)

EMC engaged **SRDC** as the research partner on the project to provide research expertise for evaluating the process and outcomes of the micro-credential pilot within the manufacturing sector. SRDC is a non-profit research organization, created specifically to develop, field test, and rigorously evaluate new programs. In this project, SRDC played a critical role as a facilitator/moderator to document the cross-sectoral exchanges and collaboration and evaluate the feasibility of the initiative. EMC and SRDC worked together on project objectives, leveraging experience from previous projects focused on workforce development, skills training, program and service delivery optimization, and innovative solutions to support populations at risk or with significant and/or multiple barriers to employment.

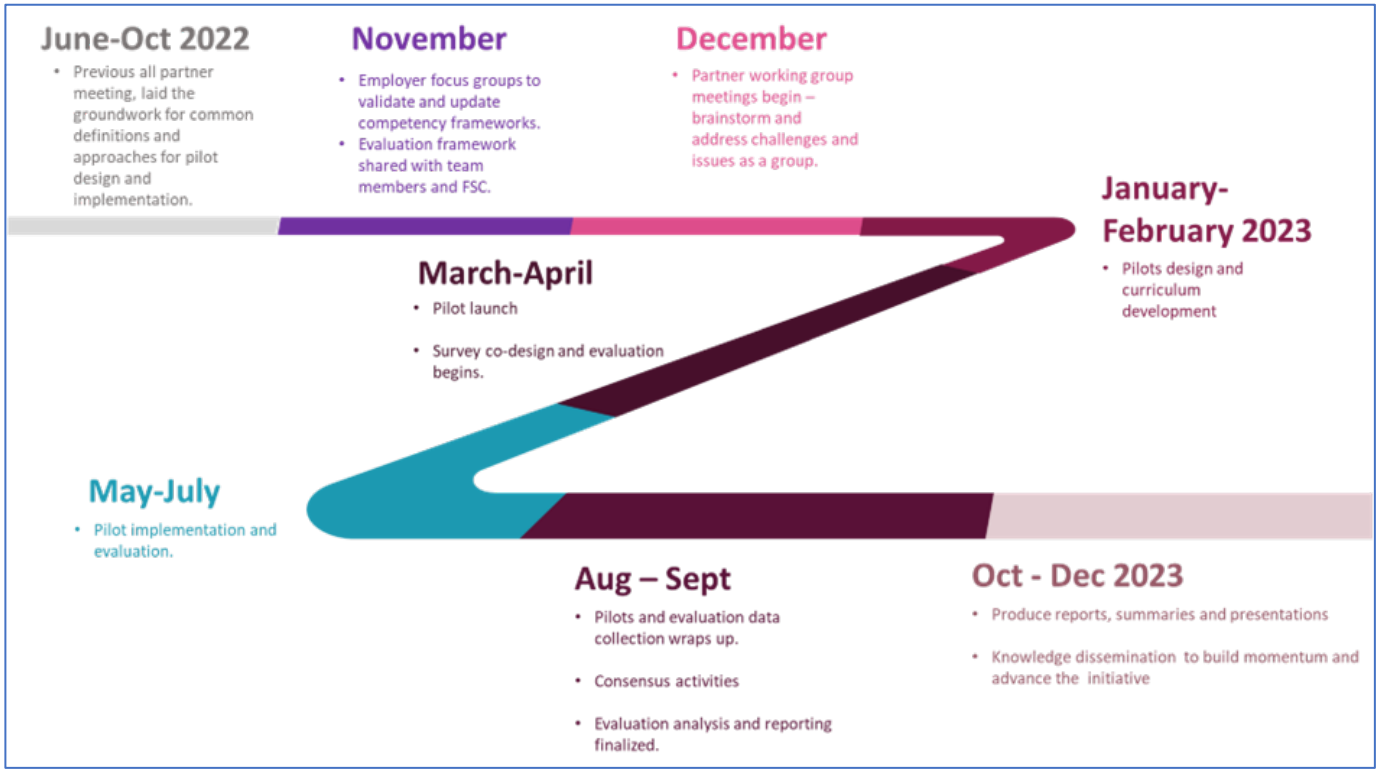
This cross-sectoral collaboration worked to build the critical mass of sectoral stakeholders to be the champions and driving force behind this skills development approach. EMC and SRDC worked together on project objectives, leveraging shared experience from previous projects focused on workforce development, skills training, program and service delivery optimization, and innovative solutions to support populations at risk or with significant and/or multiple barriers to employment.

2. Activities and Timeline

Figure 1 provides an overview of the timeline of the project. Specifically, starting in June 2022, activities for this project included the environmental scan, competency framework review, and key informant interviews with project partners and micro-credential experts from selected post-secondary institutions (Toronto Metropolitan University, eCampus Ontario, Northern Alberta Institute of Technology).

Between September 2023 and January 2023 pilot development activities occurred across the partner organizations. Between February and August 2023, sector organizations piloted and evaluated their micro-credential training. SRDC interviewed partner organizations again to follow-up with sector groups to determine the feasibility, sustainability, and effectiveness of their pilot activities. Between October and December 2023, the project team focused on analysis, report-writing, and knowledge dissemination activities to share project findings to other sectoral, educational, and governmental stakeholders.

Figure 1: Project Timeline



3. Environmental Scan: The current state of micro-credentials

In a nutshell, micro-credentials are a modernized approach to skills development where learning is not confined to the traditional walls of classrooms but rather obtained in dynamic and flexible ways. These compact and specialized learning experiences mark the start of a new era of professional growth and development. Seen as a catalyst for career advancement and a way to meet sector-specific needs, micro-credentials act as a key to unlocking new possibilities for individuals and industries alike. In the fluid landscape of modern businesses, micro-credentials emerge as a strategic advance, offering sector-specific excellence while positioning employees for success in ever-evolving professional environments.

Use case for micro-credentials

Micro-credentials serve a unique range of purposes in the professional landscape. They are instrumental in upskilling the existing workforce and enhancing skills and competencies to meet constantly evolving labour market needs. They are sometimes utilized to meet regulated competency requirements such as in applied health science professions or to recognize prior learning in regulated fields (Future Skills Centre, 2022). In addition, micro-credentials can be used to access untapped potential such as to prepare youth for specific sectors, ensuring job-readiness (Ontario, 2020). They can also be used to facilitate reskilling within sectors, enabling individuals to transition into different roles or occupations.

More broadly, micro-credentials are not just tools, they are the driving force behind sustainable workforce development, especially in the context of post-pandemic recovery (CVETNET, 2023). Micro-credentials play an important role in complementing and enhancing education, training, lifelong learning, and employability ecosystems (OECD, 2023). Moreover, these bite-sized training programs can be utilized to address soft skills gaps through work-based learning and employer involvement in the assessment process (Presant, 2020). Attention is brought towards authentic assessments of applied capabilities, particularly with transversal skills. Through these micro-learning advantages, employees are transformed into extraordinary contributors to the workforce.

Micro-credentials offer learners a wide range of flexible delivery formats to accommodate diverse learning preferences and needs. These formats can include in-person, online, or blended approaches. The adaptability of the assessment methodologies following the courses is also an asset in the learning process. Rather than relying typically on the standard 50% pass rate threshold seen in standard testing procedures, micro-credentials have introduced the practice of a 90% mastery score. This empowers learners to repeatedly tackle assessments until a solid understanding is achieved, challenging the standard of having just one opportunity to pass a course (Ministry of Advanced Education and Skills Training, 2021). Alongside flexibility, another key feature that micro-credentials encompass is its concept of “stackability”. Rather than replacing traditional higher education models, micro-credentials are made to be strategically integrated or added onto existing post-secondary education qualifications (Future Skills Centre, 2022).

Notably, micro-credentials have a significant impact on improving training access, particularly for groups that have been traditionally underserved in formal education (Hijden & Martin, 2023). Micro-credentials allow for faster and more inclusive learning. This can be advantageous for those who may not be able to commit longer hours in traditional programs due to numerous personal, financial or employment-related barriers. By breaking down these barriers, micro-credentials allow individuals hindered by social and economic obstacles to engage in career development and specialized training pathways.

The need for industry-led micro-credentials

While the concept of micro-credentials shows great promise, it is evident that there is unevenness in the landscape surrounding ideas such as perceived value, assessment methods, design, etc. This stems from a lack of a universally accepted definition for micro-credentials and inconsistencies between courses. There is a demand for collaboration with key stakeholders, learners, employers, community partners and post-secondary institutions to establish a thriving ecosystem. By establishing a transparent and dependable knowledge sharing system, skills training that resonates with the needs of both learners and employers can be established (Future Skills Centre, 2022). Additionally, efforts to clearly define and raise awareness about micro-credentials are essential for identifying untapped interests of employers and employees. Industry-driven micro-credentials serve as a bridge, aligning this newfound interest with the dynamic needs of the workforce and reshaping the micro-credential landscape.

Canadian micro-credential landscape

When exploring Canada's journey on the realm of micro-credentials, it is evident that there is a lot of potential. While the absence of established standards across a provincial and federal scale might add complexity, provinces are introducing unique and innovative approaches to implement micro-credential training.

Colleges and Institutes Canada (CICan)

To develop an understanding of the federal landscape, Colleges and Institutes Canada (CICan), a national organization that represents publicly supported post-secondary institutions conducted a scan of micro-credentials in various regions across Canada. They utilized the working definition of micro-credentials as "certifications of assessed competencies that is additional, alternate, complementary to or a component of a formal qualification" (College & Institutes Canada, 2021).

The scan highlighted the interest of micro-credentials throughout Canada with consensus on the value they bring due to features such as stackability, flexibility, validation, and accessibility, especially with vulnerable populations. The importance of bringing in business and industry partners in both the development and implementation phases was emphasized by stakeholders throughout the nation.

In September 2020, the Higher Education Quality Council of Ontario, a collaborative partner with the Colleges and Institutes Canada distributed a survey to 2,000 working-age Canadians who were not currently enrolled in post-secondary programs. Results indicated that only a quarter of the participants had heard of the term "micro-credential" and that only some of them understood the meaning of the word. The survey also indicated that almost 70% of participants expressed an interest in the concept of short and skilled-based learning in terms of their professional development (College & Institutes Canada,

2021). This indicates a notable gap in comprehension and lack of familiarity with the concept of micro-credentials, despite potential interest from many Canadians.

CICan expressed next steps including further establishing a national consensus on micro-credential characteristics and collaborating across Canada to make micro-credential learning recognized and offered by the colleges and institutes associated with CICan.

British Columbia

British Columbia introduced a $5 million dollar fund for the implementation and development of micro-credentials into post-secondary institutions. This support aims to create and rollout an extra 35 micro-credentials that align with labour market priorities, targeted across 7,500 learners within 3 years (Ministry of Advanced Education and Skills Training, 2021). Micro-credentials are defined distinctly by their competency-based nature, recognizing the brief learning episodes that align closely with the specific needs of various key players including industry, employers, communities, and Indigenous communities. With the guiding principle of inclusivity and dismantling barriers to education and employment. BC has prioritized a commitment to quality to ensure that micro-credentials meet standards.

The assessment process has been intentionally designed to be relevant and mirror how employers perceive and acknowledge competency attainment. Employer alignment and validation is achieved by collaboration actively with stakeholders. This ensures that micro-credentials are academically credible through support with post-secondary institutions while being competitive with the realities of the labour market (Ministry of Advanced Education and Skills Training, 2021).

In British Columbia, Thompson Rivers University has pioneered incorporating micro-credit transfer as part of university degree programs. Other institutions have followed along, such as the University of British Columbia implanting badging and Simon Fraser University offering micro-credit courses.

Nova Scotia

Nova Scotia defines micro-credentials as recognition of assessed competencies and skills through short-duration or applied learning experiences that can either stand alone or be interconnected and stacked with other credentials. Nova Scotia's guiding principles follow a focus on relevance, trustworthiness, partnerships, and pathways.

The assessment process involves an emphasis on validity, reliability, practicality, flexibility, fairness and sufficiency. There will be alignment with the assessment methods and the Universal Design for Learning and IDEA principles, with a range of tools used such as standard exams, portfolios, peer assessments, simulations, demonstrations, automated assessments and expert reviews through workplace, educational and contextual settings. Equitable assessments are prioritized to create inclusive and accessible learning environments, including those whose first language may not be English.

The alignment and validation process begins with employer engagement throughout the development. This is followed by the utilization of Labour Market Information (LMI) to confirm demands for skills and competencies and employer confirmation of micro-credentials ability to address demand while aligning with the competency frameworks and employer recommendations (Nova Scotia, 2023).

Ontario

Ontario has expanded its Student Assistance Program (OSAP) to include financial aid for 600 micro-credential programs. One of the leaders of this initiative is eCampus Ontario which aims to help institutions, industry and communities develop and test online learning tools to advance education.

eCampus Ontario's guiding principle in micro-credential development highlights verifiability, ownership and extensibility. This ensures that micro-credentials language aligns with common competency frameworks. They commit to consulting with employers and post-secondary institutions to connect with the evolving labour market (eCampus Ontario, n.d.).

A unique design priority by eCampus Ontario is to ensure micro-credentials are designed to seamlessly be integrated to existing transcripts and educational records. Summative assessments highlight tangible evidence of outcomes to transparency and credibility for employers. Similarly, there is emphasis on reliability and authenticity during the assessment process.

In terms of employer alignment and validation, micro-credentials are offered through established agencies, institutions, and employers where confirmation about the demand of the industry is received through collaboration (Bigelow et al., 2022).

Alberta

In 2021, Alberta announced a micro-credential pilot program partnering with post-secondary institutions and the industry. The government of Alberta launched a collaboration with post-secondary institutions, industry, and employers to invest over $5.6 million dollars into a pilot program to create micro-credential learning opportunities in priority sectors and high-demand industries. These programs range from reskilling to upskilling for individuals hoping to enter or re-enter new employment avenues.

This new initiative is a key component of Alberta's Recovery Plan, a strategy to diversify the economy and create jobs. Micro-credentials have been determined as a key element in investing in skills for success and allowing Albertans to advance in or pivot their careers. The pilot program offers 56 different micro-credential programs with work-integrated learning components in partnership with 19 post-secondary institutions to address labour market needs in priority sectors and support career advancement (Alberta, 2021).

Saskatchewan

Finally, the government of Saskatchewan is championing the adoption of micro-credentials through the release of "Saskatchewan's Guide to Micro-Credentials" in line with the province's Growth Plan priority. This initiative focuses on cultivating a skilled workforce that keeps up with the evolving economy through the concise and focused programs ("Micro-credentials in Saskatchewan", n.d.).

International micro-credential landscape

In the past few years, there has been growing global experimentation with the idea of micro-credentials. This has led to a shift worldwide in how education and professional development has been perceived and consequently has led to the development of various unique frameworks.

New Zealand

New Zealand is one of the leading countries in the world in the field of micro-credentials and has demonstrated proactive approaches to its educational system. Micro-credentials have been designed here to seamlessly integrate into the National Qualification System where it receives the same recognition as traditional degrees, diplomas, and certificates. Using a centralized framework, it serves as a guide to all the educational issuing authorities.

Micro-credentials are officially defined and regulated by the New Zealand Qualifications Authority, who outline characteristics and procedures for recognition. This included guidelines such as size, which needed to be valued between 5 and 40 credits (College & Institutes Canada, 2021). Furthermore, the Qualifications Authority Guidelines attracted significant attention because adherence to them resulted in eligibility for public funding, adding another layer of importance to their role in shaping the recognition and integration of micro-credentials in New Zealand.

New Zealand's definition places emphasis on a coherent set of skills and knowledge with a clearly defined elements such as purpose, learning outcomes and industry or community demand. There is a lot of overlap with CICan's definition of micro-credentials, though it doesn't explicitly highlight competency-based criteria (College & Institutes Canada, 2021).

Australia

In 2020, the Australian government invested $4.2 million dollars into the creation of a "Micro-credentials Marketplace", which was designed to serve a nationally uniform platform of digital learning course offerings. While conducting user research through collaborating with learners, higher education providers and employers who utilized the marketplace, it became apparent that the lack of a national framework servers as a barrier to further micro-credential development. This led to the development of the National Micro-credentials Framework in 2022, which aims to instill more transparency, consistency, and objectivity in the sector with credit recognition and micro-credentials (Australian Government, 2021).

The government has also invested $18.5 million dollars into The Micro-credentials Pilot in Higher Education Program, with the goal of delivering 28 micro-credential courses provided by 18 universities to approximately 4,000 students by 2026. These courses will range across various sectors where upskilling and reskilling is necessary such as teaching, nursing and engineering (Ministers' Media Centre, 2023).

Deakin University has acted as one of the champions, by releasing a document titled "Making Micro-Credentials Work for Learners, Employers and Providers". This document not only does an incredibly thorough examination of micro-credentials but has also been utilized frequently in international discussions (College & Institutes Canada, 2021).

Europe

In March 2023, Europe hosted the International Micro-credentials Summit in Barcelona. Over 100 international policymakers, educational leaders, innovators, CEOs of EdTech companies and stakeholders in continuous and higher education platforms met to discuss the potential of micro-credentials in the European education landscape. One major takeaway from the summit was the importance of cooperative partnerships between the various European leaders and policymakers in micro-credentialing strategy ("Micro-credentials: An Evolving Discourse", 2023).

Moreover, on the landscape, the European Education Area is an initiative that has been introduced by the European Commission with the purpose of creating a more integrated and collaborative education system across Europe. The aim is to create more efficient and accessible education systems by 2025 while promoting excellence, inclusivity, and innovation. This has led to Europe embracing micro-credentials as a crucial part of their educational framework. This has led to the launch of projects such as MICROBOL, which focuses on enhancing the recognition and transferability of micro-credentials through student-centered learning and flexible educational pathways.

In addition, the Common Micro-credential Framework, developed by the European Massive Open Online Course in 2019, has been utilized to set parameters and standards for micro-credentials (College & Institutes Canada, 2021).

United States

There has been a major shift in the past decade from major companies within the United States such as Apple, Google, IBM, Bank of America and EY, as they have moved away from requiring degrees for new hires. This transformation comes in response to the high cost associated with traditional academic degrees, with over $1.5 trillion dollars owed in student loans in the United States. Despite substantial investment in education, employers continue to report struggling to identify workers with the skills they need. Many jobs now require higher level skills now than they have in previous years, contributing to skill mismatches and shortages. Major industry players such as Google and Amazon have adjusted to increasingly favouring candidates with professional certificates (Mateo-Berganza Díaz et al., 2022).

While there is no national system established in the United States, there are a lot of flexible supports that have been established to acknowledge and advance micro-credentials. The National Association of College Registrars has played a pivotal role in recognizing and celebrating the diversity in the space of alternative credentials. Rather than just viewing micro-credentials as scaled-down diplomas, the unique attributes of micro-learning courses. Moreover, the association also identifies the use of Open Badges as a form of recognition, which illustrates a forward-thinking and adaptable approach to the evolving nature of alternative credentials.

The United States has also adopted the Credential Transparency Description Language (CTDL) database, which serves as a centralized repository of credentials. With the goal of standardizing and organizing information about micro-credentials, the CTDL finds commonality around nomenclature, quality, and content.

There have been industry partners who had led initiatives to further promote and implement micro-credentials. For instance, IBM has created The Learner Credential Network (LCN) a verifiable blockchain-based digital record of learning that secures the integrity and authenticity of micro-credential

certifications. It also allows for a seamless way to verify learning achievements and reduce fraud (Future Skills Centre, 2022). Initiatives like the CTDL and the LCN demonstrate a commitment to building trust and increasing accessibility of digital learning.

Other

Various other countries, including Korea, China and Singapore have begun to develop their own digital systems and passports that help log and manage credentials. These systems act as a part of a greater global landscape of micro-credentials by providing efficient and accessible means of tracking and verifying individual accomplishments.

Consultations with SMEs, sectoral partners, and key subject matter experts

To deepen our understanding of micro-credentials between June and August 2022, SRDC conducted preliminary consultation interviews with key subject matter experts from eCampus Ontario, Northern Alberta Institute of Technology, Toronto Metropolitan University, as well as noted micro-credential Subject Matter Expert Don Presant, President of CanCred Open Badge Factory. Additionally, we conducted interviews with sectoral partners, who also had conducted extensive research into micro-credentials or had first-hand experience implementing micro-credentials prior to the project. These sectoral interviews provide the project with a deep understanding of the state of micro-credentials and their relevance and use in their respective industries. Interviews were audio-recorded and transcribed verbatim using NVivo's transcription module (NVivo 14, QSR International, 2023).

Findings

Lack of consensus and clarity in definition

A lack of consensus regarding the definition of micro-credentials is evident in the existing literature, posing a challenge to their recognition and uptake in educational and professional contexts (United Nations Educational, Scientific and Cultural Organization, 2022). This lack of consensus creates confusion and hampers effective communication among stakeholders, including educators, employers, and learners.

To contribute to creating a shared understanding of micro-credentials, initiatives have emerged to address the challenges. Notably, the efforts of eCampusOntario and the Future Skills Centre have aimed to establish a common understanding and foster consistency in the recognition and implementation of micro-credentials. The eCampusOntario micro-credential framework is a living document that outlines principles and framework for designing micro-credential programs and building a harmonized micro-credential ecosystem in Ontario. The framework is encouraged to be tested when launching a micro-credential program (eCampus Ontario, n.d.).

Table 1 **eCampusOntario micro-credential principles and framework**

Principles	Framework
▪ **Relevance**: Micro-credentials will only be issued for competencies that are currently relevant to the labour market.	▪ Issuing body: Established agency, organization, institution, or employer
▪ **Verifiability**: Micro-credentials will be verifiable, and integrity will be maintained.	▪ Competency/skills targeted: adhere to harmonized skills and competency language & aligned with a common competency framework such as ESCO (European Skills/Competencies Qualifications and Occupations - European multilingual classification of skills, competences, qualifications and occupations)
▪ **Ownership**: Once awarded, micro-credentials and associated data will be the property of the earner.	▪ Outcomes: Recognize performance competencies
▪ **Extensibility**: Micro-credentials will be designed to facilitate continuous pathway for lifelong learning, where possible.	▪ Summative assessment: Require evidence of achievement of outcomes. Evidence will be embedded and visible to employers ▪ Transcriptable: Compatible with traditional transcripts, where possible ▪ Partner endorsement: Validated by industry partners/external bodies to confirm 1) the competency is in demand by industry and; 2) the established assessment is reflective of job performance in that industry

Source: eCampusOntario micro-credential principles and framework

In an effort to refine the micro-credential principles and framework, eCampusOntario collaborated with a number of post-secondary education (PSE) institutions in Ontario to launch 36 micro-credential pilot programs. These pilots served as a testing ground for the framework's effectiveness. The lessons learned from these pilots and recommendations to advance the micro-credential ecosystem in Ontario are outlined in a report by Future Skills Centre (Future Skills Centre, 2022).

Additionally, eCampus Ontario has recently enhanced its widely used "Micro-Credential Portal" to help job seekers and workers improve their career trajectories through skills-based training for in-demand jobs. By inputting their skills and job titles, the system will identify their existing skill sets and cross-

reference it with an inventory of over 2000 micro-credentials offered by various post-secondary institutions in Ontario. Through its partnership with the Conference Board of Canada and Future Skills, eCampus Ontario has empowered individuals to accelerate their skill development (eCampus Ontario, 2023).

Table 2 **Lessons learned and recommendations from the micro-credential pilot projects**

Key lessons	Key recommendations
▪ Balancing a common definition and flexibility	▪ Create robust employer and educator networks to facilitate collaboration and connection across sectors.
▪ Filling the awareness gap	▪ Conduct further research into the assessment methods that work best in the context of micro-credentialing.
▪ Improving assessment in the micro-credential ecosystem	▪ Conduct a comprehensive mapping of skills in demand in the present and future.
▪ Meeting learner needs	▪ Amend the eCampusOntario Principles and Framework to account for the insights gathered in this report.
▪ Collaborating in the micro-credential ecosystem	▪ Support experimental and innovative micro-credential development, delivery, and pedagogy.
	▪ Drive awareness of micro-credential potential and opportunity across Canada among the stakeholder groups identified in this report: educators, employers, and learners.
	▪ Conduct additional research on the potential of micro-credentials to support competency and skill development among equity-seeking groups.
	▪ Invest in research to capture feedback from learners and/or employers.

Source: The Future is Micro: Digital learning and micro-credentials for education, retraining and lifelong learning

Internationally, several countries have taken steps towards standardizing micro-credentials within their respective jurisdictions. Prominent examples include the European Union(EU), New Zealand, Australia, and Malaysia. For example, the New Zealand Qualifications Authority (NZQA) has made strides in integrating micro-credentials into the regulated education and training system (NZQA, 2023). Australia has introduced a national micro-credentials framework that encompasses higher education, vocational education, and industry sectors. This framework provides a common understanding and definition of

micro-credentials, ensuring consistency and quality across different educational pathways (Australian Government, 2021).

Common defining features of micro-credentials encompass their role in supporting upskilling and reskilling in response to labour market transformations (Future Skills Centre, n.d.). They can hold standalone value, but they can also complement prior learning and promote lifelong learning (OECD, 2023). One notable feature of micro-credentials is their ability to recognize and validate both soft and hard skills. Micro-credentials can be developed by educational institutions or in collaboration with employers (Ministry of Advanced Education and Skills Training, 2021), reflecting the need for close alignment with industry demands and skill requirements. Moreover, authentic assessment of applied capability embedded in workplace practice rather than assessment of course content would be the typical need of a micro-credential in the workplace, particularly when applied to transversal skills (Presant, 2020).

General themes

When asked about **why micro-credentials are important**, industry and key subject matter experts highlighted that they are a method to upskill workers to address labour and skills shortages. Micro-credentials are typically shorter than other traditional post-secondary training and minimizes lost productivity due to workers being off the production line.

Industry partners have a **strong capacity to leverage their existing inputs** to keep an up-to-date understanding of job competency needs that are validated with employers. These are usually focused on practical skills required on the job with a varying degree of customization to roles, occupations, and subsectors. Other existing resources include labour market information (LMI), National Occupational Standards (NOS), sector-side competency dictionaries, Canada's Skills for Success framework, and skills mapping for in-demand occupations.

Many key informants emphasized the importance of both **technical ability and social-emotional skills** as components for worker success. Additionally, core foundational training in soft skills is essential across industries and can make employees more transferrable with skills that apply in different contexts. Micro-credentials provide an opportunity for confirming someone has soft skills, however, key informants stated that challenges remain around assessment methods.

Employers' buy-in and engagement

An early element of micro-credential development highlights the significance of employer engagement and participation in the process. Employers should be at the front of the pipeline for micro-credentials to adequately address their needs. Unfortunately, key informants emphasized that employers have a low general awareness of the micro-credential landscape and employer participation remains a significant challenge.

There's this perception from employers of the "Wild West" of micro-credentials and short courses… It's hard for employers to understand: "Is this valuable? Is it validated? How do I know if this person with this micro-credential is going to be a good employee for me? (ICTC)

There was considerable emphasis on the need for including employers from the start of the micro-credential process to ensure that training is industry-led, and therefore, relevant for and meets employer needs. For example, key informants stated the importance of aligning training objectives with worker competencies. Therefore, development requires close collaboration with employers (or a group of employers) to map and organization the key competencies. In short, industry are the subject matter experts, but the time commitment for employers can be a substantial barrier to their engagement.

It is important to ensure employer involvement in the validation and assessment processes, however, engagement and assessment strategies need to consider industry cycles (e.g., harvest, or high tourism seasons). In addition to busier seasons for some industries, surveys or other assessment methods need to be short, accessible, user friendly, and must not interfere with workflows as much as possible.

Assessment and competency demonstration

Key informants clearly emphasized that micro-credential credibility is linked to contextually specific, competency-based assessments for the validation of skills. Assessments also need to balance efficiency, fiscal, and logistical considerations with methodological rigour and validity. Another component is ensuring that these parameters and partnerships between micro-credential trainers and employers are defined at the start to ensure the sustainability of the process. Key informants indicated that is also helpful when assessments are collaborative between the employee and the evaluator.

A micro-credential program without assessment carries very little weight with an employer. (eCampus Ontario)

That's what our workplace performance projects are doing. And not only to do the job, present and discuss it with management, and show that you have mastery of the solution. (EMC)

Varied approaches to assessment include on-the-job approaches where supervisors or coaches are trained in assessment and sign off on a participant's demonstration of the necessary skills to issue the micro-credential. A downside to this observational approach is that it's time intensive, and therefore, expensive. Regardless, the strength of employer participation in assessment is worth the effort and there are a variety of ways to incorporate this into the flow of work:

- Workplace performance projects
- Competency logbooks
- Practical demonstrations of skills on the job (e.g., in real-time or as a submitted video recording)

- Other assessments: Multiple choice situational judgment tests, behaviour-based interviews, and benchmarking participants in comparison with "ideal" employee in the same role.

> *It's one thing to assess general knowledge and best practices on project management. But how do you assess for the difference between entry level and expert level? I think that's another use case for micro credentials that the traditional credential and education system isn't addressing. And I think there's an opportunity there. (NAIT)*

Key assessment challenges include contextual factors. For example, how to assess communicative skills in a manufacturing facility compared to an executive role is very different. Additionally, there are differing levels of skill complexity that are difficult to tease out and distinguish between entry- and mid-career job expectations. Another challenge includes balancing the assessment to ensure it's appropriate for existing employees on the job while also applying to people who are in the process of skills development. In other words, employees should also be able to take assessments as part of the process to recognize existing skills of prior learning and experience. This ensures that micro-credentials also address learner needs by allowing people to demonstrate learning from "non-traditional" pathways such as mentorship, on-the-job training, or self-directed learning.

Partnership and collaboration

> *The industry looks to us to be the leader on this, to show them the way, and to provide them with the tools they need. I don't think any of them in industry are interested in being the leader of this or the keeper of the credentials. (CCAA)*

While employers were seen as needing to be in the driver's seat, industry associations were perceived by key informants as having the ability to facilitate collaboration between post-secondary, employers, and other potential stakeholders. They are also best positioned to identify and recognize existing or emerging gaps in skills and labour. Moreover, industry groups often have a reputation that employers recognize, which key informants identified as a major strength. Therefore, industry associations being strong proponents of micro-credentials can help to build credibility and awareness (i.e., employers may not recognize the value of micro-credentials, but they trust the judgment of their industry associations if they value it).

Post-secondary education (PSE) is another major player in the ecosystem. Partnerships on micro-credential development looked differently depending on the industry, as well as how well-developed collaborative networks are between PSE, industry, sectoral partners, and other actors. In general, connections between employers, PSE, and industry partners are perceived as beneficial because every stakeholder brings varied expertise.

> *We work well with the colleges, but it does take them longer to update and it's harder for them to, you know, when they want to change something, it has to usually wait to the next year. (CCAA project staff)*

PSEs bring strengths with pedagogy, assessment, and curriculum development. Most have existing training space. Key informants shared varied viewpoints on the role of post-secondary education. Some thought they might be ideal providers for micro-credential training and assessment, while others viewed PSE as partners but not the sole drivers. The considerable emphasis on flexibility of training might be challenging for PSE, which is seen by some as slower to adapt to industry trends and changes. There is also tension when PSE and other micro-credential providers are perceived as a competitive relationship. Key informants emphasized that the partnership between PSE and industry micro-credential providers can be complementary and collaborative rather than competitive. In general, there is a need for PSE to adjust how they provide training by potentially building better, or new partnerships with industry and micro-credentials may be a timely opportunity to build those collaborative networks.

Emerging best practices

Based on these early interviews with four experts on micro-credentials, and the six project partners, we can summarize themes into an array of **emerging best practices for pilot design and implementation.** These included a variety of insights including lessons learned from previous implementation challenges, as well as what was currently working well for partners. Lastly, key informants shared what they would like to see in an ideal micro-credential ecosystem. These best practices include:

- Micro-credential curriculum that is demand driven, industry led – built on **up-to-date** competency profiles and meeting the needs of both employers and learners
- Ideal for skills with a **degree of cross-industry transferability** (e.g., food handling, first aid, time management, communication skills, etc.)
- Short, flexible training formats, including online (self-directed e-learning, virtual facilitated) and accessible through multiple devices
- Training includes work-integrated learning where possible
- Training into the flow of work to reduce disruption and provide learners the chance to immediately apply and practice what they have learned
- **Employers should be involved in development, including design of training assessment**
- Strong assessment approaches to both validate new skill acquisition and recognize skills gained through past experience
- Explore benefits of having micro-credentials **adopted by funding or regulatory bodies** (e.g. faster approval by regulatory agency)

Challenges and opportunities

There were a variety of challenges mentioned by key informants that went beyond the primary challenge of employer engagement and assessing competency-based skill acquisition. Another issue for the assessment of micro-credentials is the difficulty in measuring soft skills. While technical abilities are generally easier to assess, it is less well understood how to measure soft skills such as problem solving, creativity, or adaptability in the workplace context. Additionally, some key informants mentioned the pace of technological change makes it difficult to predict in-demand skills.

> *Skills are changing relatively quickly… employers aren't getting this qualified talent they need. (ICTC)*

> *Post-secondary institutions are often looking for funding as well. So, we're all kind of faced with these challenges of finding the funding and implementing the programs and getting it off the ground. (CCAA)*

As previously mentioned, there is also that potential tension, or competition between post-secondary institutions and industry associations or other training providers who may all be looking for funding from similar sources. They may also compete for learners in some regions, and since education falls under provincial jurisdiction, there is a lack of consistency across provinces in Canada. Post-secondary and employers may also disagree on the very purpose and definition of micro credentials. For example, are they a pathway to traditional post-secondary credits or are they the assessment and recognition of non-traditional learning.

There are also major issues navigating the current micro-credential landscape. Generally, there is a perception of a deluge of micro-credential offerings of varying quality, and employers do not necessarily have the capacity to determine which micro-credentials are valuable, validated, and accurately indicate whether an employee has the associated skills to be successful in their workplace.

> *[Courses] are based on national occupational standards that have been validated. They have been formulated by employers and accredited post-secondary academic institutions. (BioTalent)*

Despite the challenges of the current micro-credential ecosystem, there are significant opportunities to leverage synergies across industry sectors. Through partnerships, there can be common efforts on transferrable skills micro-credentials that could apply across industries with some sectoral customization. Moreover, partnerships allow for the sharing of best practices on design, delivery, assessment methodologies, and the possibility of sharing content among sectors when possible. Additionally, through a collaborative approach with post-secondary education, there is potential to develop a collaborative system for design, delivery, validation, and therefore the accreditation or endorsement of micro-credentials developed by, or in partnership with industry training providers. This could better align PSE curricula with current and emergent industry needs.

Lessons learned

The successful implementation of micro-credentials faces many challenges. One obstacle is the lack of consistency in processes such as assessment, recognition, portability, and quality assurance, which can challenge applicability and transferability. Additionally, the lack of digital solutions for assessment, validation, sharing, and storage of micro-credentials can challenge portability. Another hurdle lies in the limited use cases of micro-credentials in employer workflows, such as hiring, onboarding, upskilling, and promotion, which can challenge implementation. Furthermore, the lack of employer buy-in and acceptance of micro-credential outcomes as a proof of competency development can challenge sustainability. Lastly, the lack of learner relevance can challenge motivation to complete micro-credentials, especially when implemented in a virtual and self-directed learning environment.

The environmental scan has provided valuable insights into the lessons learned for the successful development of micro-credential programs. While micro-credentials share similarities with regular course, they are more flexible in format, length, and content, which necessitates context-dependent approaches. Additionally, it is important to establish different kinds of partnerships between industry and PSE institutions. For example, in some cases, industry takes the lead in developing content and assessments while PSE institutions deliver the training, ensuring alignment with industry needs. In other instances, industry plays a role in quality control, certifying that a course developed and delivered by PSE meets skills needs. Furthermore, industry can provide content control, certifying performance standards to inform PSE curricula. Another approach is involving a collaborative partnership between industry and PSE institutions in all aspects of design, delivery, and assessment. This collaborative approach ensures that the micro-credentials address the specific skills needs of industries while maintaining academic rigor.

4. Research Framework for Cross-Sector Synthesis

Evaluation framework

As a proof-of-concept, or feasibility study, the evaluation focused on questions related to micro-credential **implementation** (process) and **effectiveness** (outcomes). The current project timeframe did not permit more complex statistical analyses such as impact or rigorous cost-benefit analysis; these would require a longer timeframe to stabilize the implementation model and then pilot in a comparative design to measure the incremental effects of the training. Following are the key research questions and research tools for the implementation and outcomes evaluation.

Key evaluation questions

Implementation (Process)

The key evaluation questions on implementation focused on the delivery of the micro-credential pilots: the method(s) and extent (length, depth) of the training, the characteristics of the participants and employers, and any adaptations or customizations to the curricula. We used these approaches to gather information and analyze what features were associated with successful implementation to identify lessons learned to support future delivery and potential expansion.

Key questions included:

- How was each pilot **implemented** and were they implemented according to plan?
- What are the characteristics of the employers, and the participants, who took part?
- Was there any **adaptation or modification**, and if so, what, and why?
- What challenges occurred during the pilot?
- Were innovations introduced during design or delivery?
- What were key **best practices** and **lessons learned** to ensure future iterations will be successful?
- What are the key factors to ensure **sustainable design, development, delivery, and evaluation** of micro-credentials in the future?
- What are the factors to maximize **employers' buy-in**, recognition, and acceptance of micro-credentials as a proven skills development mechanism for their workforce?
- What are the factors to maximize **learners' engagement**, motivation, and completion of micro-credentials?
- What are the factors to maximize partnership and collaboration across key stakeholders **within a sector** to further foster industry-led micro-credential development (including employers, industry associations, and post-secondary institutions)?

- What are the factors to maximize **cross-sector** partnership, collaboration, and sharing of knowledge?

Effectiveness (Outcomes)

The key evaluation questions on effectiveness of the micro-credentials focused on learning outcomes achieved by learners; the capacity-building of stakeholders to design, develop, and deliver micro-credentials; and the effects of cross-sector partnerships and collaboration.

The following lists examples of the outcomes questions:

- Did **learners** achieve the intended skills gains and other learning outcomes?
- What improvement in **skills** did they achieve (e.g., technical skills, social-emotional skills)? To what extent did their skills improve (i.e., magnitude of skills gains)?
- What improvement in **job competencies** did they achieve (e.g., safety, productivity)? To what extent did their competency improve (i.e., magnitude of competency gains)?
- What improvement in other **psychosocial assets** did they achieve (e.g., self-efficacy, social networks, receptivity to continuous learning)?
- What change in capacity to design, develop, and deliver micro-credentials did project **stakeholders** achieve?
- What enhancement in capacity did industry associations achieve?
- What enhancement in capacity did post-secondary institutions achieve?
- Did the project contribute to an increased capacity for **collaboration across sectors**? What were the tangible outcomes to increased collaboration?

Approach and research tools

The evaluation utilized a mixed-methods approach, with research tools designed to collect data to support both the implementation and outcomes analyses. Data sources included learners, employers, project staff and other stakeholders, and program administrative data. The primary research tools include qualitative focus groups and interviews, and quantitative surveys.

Research tools were selected and refined based on the numbers of learners and employers participating, discussion with industry, and to minimize respondent burden especially in busy workplaces. Following is a list of the tools and the main types of data they were designed to collect:

Baseline surveys with learners:

- Implementation: Background demographics and characteristics of learners
- Outcomes: Baseline skills and competencies assessment (self-reported and/or administered)

Post-training surveys with learners:

- Implementation: Feedback on micro-credential curriculum, delivery

- Outcomes: Post-training skills and competencies assessment to measure changes in skills (e.g., technical and social emotional) and competencies (e.g., safety, productivity, other KPIs)

Interviews and/or focus groups with employers, and with program staff to gain in-depth, experiential information from multiple perspectives on:

- Implementation: Training strengths and weaknesses, bottlenecks, use of training materials, lessons learned, adaptations, future sustainability
- Outcomes: Why and how specific elements of training may have contributed to outcomes; effects of the training on learners (specific illustrations/examples); effects on workplaces; on future cross-sector collaboration; implications for competency frameworks and where to go from here

Most project partners each had their unique way of designing and implementing the data collection tools aligned with their own micro-credential pilots. Partners used the same overall evaluation framework as a common guide for all partners to work toward answering the same overarching questions. In this report, we synthesized pilot findings across all partners to facilitate further discussion. These cross-sector themes will be shared more widely to inform future decision-making, supporting the sustainability of such industry-led, competency-based micro-credentials in the long run.

Draft common elements of micro-credential pilots

Before the sectoral partners started delivering the micro-credential pilots, we came to an agreement on the draft common elements that all of our micro-credential pilots should have, to ensure some degree of consistency. Figure 2 summarizes these common elements raft common elements.

Figure 1 Common elements of micro-credential pilots

Competency-focused
Address a targeted gap in learner's job competency, support better job performance

Aligned with current industry needs
Contribute business outcomes, e.g., safety, productivity, quality, environmental impacts, revenues, customer relations

Responsive to workplace context
Minimize opportunity costs of training, especially for small and medium-sized businesses, e.g., minimize worker release time

Assessment-based
Include assessments relevant to the workplace

Potentially connected to post-secondary programming
Leverage opportunities to partner with post-secondary institutions

More specifically, we wanted to emphasize the competency-focused nature of these industry-led micro-credentials – that the micro-credentials should address a specific gap in learner's job competency, with the goal of supporting better job performance as an ultimate learning objective. It should align with current industry needs and directly contribute to business outcomes that employers prioritize, for example in the area of safety, productivity, product or service quality, environmental impacts, revenues, customer relations, and diversity and inclusivity of the workforce. It should be responsive to workplace context, with minimal opportunity costs of training borne by the employers, especially for small- and medium-sized enterprises. We also aimed to include some form of assessments relevant to the workplace in the micro-credentials, to add some layer of training quality assurance for both learners and employers. Finally, we explored possibilities for collaboration with post-secondary education providers, finding ways to leverage and build partnerships as we go through the pilots.

5. Micro-credential Pilots

Collectively, the project engaged with close to 1,000 learners and about 300 employers through different micro-credential pilots. Specifically, across all participating sectors, we enrolled 943 learners in micro-credential pilots and supported 548 learners in completing their learning within the timeframe of the project implementation phase. On the employer side, 362 employers contributed to the project in various ways: as industry stakeholders and subject matter experts during the needs analysis and consultation phase to inform the design of the micro-credentials; as participating employers nominating employees for training during the implementation phase; and/or as providers of feedback and suggestions for improvement after the training. Given the short timeline of micro-credential implementation (approximately 6 months), this is an impressive achievement in raising awareness and generating conversations around micro-credentials across different sectors.

In this section, we describe the micro-credential pilots of all participating partners in greater details. We go through the background and rationale for the pilots, describe the design and implementation process, discuss the outcomes and findings, and summarize key takeaway messages from each of the partners' experiences. Project partner reports on their pilots are available upon request.

BioTalent

Background and Overview

BioTalent Canada's *BioReady* micro-credential pilot was motivated in part by labour market information (LMI) analyses suggesting that a "fairly significant" labour shortage in clinical trial biomanufacturing was imminent. Their goal was to develop a training program that would leverage BioTalent's existing evaluation tools (i.e., their BioSkills recognition program) to help people enter the bioeconomy. Prior to the pilot, BioTalent had used their BioSkills recognition program to map the "competencies of internationally educated professionals to the competencies of Canadian workforce" in their sector. By combining this system with an online training component, they hoped to create an efficient means for co-op students to develop the fundamental skills required for biomanufacturing roles. As the pilot

progressed, it became clear that their primary learner group was not inexperienced students, but internationally educated professionals with relevant experience. Despite the difference in intended and actual audience of the course, learners had positive experiences in the pilot, drawing value from it in ways that BioTalent did not expect.

Pilot Design

Development

A number of data sources informed the pilot development, including competency profile mapping, focus groups with industry stakeholders and labour market analyses. BioTalent used the National Occupational Standards (NOS), a framework with competency profiles for 53 roles in the bio-economy. Focus groups helped BioTalent narrow this framework down to 10 high priority roles. These groups were comprised of 18 employers, many of whom had pre-existing relationships with BioTalent or prior familiarity with their recognition program. In addition to role selection, these focus groups discussed the micro-credential's hiring value – e.g., would they be more likely to hire a job candidate if they had this micro-credential? Notably, BioTalent's pilot had already been drafted by this stage, as a description was provided to during focus group discussions. BioTalent felt having this concrete description of the micro-credential's design helped persuade some employers. Interestingly, at this stage, overall employer reception was mixed, i.e., not every employer was convinced that the micro-credential signified a "ready-to-hire" status.

Platform and Program Format

BioTalent's *BioReady* micro-credential consisted of three components: an online training program, the BioSkills competency mapping program, and an e-portfolio exercise. Online training included 13 online-asynchronous training courses (1-2 hours each) divided into two sections: an Essential Skills Fundamental series (e.g., Collaboration skills, Problem Solving skills) and a Technical Skills Fundamental series (e.g., Report Writing skills, Quality Assurance skills). Each course involved a pre-post assessment. Online training was structured so that completion of the Essential Skills course series was required before they could take the Technical Skills course, ensuring a steady learning progression. Courses were made interactive by including mandatory knowledge check questions. The pre-post measures tested learner's knowledge both before and after the course, providing an individual measure of learner progress as well as an overall validation of course quality.

After course training, learners moved to the e-portfolio creation and competency mapping stage. At this stage, learners chose one of the occupations within the bioeconomy and designed their e-portfolio to demonstrate their role fit. Specifically, learners selected five role-relevant skills to highlight in their e-portfolio, matching them to examples from their own background experience (e.g., education) and skillset. E-portfolios were then reviewed by one of 15 sector-experts selected by BioTalent based on their background and experience in one of the key bioeconomy roles. Reviewers evaluate the e-portfolio's relevance and fit for the learner's selected role. Learners received the BioReady micro-credential upon e-portfolio approval.

BioTalent hosted the micro-credential training courses on their learning management system (LMS), which was integrated into the BioTalent Canada website. This LMS was developed in cooperation by ILS, a service provider that BioTalent recommended highly due to their system's high degree of

customization and interactivity. Learners used this system to select courses and complete assessments. This system allowed BioTalent to track individual progress in multiple areas, including course statistics and assessment results. However, BioTalent identified some limitations in this LMS that needed further exploration. For example, though learners could complete everything on one system, they had limited access to LMS functionality beyond course selection. Another limitation of their LMS approach was that it could not be used to host or administer the actual credential. Instead, they used a customized system to issue, store, and display the learner's BioReady Status, e-portfolio, and competency map. Due to this separation in functionality, learner progression had to be coordinated across these two systems. Though manageable, BioTalent acknowledged that this occasionally led to "breakdowns in the pipeline" that connected learners from one system to the next. BioTalent was unsure whether they would keep this two-system approach in the future or take a more integrated approach. They believed this decision may be influenced by the outcomes of the project's overall micro-credential research.

Outcomes and Observations

Participants

Forty-nine learners enrolled in BioTalent's BioReady micro-credential, though only 39 learners completed the demographic survey. Of those who responded, 73% identified as women. Although the pilot was designed with younger co-op students in mind, only 18.4% of learners came from BioTalent's Student Work Placement Program. Instead, BioTalent noticed that most of their learners were internationally educated adult professionals. Indeed, most learners were over the age of 25 (77.8%), identified as immigrants (59.5%%), were members of a racialized community (67.6%), and were likely to hold a university-degree (i.e., Bachelor or higher) (88.9%). In addition, 15 reviewers were involved in the BioRecognition phase of the pilot. Reviewer demographics are not available.

Implementation

BioTalent felt their pilot was implemented according to plan. Adapting their existing BioRecognition program helped speed development by allowing them to focus on course development. Though there were some changes between design and implementation, the result was in line with their goals. As mentioned prior, they felt there was potential for mismatch between course design and learner experience. The course was designed to introduce co-op students to biomanufacturing fundamentals, but most learners were mid-career professionals with prior relevant experience. Despite a mismatch of course design and audience experience, learner responses suggested courses were still useful. Indeed, pre-post assessments suggested there were considerable knowledge gains for each course (approximately 10% or greater).

BioTalent felt their pilot was successful overall, but some areas needed improvement. One of the main challenges was pilot length, particularly at the e-portfolio stage. The length of this stage varied quite a bit across learners (from 30 minutes to 4 hours, with some longer exceptions), with delays occurring on both the learner side and the reviewer side. Some delays were due to procedural issues that could be easily addressed in the future. For example, some reviewers were unclear on their role in the process or unaware of e-portfolio submissions. Other challenges were more intrinsic to the recognition tasks' design. For instance, e-portfolio evaluation relied on the reviewer's subjective background experience to judge the learner's role fit. Consequently, evaluation difficulty (and, to a lesser extent, validity) varied based on the reviewer's familiarity with the e-portfolio content (e.g., credentials, institutions). BioTalent

thought it would be useful to supplement their subjective review process with "more systematic criteria for deciding if somebody's 'BioReady". They felt the main obstacle here was time and not a lack of information. BioTalent Canada already has a wealth of both information and criteria lists, but it would take time to incorporate those resources into the micro-credential.

Learners and Reviewers' Feedback

Learners appreciated the interactive course design. Though the introductory and essential skills courses were designed for entry-level individuals, experienced learners still found value in them. For example, international learners felt these courses helped them refresh their knowledge and gain a better understanding of the Canadian work culture. Learner responses suggested that the courses helped enhance their professional and interpersonal skills in addition to the intended biomanufacturing skills. BioTalent felt this was important because those interpersonal skills are a "pain point" for employers. Thus, the micro-credential seemed to supply skills valued by both learners and employers. Further, a pre-post assessment suggested that even experienced learners had observable knowledge acquisition gains.

E-portfolio reviewers had some constructive feedback for the pilot. As mentioned prior, the rating varied depending on the reviewers' familiarity with e-portfolio content, and having more systematic criteria would help standardize the process. Some reviewers (and employers) felt the e-portfolio evaluation may be too brief to reliably assess the candidate's skill level. BioTalent agreed that one limitation of their design was that assessments focused on knowledge acquisition and may not be sufficient to demonstrate skill level.

Employer Reception

BioTalent felt employers' response was mixed, leaning positive. Overall, employers seemed to find some value in micro-credentials, but were unsure whether that value was sufficient for hiring decisions, or whether they had value over other forms of skill development. This was demonstrated in the employer focus groups, where employers were unsure whether the micro-credential would be relevant to their hiring decisions. They noted that this mixed reception was not specific to their micro-credential pilot (which benefited from a clearly communicated design) but to micro-credentials in general. Employers' main concern was that most micro-credentials (including BioTalent's) focused more on assessing knowledge acquisition than validating actual skill level, despite the candidate's skill level being more relevant to hiring decisions.

From BioTalent's perspective, micro-credential reception faced two key challenges. First, there may be a lack of familiarity. Many employers were simply not familiar with micro-credentials or confused them with other types of training and credentialing ("some people think they are courses, some people think they are certificates" – BioTalent project staff). Though awareness of micro-credentials was increasing, due to their use by "big players" like Google and LinkedIn, awareness did not always entail understanding. This was complicated by the second dilemma, which was a lack of proper definition. BioTalent felt that the terminology and "taxonomy" of micro-credentials were currently ill-defined. Even if employers were aware of micro-credentials, it was difficult to know whether they were talking about the same thing when they used the term. Even BioTalent's own project team had difficulty establishing a shared definition ("they have their vision of what a micro-credential is, and it might be quite different from mine" – BioTalent project staff).

Conclusion

The BioReady micro-credential pilot was an overall success. Its structure was relatively complex, combining self-directed courses with external evaluations. Both learners and reviewers found value in this process. However, BioTalent made it clear that the micro-credentials true success remained to be seen. Learners would value the micro-credential if it helped them gain employment. That link, however, required employers to value the micro-credential in their hiring decisions. At the present time, it is unclear whether they would do so. BioTalent stressed the importance of communicating the pilot's value to employers so that the pilot will have value for learners. These represent interesting potential areas for further exploration for BioTalent in future micro-credential initiatives.

Canadian Agricultural Human Resource Council (CAHRC)

Background and Overview

The Canadian Agricultural Human Resource Council's (CAHRC) micro-credential plan evolved over the course of their partnership. Though they started with multiple ideas for a micro-credential pilot, an LMI analysis helped them focus on an identified labour gap at the level of farm supervisors. Though the exact nature of the gap was unclear, they believed training that addressed the fundamental leadership competencies in the sector could help mitigate the issue (e.g., addressing the difficulty transitioning workers into leadership roles, upskilling candidates who may lack leadership experience). Motivated by this, CAHRC created a micro-credential focused on leadership skills such as collaboration and problem solving, titled *Foundational Skills for Supervisors in Agriculture*.

Pilot Design

Development

CAHRC developed its micro-credential by consulting with relevant stakeholders and experts, analyzing LMI, and incorporating existing competency frameworks. Consultations included employers, micro-credential subject matter experts, training experts from PSE, and sector-specific training experts. In their consultations, stakeholders "strongly agreed" that there was a benefit to offering micro-credentials through industry associations. They valued having rapid credential training that could be delivered without needing workers to take time off or enroll in long programs.

Some of the earliest consultations focused on the need for culturally sensitive leadership training within the industry. CAHRC believed that industry members should be meaningfully engaged in discussions around of equity, diversity, and inclusion (EDI). They integrated the EDI lens as part of job performance training emphasis to ensure the topics did not feel "forced" or misunderstood to single out any groups. Employers and industry associations affirmed this integrated approach; they too wanted a method for delivering EDI training without triggering backlash.

After the initial group consultations, CAHRC moved on to individual consultations with subject matter experts (e.g., supervisors, Human Resources staff). Their goal at this stage was to create a program outline consistent with their National Agriculture Occupational Framework. This framework was developed over many years and had been used to create competency profiles, including soft skills requirements, for each role in the agriculture industry. In turn, the supervisor competency profile was

used to create training modules for CAHRC's micro-credential. For instance, the "leading by example" module mapped onto competencies of "interactive communication", "visioning", and "results management". This helped ensure the curriculum was grounded in industry realities.

Platform and Program Format

CAHRC's *Foundational Skills for Supervisors in Agriculture* micro-credential consisted of six modules lasting 3 hours total.

These modules were:

- Introduction to leadership skills;
- Leading by example;
- Motivating and engaging others;
- Planning, problem solving, and innovating;
- Developing others; and
- Leading others from different backgrounds.

These modules were designed for self-directed online-asynchronous learning.

Under normal circumstances, CAHRC would have hosted the micro-credential using their own LMS. However, the agriculture industry's seasonal nature created unique time-constraints for this project: they needed to finish before April, when farm supervisors would become too busy to participate. Consequently, they lacked the time to implement the pilot on their LMS. Instead, CAHRC used a temporary platform to host the project. Seasonal constraints also meant the pilot duration was shorter than they would have liked (3 weeks).

Learners' progress and achievement was measured through an optional pre-post survey comparing their self-reported skill level before and after training. Completing this survey did not change whether the micro-credential was awarded. The micro-credential was awarded solely based on course completion. CAHRC emailed the micro-credential to learns in a pdf format rather than host it on their temporary learning platform.

Outcomes and Observations

Participants

A total of 355 learners enrolled in CAHRC's *Foundational Skills for Supervisors in Agriculture* micro-credential. Because of the pilot's tight timeline, only 97 of these learners were able to complete all 6 modules within this period. Demographic information for the full pilot sample is not available, as it was only collected in a follow-up survey that was not completed by all learners. Of the 53 learners who completed the follow-up survey, 59.6% identified as women. For highest level of education, most learners had a bachelor's degree (or higher) (47%), followed by a community college or CEGEP degree (27.5%) and a high school diploma (13.7%). Almost every participant (96%) reported full-time employment in a small company with 10-99 employees.

Pilot Outcomes

Despite the time constraints, CAHRC felt they had achieved their pilot goals. The pilot helped them understand what the industry needs were as well as how they could develop training that might meet those needs. The pre-post learner survey suggested their training increased learners' self-perceived leadership ability. For instance, the post-survey found modest increases in the number of learners who strongly agreed that they were confident in their ability to lead by example, (pre-program = 53.4%, post-program = 60.3%; difference = 6.9%) and in their ability to plan activities, problem solve, and innovate (pre-survey = 52.7%, post-survey = 61.5%; difference = 8.8%). The greatest increases were in the number of learners who strongly agreed that they were confident in their ability to motivate and engage others (pre-survey = 43.2%, post-survey = 60.3%; difference = 17.1%), and in their ability to lead others from different backgrounds (pre-survey = 38.4%, post-survey = 55.8%; difference = 17.4%). The response pattern for the latter item suggests CAHRC was correct to include an EDI component in their training: in the pre-survey, this was the item where learners were the least confident overall (e.g., 10.3% disagreed that they were confident they could lead others from different backgrounds). By the post-survey, 96.2% of learner's felt confident in this area, suggesting that CAHRC's successfully "wove" their EDI lens into their training modules to address a potentially neglected leadership area.

Learner Reception

The post-survey also asked learners to rate the micro-credentials effectiveness. Learner responses were strongly positive overall, with every respondent saying they would recommend this training program to others. Further, most learners strongly agreed that the training should continue to be offered online (75.5%), that training was easy to access and navigate (71.7%), and that they were given enough time to complete it (58.5%). They also strongly agreed that the content was well-organized (66%) and relevant (60.4%). In contrast, learners were less enthusiastic (but still positive) toward the teaching examples, with 49.1% strongly agreeing that examples provided useful learning experiences and 41.5% strongly agreeing that examples were relevant to them.

Employer and Stakeholder Reception

Stakeholder responses to CAHRC's pilot seemed to be positive, particularly during consultation. CAHRC felt the consultation process went quite well. Stakeholders valued the specificity of the training examples, and the way content was presented to learners. Even stakeholders who were unsure about how to best deliver EDI training seemed to value CAHRC's approach and wanted to see more of it in the future. They also strongly agreed that industry-association led micro-credentials would be an effective way to address skills gaps in agriculture. Stakeholders also valued CAHRC's delivery, as it was important to them that the people delivering the training really understood the sector. Indeed, CAHRC felt that one of the main features that distinguished their micro-credential training from those of post-secondary institutions was that they were attuned to the industry's needs.

Though CAHRC's pilot was positively received, they felt that employers had a mixed reception towards micro-credentials in general. The name was contentious, with employers preferring the term "short rapid response training" over "micro-credentials". Further, employers were frustrated by the lack of proper definition for micro-credentials, a sentiment that was shared by other partners. CAHRC noted a wide number of micro-credential frameworks existed in the "education sphere", which made it difficult to know which framework to choose. CAHRC tried to deal with this definition problem early in the pilot

by developing a micro-credential framework that fit their sector's needs. A framework grounded in the agriculture industry's practical concerns could then be presented to employers to provide some clarity.

However, some employers struggled to accept micro-credentials for reasons beyond muddled definition. Many concerns stemmed from uncertainty over micro-credentials effectiveness or its potential consequences. Some employers were concerned that "upskilling" their employees in this way will cause to demand better pay or to search out better job opportunities. Others were uncertain whether "upskilling" would even occur. These concerns were difficult to assuage given the difficulty of assessing micro-credential outcomes. For example, CAHRC's pilot found an increase in learners' confidence in their abilities, but increased confidence is only an indirect proxy for increases in skill. CAHRC acknowledge this limitation and wanted to follow up with training participants to better understand the training's actual impact.

Despite some hesitations on the employer side, CAHRC still felt that micro-credentials will play a key role in addressing the industry's needs. The agriculture industry is facing major labour shortages and has a critical need for "rapid response training to fill skill gaps". They felt that micro-credentials have the potential to meet this demand. Employer concerns uncovered through the consultations process of this project provided valuable insights on how to enhance the process in the future.

Collaboration

CAHRC greatly valued this project's collaborative aspects because it aligned with the organization's long-term goal of building relationships within the sector. With respect to within-sector collaboration, CAHRC always believed that collaboration was vital to avoid "re-inventing the wheel" and "duplicating efforts".

In addition, the project's emphasis on cross-sector collaboration was a unique benefit that CAHRC staff enjoyed. They valued working with the other sectors to develop a workforce development solution that benefitted each of them and wished that same model could be applied within-sector. Consistent with their within-sector approach, they found that cross-sector partnerships were a valuable way to learn by example and avoid redundancy. Learning from other sectors' challenges and attempted solutions helped add to their own knowledge base around micro-credential design and delivery. They emphasized that the regular meetings and informal conversations are what made this information exchange work so well ("It was those conversations, rather than just a report on lessons learned, that were really helpful" – CAHRC project staff). CAHRC hoped to continue these collaborations in the future.

> *It was those conversations, rather than just a report on lessons learned, that were really helpful. (CAHRC project staff)*

Conclusion

CAHRC's *Foundational Skills for Supervisors in Agriculture* micro-credential was a successful learning experience, one that helped CAHRC reaffirm their role as the "connection" between industry and PSE. Through their pilot, CAHRC was able to identify and address key skills gap in the industry, including a critical need for effective EDI training. Learners seemed to benefit from and value CAHRC's approach, with pre-post comparisons showing a universal increase in leadership confidence. Though their unique

time constraints limited some of what CAHRC could explore, they felt this pilot created a strong learning foundation that could be built on going forward.

Canadian Council for Aviation & Aerospace (CCAA)

Background and Overview

CCAA's pilot involved adapting their pre-existing Numeracy training into a digital micro-credential format. Numeracy skills were vital for working in the aviation industry, but CCAA found there was often a gap or inconsistency between the numeracy skills of high school graduates and the numeracy skills required in aviation colleges or workplaces. Their goal was to create a numeracy skills training course that could quickly bridge this gap, ensuring a smoother learning curve for students and workers.

Pilot Design

Development

CCAA consulted with micro-credential subject matter experts, as well as experts from industry and post-secondary institutions. They highly valued industry consultations because they helped ensure that training would be relevant ("I think you should always go to industry. You should always find out what skill sets they're looking for and which ones they can get training on" – CCAA project staff). However, the key consultation pieces for this micro-credential were mainly with educational institutions. CCAA ran focus groups with post-secondary institutions to learn about relevant skill gaps in new student cohorts. College consultations identified a numeracy skills gap, as well as skill gaps in both literacy and document use. Notably, most of these consultations occurred well before the pilot as part of an effort to develop a "Numeracy Essential Skills workbook" for high schools and colleges. The main challenge for the micro-credential pilot was updating this content and fitting it into an online course design. Though the online course modules were developed by CCAA's training development team, they felt that developing the course assessment would require external support. To ensure the assessment was accurate and appropriate, they had a teacher from a high school aviation program help create the assessment content.

Platform and Program

CCAA's Numeracy micro-credential used an online asynchronous design including course modules and mandatory standardized assessments. As the name implies, this micro-credential was designed to improve or refresh the learner's math skills, while also training general problem-solving skills. Course content focused on foundational math skills because CCAA's target audience was younger workers entering the aviation industry or college students entering aviation programs. The micro-credential's goal was to prepare learners for the more "heavy-duty" math and physics courses that might be a required part of their workforce training or their post-secondary education.

They used the "Learning Cart" LMS to host each component of the micro-credential (i.e., course modules, assessment, badge). CCAA used this LMS often, finding it cost-effective and easy to manage. The assessment used a pre-post design and was required to complete the micro-credential. Access to course modules was gated behind completion of the pre-assessment, with completion of the post-assessment serving as the final step to earning the badge.

Outcomes and Observations

Participants

Fifty learners were enrolled in CCAA's Numeracy micro-credential. Of those learners, 28 completed the micro-credential. Demographic information was reported by 45 of the enrolled learners. A majority of learners identified as men (78%), with 22% of the sample identifying as women. Roughly 36% of enrolled learners identified as immigrants. Most learners' highest level of education was a high school diploma (40%) or lower (36%), with 24% reporting either a college or university degree (24%). Around 26% of enrolled learners reported part-time employment.

Implementation

CCAA felt their Numeracy micro-credential was a success overall. They felt the pre-post assessment design helped learners develop confidence in their own skills by seeing how much they were able to grow. They hoped learners would carry this confidence into more difficult math courses in the future. CCAA reported that it was extremely likely that they would offer their numeracy micro-credential again, but in a different form. They envision "stacking" an essential skills micro-credential covering three key skill areas: numeracy, literacy, and document use. These essential skills micro-credentials would then be combined with their more general 8-week onboarding program to help transition recent high school graduates into the aviation industry.

Employer Engagement and Reception

According to CCAA, employers in the aviation industry are largely aware of and understand micro-credentials. Employers seemed neutral towards micro-credentials, evaluating them on a case-by-case basis. They felt two factors were key to employer reception: content and reputation. Employers wanted training that enhanced or expanded their employees' skillsets, rather than just replacing skills that are already there, making it important to develop micro-credential training that complemented college training. CCAA also felt that their reputation as a trustworthy training provider enhanced employer reception to their micro-credential. They attributed their good reputation to their emphasis on course quality over course quantity.

The pilot also reaffirmed to CCAA that industry involvement was a crucial part of training development. Though they had always made industry involvement a priority, this pilot made it clear to them just how important it was to have industry involved from the beginning ("If you don't have enough industry involvement right from the get-go, it's just not going to get off the ground" – CCAA project staff). This seemed particularly true for sectors like aviation, which may require more deliberate training designs that account for industry regulations ("we have to be careful we're not dabbling in … training we're not accredited at" – CCAA project staff) and varying company capacity ("every company has different equipment they're working on" – CCAA project staff).

> *If you don't have enough industry involvement right from the get-go, it's just not going to get off the ground. (CCAA)*

Collaboration

CCAA felt that the collaborative element was the part of the pilot that worked best ("the biggest thing is the collaboration that's come out of this" – CCAA project staff). Having regular cross-sector meetings helped them share lessons to avoid "re-inventing the wheel". Most appreciated was the ability to develop a "common ground" for defining micro-credential frameworks. This helped address what they felt was an abundance of training hindered by a lack of shared standards ("There's so much training out there now … But how does anybody know that these [courses] are a good idea? How do you know industry respects these courses? How do you know that you're really learning what's out there and taking the best course that's available for what you want?" – CCAA project staff). CCAA believed that developing a shared set of rules and guidelines for micro-credential would help keep training providers accountable. They hoped they could continue these collaborations in the future, perhaps by creating cross-sector micro-credentials that cover common skill areas, supplemented by industry-specific training modules. In turn, they thought this might create more "concrete pathways" between industries, making it easier to transition workers across industries (e.g., from automotives to aviation).

Conclusion

CCAA felt the pilot provided a number of valuable learning opportunities. The pilot reaffirmed the importance of having strong ties to industry and educational institutions while also demonstrating the value of cross-sector collaboration. Indeed, one of the most valuable lessons CCAA learned was that micro-credentials should have shared and clearly defined criteria so that they can fulfill unique training needs. In CCAA's view, micro-credentials meet industry needs by providing practical training in a short time frame, allowing workers to "hit the ground running".

Information and Communications Technology Council (ICTC)

Background and Overview

The Information and Communications Technology Council (ICTC) piloted two micro-credential programs: *Big Data* and *Cloud Computing*. The goal of their micro-credential pilot was to prepare learners for employment by providing them with fundamental skills and an insight into available job opportunities. These programs were in high demand, but ICTC intentionally limited the number of available spots in order to control the quality of the learning experience.

Pilot Design

Pilot development involved consultations with employers, micro-credential subject matter experts, training experts from PSE, and sector-specific training experts. Other steps included a LMI analysis and a literature search. The latter focused on understanding different micro-credential frameworks, the benefits of micro-credentials, and the gaps in micro-credential training. However, they felt they were not able to find the amount of information that they wanted ("We tried to get some data sources on alternative education and the numbers of students that take these, for example. Unfortunately, we didn't really find a lot from that." – ICTC project staff).

Focus groups were conducted with over 100 employers across Canada. The goal of these conversations was to see how much employers understood and valued micro-credentials. In addition, ICTC had

employers rate which criteria they looked for in a micro-credential (e.g., association with post-secondary education, use of assessments). Notably, there was a difference between how employers and learners evaluated micro-credentials. Counter to learners' expectations, employers did not place a lot of emphasis on whether a micro-credential was associated with post-secondary education.

ICTC also spoke with over 30 post-secondary institutions, alternative training institutions, and private training institutions (e.g., Coursera, LinkedIn). They found that many "traditional post-secondaries" were largely new to micro-credentials. Most of them were still trying to "get into the micro-credential space". Their interviews suggested that PSE was having some trouble creating "new material" for micro-credentials. Most of its efforts seemed to involve modifying existing material to fit the micro-credential's shorter timeline. ICTC felt that some of PSE's challenges creating new content were due to its organizational characteristics and curriculum development nature – PSE may not necessarily be built to develop rapid training that could change or evolve quickly. Conversely, micro-credentials were essentially the "business model" for private training institutions like EdX and Coursera. They were much more comfortable and familiar with micro-credentials, focusing on ways that they could be improved to ensure their value will be recognized by employers (e.g., integrating more pre-post assessments).

Platform and Program Format

ICTC had two micro-credentials: *Cloud Computing* and *Big Data*. Each micro-credential contained between 5 and 6 modules focusing on role-relevant skills. For example, *Big Data* taught skills relevant to data engineer and data scientist roles, while *Cloud Computing* taught skills relevant to cloud engineers or other "digital infrastructure" roles. Unlike other partners, ICTC's modules were taught synchronously, allowing greater control over program format. For example, module access was staggered so that learners could only access one at a time, ensuring that learners progressed through the course at similar rates. Further, both micro-credentials culminated in a 3-hour graded workshop activity, followed by a timed test.

Notably, earning the micro-credential required passing both the workshop and the final assessment. The workshop used a pass/fail judgement based on multiple indicators (e.g., participation, evaluator feedback). The final assessment was graded, and learners had to achieve a minimum grade (70%) to pass the course. In contrast with other partners' pilots, this gave ICTC's pilot a strict failure condition: learners had two chances to achieve a passing grade on the final assessment, after which they were ineligible for the micro-credential. The inclusion of a workshop evaluation and a graded assessment was partly a response to employer focus groups, which were skeptical towards micro-credentials awarded solely on course attendance.

Courses, assessments, and micro-credential badges were all hosted on the Canvas learning management system. This also contained information about the course curriculum, the method of teaching, hours of learning, expected skills, applicable jobs, and the number of learners who passed the course, making it easier for employers to evaluate (see above). ICTC was "quite happy" with Canvas and recommended it to other training organizations, highlighting the benefits of using an easily modified system that can integrate courses and credentials.

Pilot Outcomes and Reception

Participants

There was a high demand for ICTC's micro-credentials, receiving around 300 applications. However, the synchronous workshop approach required a certain ratio of instructors to learners (i.e., 2 instructors for 6 students), meaning there was a limit to how many learners could be accepted into the pilot. To ensure training went to those who might benefit most, acceptance criteria prioritized applicants in relevant entry-level to mid-level careers (as assessed by intake surveys and applicants LinkedIn profiles). Using those criteria, ICTC narrowed down its applicants to admit around 100 learners (33% women, 65% men) to the pilot. Of those 100, approximately 80% went on to the workshop stage, with a slightly lower amount passing the test to receive the micro-credential.

Pilot Outcomes and Learner Reception

As with other partners, they felt that the short duration of pilot implementation meant they had to pay attention to the scope of the pilot to ensure it was manageable. ICTC felt that their pilot was successful. Most learners earned their micro-credential even with the relatively strict assessment criteria. Still, about 20% of learners did not complete their program. This outcome was difficult for ICTC to interpret. It could be that the assessment was working as intended, but it was also possible that the requirements were too strict. Though they collected learner feedback in a post-assessment, many learners did not complete this part. For this reason, they believed the post-assessment should have been made a mandatory step towards earning the micro-credential, so that they could better understand the learner's perspective. ICTC also felt that other steps could be taken to better capture the learner's perspective in the future ("Do they know what micro-credentials are? What value do they think it carries?" – ICTC project staff). For example, they believed learner focus groups might help them understand how learners' views on micro-credentials differ from employers.'

Employer Reception

ICTC acknowledged that most partners were "struggling" to get "employer buy-in", though they felt that employer reception was positive overall. They speculated that this positivity was sector-specific: micro-credentials started in the tech sector, making it more familiar to employers in that sector. In addition, micro-credentials' rapid nature reflects the pace of the information and communication technology sector. Rapid technological development gives skills in this sector a "shorter shelf-life" – new skills are constantly introduced while old skills quickly become obsolete. Employers viewed micro-credentials as an efficient means of upskilling employees in novel areas of technology. Their main concern was the lack of standardization and the difficulty of determining a specific micro-credential's value ("there are so many, anybody can create one and there's not really a way to validate that it produces the skills that it says it does" – ICTC project staff). Employers also suggested that "bundling" different micro-credentials together might give them greater value.

Collaboration

ICTC thought the cross-partner collaboration was good, although more structure could be added to enhance the knowledge sharing experience. As partners were at different points in their micro-credential design and delivery journey, it could be challenging to find a perfect alignment in goals and progress. As one of the partners that were more advanced in their micro-credential capacity, ICTC felt it

could have been more useful to have concrete discussions around promising practices and lessons learned, finding out "what worked for people versus what didn't." Without understanding how their sector could be relevant to the other partners' sectors, it was difficult to know how they could collaborate. That said, they found the quarterly partner meetings useful as they followed pre-determined meeting agendas and included guided discussion questions that helped facilitated more structured information-sharing.

Conclusion

ICTC seemed to be quite satisfied with the outcomes of their micro-credential pilot. Though their pilot was relatively more complex than other partner pilots, they seemed to handle these challenges with confidence. Their pilot also attempted to address employer concerns about micro-credential validity by subjecting learners to a graded assessment, which not all learners passed. This approach raises interesting questions about the way micro-credential learning outcomes are assessed.

Overall, all partners designed and delivered micro-credential pilots aligned with their sectoral competency needs and skills development context. It was interesting to dive deeper into each partner's unique experience, learning the details around their process. A lot of common themes around success stories, promising practices, as well as challenges and lessons learned also emerged. In the next section, we synthesize these commonalities.

Excellence in Manufacturing Consortium (EMC)*

** See Part Two for complete EMC report*

Background and Overview

EMC's pilot included eight micro-credentials. Each micro-credential was targeted at an "emerging or timely need" in the manufacturing industry, ranging from updating its general manufacturing supervisor training to include more specific skills (e.g., time management, mental health awareness). EMC heard from employers during consultations how difficult it was for them to make time for their employees to participate in training. EMC choose to offer their courses in a variety of formats and delivery options to provide employers and their employees flexibility. Though logistically challenging, this multi-format approach was valued by employers and learners and provided EMC with insights that would help them build future micro-credential training.

Pilot Design

Development

As EMC offered multiple micro-credentials, an overarching development plan was provided, with room for customization for each micro-credential. Some of their micro-credential offerings were updates or modified versions of their pre-existing training and others were developed in response to identified in-demand training needs. Their overall development plan generally involved consultations with employers, micro-credential subject matter experts, post-secondary institutions, and training experts. One of their first steps was updating and validating relevant competency profiles (i.e., Production Supervisor, Production Worker) through employer focus groups. In addition, they used these focus groups to determine what training content employers would value. Focus groups discussed immediate skill needs, such as skill gaps or training challenges. These consultations highlighted a need for training in

three key areas: psychological health, time management, and “green manufacturing”. In addition, consultations convinced EMC that offering training in multiple formats (e.g., offering different lengths of training, asynchronous delivery) would help each employer meet their needs.

Platform and Program

EMCs eight micro-credentials covered a range of topics and delivery methods. The most common micro-credential topics were Time Management (3 courses) and Psychological Health and Safety (3 courses). Each course topic was offered in three course designs: a 4-hour online asynchronous course, a 4-hour virtually facilitated synchronous course, and a 12-hour virtually facilitated synchronous course. In addition, they offered two synchronous hybrid courses: a “Manufacturing Essentials Certification for Supervisors” course and a “Manufacturing Essentials Certification – Green Skills” course. These last two courses were more time intensive, spanning approximately 40 to 60 hours each.

Assessment strategies varied across course, including some combination of learner self-reports, instructor observations, and workplace performance projects (for the Manufacturing Essentials Certification (MEC) for Supervisors and Green Skills). Assessment function also varied across courses. For instance, only some courses used an assessment to determine whether the micro-credential was awarded (e.g., a mandatory pre-post assessment). In addition, EMC’s validation strategy also used employer reports to determine whether training led to observable improvements in workplace performance. These reports were also used to determine whether a micro-credential was awarded.

EMC used a Learning Management System (LMS) called “Thinking Cap” to deliver online training. Micro-credential digital badges were issued, stored and displayed using CanCred. Micro-credential badges contained meta data about skills, type of training, assessments, learning outcomes, and training hours and is protected by blockchain. Learners could display their digital badges on social media by uploading them from the CanCred platform. The platform worked well for the most part, with few complaints from admin and participants. The main challenge was that CanCred could not link with their LMS, requiring them to manually match information across systems. They planned to address this for future course offerings to increase efficiency and improve the user experience.

Outcomes and Observations

Participants

Enrollment varied across micro-credentials (range=30-66 per course), with a total of 383 learners enrolled across the pilot. Demographic information was collected for approximately 295 of the learners who completed their micro-credential. Of those, a nearly even proportion identified as men (47%) and identified as women (49%). Around 30% of those learners identified as immigrants. A bachelor’s degree or higher was the most reported level of education (47%), followed by community college (25%), a high school diploma (11%), and some university (9%). Almost every learner who provided demographic information reported full-time employment (98%). In addition, approximately 208 employers participated in the micro-credential, most of which were of either medium (i.e., 100-499 employees; 52%) or small (i.e., 10-99 employees; 38%) size, with a handful of large-sized employers (i.e., 500+ employees, 10%).

Implementation

EMC felt that their pilot was mostly implemented according to plan, requiring no major changes. However, they felt that survey management had been a major struggle. Learner surveys were implemented differently across micro-credential courses, leading to uneven response rates. Surveys that were built into the e-learning (e.g., mandatory pre-post assessments) had higher completion rates than surveys that were emailed to participants. Emailed surveys also created some logistic challenges. For example, learners who participated in multiple EMC offerings would sometimes get confused about which course a survey corresponded to.

Similarly, the employer surveys were difficult to manage. Part of the problem was that employer validation was used to determine whether a micro-credential was awarded, creating a delay between course completion and badge issuing. Though they still felt the rationale was solid, in practice, this process was unsustainable because it placed a heavy workload on employers. Employers were generally too busy to be involved to this extent ("they barely have enough time to send people through training, let alone reading documents and answering surveys, emails and phone calls" – EMC project staff). They intend to switch to internal validation procedures (e.g., facilitator reports) for future training, reserving employer validation for select programs.

Learner Response

EMC believed that learners generally met their training goals. Anecdotal reports suggested that learners benefited from training (e.g., an employer reported that the supervisor training program helped a learner get promoted into a supervisor role). Learner responses to the micro-credentials were ambiguous. EMC came away from the pilot with the perception that learners valued skills training more than the actual micro-credential itself. This perception was largely due to the low rate of claiming and sharing badges ("looking at the numbers in the system, quite a few people, when we issued their credentials, did not claim them. This tells me that maybe the interest wasn't in the micro-credential" – EMC project staff). At the time of the interview, approximately 36% of badges were claimed and the vast majority of those badges were not shared on learner's social media. Thus, learners seem to value the training but may be currently unaware of (or uninterested in) the micro-credential's utility.

Employer Responses

Employers responded positively to EMC's multi-format training. They particularly valued the shorter course options, seeing them as an effective way to introduce concepts and "scaffold" further training. Yet, EMC staff felt that employers were more engaged in longer course formats involving workplace projects. They suspected this might be a selection effect, such that employers who can afford to be engaged are more likely to select longer training courses. For employers who lack the resources or time to invest in training (e.g., small businesses), enrolling employees in short-term training courses might be the most they can manage.

Though employers responded positively to EMC's training, employer perceptions of micro-credentials appeared neutral at best. EMC felt that employers did not have a high level of buy-in for micro-credential training and that they did not recognize the value of micro-credentials. It was also not clear to them whether employers accepted micro-credentials as a valid indication of skills or as an effective skills development option for employees. EMC felt that employers did not currently value micro-credentials in

part because micro-credentials are not "universally understood" in the manufacturing sector. Employers were generally open to them but were not fully aware of their unique feature or how they should be used in hiring decisions ("no one know how to use it … to hire or to promote or anything" – EMC project staff). Instead, employers seemed to value micro-credentials based on the reputation of the training provider ("The feedback I certainly heard was if EMC tells us it's valuable, it's valuable because it's EMC" – EMC project staff). They felt more work needed to be done to make micro-credentials an established "currency" with easily recognizable value.

Collaboration

EMC felt that it took some time for cross-sector collaborations to "get off the ground" because they had never worked with the other sector partners before. However, cross-sector collaboration become a lot easier over time, becoming a highly rewarding feature. Specifically, the biweekly partner meetings helped them build trusting relationships with the other partners. These meetings allowed for information exchanges and shared exploration, increasing EMC's confidence in its ability to create and deliver micro-credential training. In contrast, EMC felt it did not currently have strong collaborative relationship with post-secondary education. They believed that this is an area that needs more work, and once such collaboration can be established, it may open up further opportunities for shared capacity and leveraged resources to address the common goals of skills development among the Canadian workforce.

Conclusion

EMC was very satisfied with each of its micro-credential courses, reporting that they planned to offer them again. Offering courses in multiple formats had been a great success, allowing both employers and learners to select a training schedule that best fit their unique needs. At the same time, they felt that greater investment was needed to maximize the outcomes of micro-credentials ("I firmly believe the potential for micro-credentials is enormous, just we aren't realizing it right now" – EMC project staff). Though they were pleased that employers trusted and valued their own micro-credential offerings, they hope that micro-credentials will eventually gain independent recognition in the sector.

6. Synthesis of Findings and Implications

In this section, we summarize the key themes throughout all stages of design, development, implementation, and evaluation of micro-credentials, based on partner experience in the project. We organized these themes into innovations, promising practices, and success stories; as well as challenges and lessons learned to inform future initiatives. As well, these findings serve as building blocks for our suggested roadmap for an industry-led micro-credential program, providing a guide to other stakeholders (e.g., another sectoral organization) looking to embark on this workforce development journey.

Design

Innovations and promising practices

Consultations: Each partner made use of various consultation focus groups (e.g., with employers, subject matter experts) during the development phase. Feedback from these groups helped partners refine or validate their pilot design. For example, focus groups helped BioTalent focus their pilot on key biomanufacturing roles and reassured CAHRC that an EDI lens should be included in their program.

Labour Market Information: Partners collected and analyzed labour market information (LMI) to design micro-credentials that directly address their sector's needs. For example, CAHRC identified a present labour gap at the level of farm supervisors and designed their pilot to target leadership skills. This strategy can even be used to anticipate and pre-empt labour shortages (e.g., BioTalent predicted labour shortages in biomanufacturing and constructed their pilot to help recruit workers into this area).

Shared training objectives: A diverse set of micro-credentials were developed and offered through this project, ranging from leadership training in the agriculture sector, time management and psychological health and safety in manufacturing, fundamental numeracy skills training in aviation and aerospace, to cloud computing in information and communication technology. That said, there were also a lot of commonalities in the foundational building blocks that made up these micro-credentials. Specifically, key social emotional skills such as problem solving, leadership and collaboration, and communication were prominent across almost all micro-credentials. This represents opportunities to further streamline the cross-sectoral collaboration in the future, for example, by building a common library of training modules to be shared across sectors. This can help sectoral training providers focus more on customizing their training to align with sectoral contexts, without having to develop the fundamental training materials from scratch.

Challenges and lessons learned

Consistency in definitions and conceptual frameworks: Partners consistently mentioned the difficulty of navigating micro-credentials' wide range of frameworks and definitions. Interviews give the impression that there is somehow both too much and not enough information about micro-credentials. For example, ICTC found there was still very little data on learners' usage of micro-credentials. There is also a need to carefully consider the advantages and disadvantages of developing new micro-credential frameworks versus using existing ones. For example, it might be more cost-effective to use and build on an existing framework. On the other hand, a new, sector-specific framework might be necessary to sufficiently address the unique skills development need of employers.

Employers' perception, engagement and recruitment

Success stories

Specificity and Relevance: Employers value training materials and examples that are both sector-specific and role relevant (e.g., a common experience for supervisors in the agricultural industry). The key value-add of these sector-based micro-credentials is the reassurance to employers that the training is being delivered by a training organization that understands the specific needs of that sector.

Concrete Examples and Communication: Because employers have varying understanding micro-credentials, and because micro-credential programs are highly variant, providing employers with a concrete example or description of may help buy-in. For example, CAHRC shared design information with employers during focus groups and ICTC found a way to bundle course statistics and other information with their micro-credential badge.

Reputation: Both EMC and CCAA felt that employer's perception of micro-credentials largely depended on how much they trusted the training provider. Even if they are not necessarily familiar with micro-credentials, if they trust the training provider (e.g., they have successfully provided training in other formats) they may have a more positive reception.

Lessons learned

Lack of unity: Employers are frustrated by micro-credentials' lack of both common definition and common framework. The term "micro-credentials" seems to refer to a wide range of pedagogical approaches, course designs, and assessment choices. This makes it difficult for employers to rely on micro-credentials in hiring and promotion decisions.

Demonstrating Efficacy: Both partners and employers seemed to share an uncertainty that micro-credentials actually instill the intended skills. They felt that there needed to be more research that directly examines the relationship between micro-credential training and future job performance.

Familiarity: Employer's prior familiarity with micro-credentials may play a role in their response. For example, ICTC felt tech-sector employers gave a more positive reception because micro-credentials have a longer history in the tech sector. Employer "buy-in" may be toughest in sectors that are only just starting to use micro-credentials.

Learners' perception, engagement and recruitment

Success stories

Cultural Competence and Diversity: An unexpected success story emerged from the project, highlighting the potential for micro-credentials to be the tool to address various aspects of workforce diversity and inclusivity. For example, CAHRC's diversity module seemed to have an appreciable impact on learner's confidence in their ability to manage employees from diverse backgrounds. From another angle, BioTalent found that a lot of pilot learners were internationally educated professionals who valued the micro-credential for its more implicit lessons about Canadian cultural norms and expectations. Navigating and embracing cultural differences may be a valuable training area for multiple levels of the workforce, and micro-credentials might be a learning format conducive to such skills development.

Demand: Each pilot seemed to be in high demand, with ICTC having to enforce an enrollment cap to ensure an adequate instructor to learner ratio. Though most pilots were designed with entry-level experience in mind, there was an unexpected demand from mid-to-late career professionals, suggesting there may be value in developing micro-credential programs that are tailored to multiple career stages.

Lessons learned

Fundamentals vs. Knowledge Niche: One perception that employers have of micro-credentials is that they focus on niche knowledge areas, with fundamentals being the domain of post-secondary education. However, learners seemed to value foundational course content, even just as a "refresher". The optimal level of specificity and scope may be something to explore in future research.

Response Rates: Learner feedback is important for evaluating micro-credential outcomes. Partners gathered learner feedback through optional post-program surveys but found that response rates were lower than desire. This made it difficult to know whether the responses truly reflected the overall learner experience. Partners had multiple ideas on how to boost response rates. For example, CAHRC wanted to send more reminders to the follow-up surveys in hopes of getting more responses. ICTC decided that in future micro-credentials they would likely make completing the post-program survey a mandatory step to earning the micro-credential.

Implementation and delivery

Innovations and promising practices

Asynchronous vs. Synchronous Design: The micro-credential pilots included a mix of asynchronous and synchronous design choices, with benefits and challenges for each approach. Synchronous designs can allow for greater control over the rate of learners' progress, as well as more involved assessments. However, capacity can become an issue (e.g., if learners greatly outnumber instructors). Asynchronous designs can give learners greater control over their own rate of progression, which may be desirable for learners who are trying to fit micro-credentials into a busy schedule.

Interactive Design: Learner's appreciated interactive course design. For example, BioTalent engaged learners by including mandatory knowledge check questions throughout their online courses. This type of interactive design also provides data that can be used to validate the course content or assess learner progress, making it valuable to both learners and educators.

Challenges and lessons learned

Aligning Logistics with Sector-Specific Contexts: Micro-credentials for sectors with major seasonal fluctuations (like agriculture and tourism) may require more careful timing. Though there was a high degree of interest in CAHRC's pilot, they had to complete it before spring, making it difficult to collect as much data as they wanted.

Learning Management Systems (LMS): Interviews suggest that particular care should go into choosing a learning management system because it can have downstream consequences that are difficult to address. In general, partners seemed to want an LMS that is able to handle and integrate each component of the micro-credential (e.g., course administration, assessments, badge hosting), but combining these features was not always possible. Partners identified coordinating learners between different systems or platforms as a source of challenge. The LMS and micro-credential technology in general is an interesting area for further exploration in future initiatives.

Assessment and recognition of skills and competencies

Success stories

Portfolios: BioTalent combined competency mapping with a resume-building assignment, helping learners to connect their experience to their desired role. Completing this portfolio was a requirement to get the micro-credential. Though this assessment approach relied on more subjective judgements and was difficult to standardize across learners, it also allowed for a degree of contact between learners and relevant employers, which learners highly valued (and wanted more of).

Graded Tests: ICTC used graded assessments. Learners had to meet a certain threshold to earn the micro-credential and only had two chances to achieve this before they were disqualified. They chose this approach because they believed higher stakes would make employers value the micro-credential more (their micro-credential badges showed the percentage of learners who passed the course). As a result, not all learners completed the micro-credential, but those that did were able to demonstrate the effort they put in to earn it.

Pre-Post Confidence: BioTalent's assessment approach focused on learner's self-confidence in their leadership skills before and after training. This was an optional assessment that did not determine whether learners earned their micro-credential. Instead, it helped assess training effectiveness. One strength of this assessment approach was that it helped identify skill areas where learners felt that they needed the most improvement and then demonstrated that training had bolstered those critical skill areas. Self-reflection could also be a useful learning tool, as learners were given the opportunity to articulate their own learning progress.

Opportunities for future work

Assessment Complexity: Each pilot used a different method for determining whether a learner earned their micro-credential, ranging from course attendance to graded tests (with limited chances to pass). More complex assessments might increase employers trust in a micro-credential but might also add more response burden and assessment fatigue for the learners.

Relevance and applicability of the micro-credentials to the labour market

Success stories

Minimal Opportunity Costs: Partners felt that micro-credentials were an effective way to quickly upskill employees with minimal opportunity costs in terms of release time (i.e., time off work to take the training) and other resources. This makes it an effective way to address employer concerns about training-related absence. At the same time, it requires less investment on the part of employees and jobseekers, who are able to quickly gain relevant skills without needing to enroll in a formal or long-term programs.

Flexibility and Rapid Response: A recurring theme in interviews was that the pace of technological development shortened the "half-life" of skills. The quick pace at which new skills emerge and old skills become obsolete incentives flexible training programs. Partners felt that micro-credentials were an effective solution to this challenge for two reasons. First, micro-credentials are relatively quick to update and deliver, allowing for rapid responses to sector-specific developments. Second, there is an expectation that micro-credentials are most suited to niche or targeted subject matter, allowing for training that can home in on novel skill areas or emerging needs.

Opportunities for future work

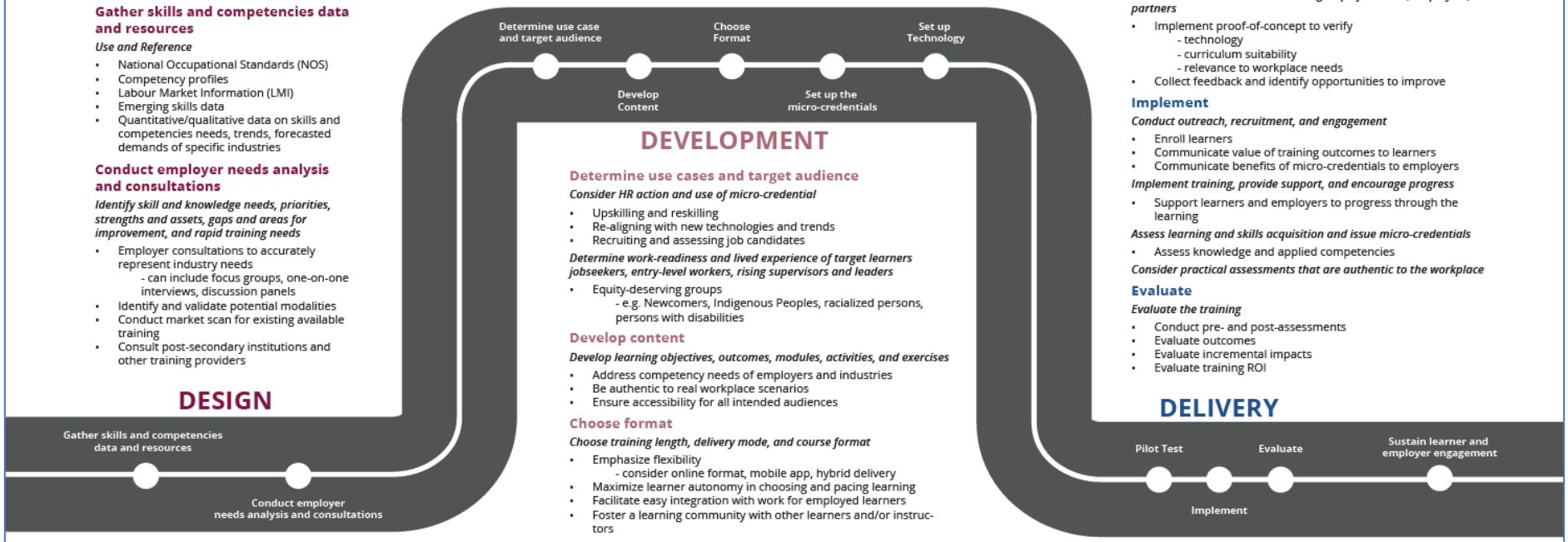
Long-term Impact: Partners felt that there was still not enough research on the micro-credentials' impact or effectiveness. Jobseekers want to know that investing time in a micro-credential will help them attain employment. Employers want to know that seeing a micro-credential on a job candidate's resume is a reliable signal of their skills. In both cases, partners felt that there is not enough information to definitively address these concerns. There is a solid demand for more research focusing on micro-credentials long-term outcomes (e.g., employment in desired role, job performance). This represents an important area for future work – one that needs close and innovative collaboration among multiple stakeholders within the Canadian micro-credential landscape.

7. Roadmap of Industry-Led Micro-Credentials

As a result of this project, EMC and Sectoral Partners developed and defined an industry-driven, multi-sector methodology for micro-credential development and adoption, known as the Sectoral Micro Credential Roadmap. The Sectoral Micro Credential Roadmap represented the culmination of our multi-sector project, leveraging our shared experience and expertise and employer and learner feedback, generate a practical and useable development methodology.

The Sectoral Micro-credential Roadmap aims to strike a balance between doing justice to the complexities of training and the micro-credential development process and providing sufficient details without being too prescriptive. Using simple language, the Roadmap does not create the impression that the process is cumbersome or overwhelming but is a practical and feasible methodology that may be shared, across sectors, to develop rapid, just-in-time skills training solutions in response to evolving labour market needs.

SECTORAL MICRO-CREDENTIAL ROADMAP:



DESIGN

Gather skills and competencies data and resources

Use and Reference

- National Occupational Standards (NOS)
- Competency profiles
- Labour Market Information (LMI)
- Emerging skills data
- Quantitative/qualitative data on skills and competencies needs, trends, forecasted demands of specific industries

Conduct employer needs analysis and consultations

Identify skill and knowledge needs, priorities, strengths and assets, gaps and areas for improvement, and rapid training needs

- Employer consultations to accurately represent industry needs
  - can include focus groups, one-on-one interviews, discussion panels
- Identify and validate potential modalities
- Conduct market scan for existing available training
- Consult post-secondary institutions and other training providers

DEVELOPMENT

Determine use cases and target audience

Consider HR action and use of micro-credential

- Upskilling and reskilling
- Re-aligning with new technologies and trends
- Recruiting and assessing job candidates

Determine work-readiness and lived experience of target learners jobseekers, entry-level workers, rising supervisors and leaders

- Equity-deserving groups
  - e.g. Newcomers, Indigenous Peoples, racialized persons, persons with disabilities

Develop content

Develop learning objectives, outcomes, modules, activities, and exercises

- Address competency needs of employers and industries
- Be authentic to real workplace scenarios
- Ensure accessibility for all intended audiences

Choose format

Choose training length, delivery mode, and course format

- Emphasize flexibility
  - consider online format, mobile app, hybrid delivery
- Maximize learner autonomy in choosing and pacing learning
- Facilitate easy integration with work for employed learners
- Foster a learning community with other learners and/or instructors

Set up the micro-credentials

Define the micro-credentials and what it takes to earn them

- Design badge and accompanying training description
- Determine assessment criteria to issue the micro-credential
- Determine what micro-credentials signify
  - individually and as a series

Set up technology

Use LMS or micro-credential platforms to host, deliver, verify, and store micro-credentials

- Enable accessibility and sharing across multiple platforms
  - LinkedIn, other provincial micro-credential systems
- Provide ongoing technical support

Align learning and career development pathways with technology

DELIVERY

Pilot test

Test micro-credentials with a small group of learners, employers, and partners

- Implement proof-of-concept to verify
  - technology
  - curriculum suitability
  - relevance to workplace needs
- Collect feedback and identify opportunities to improve

Implement

Conduct outreach, recruitment, and engagement

- Enroll learners
- Communicate value of training outcomes to learners
- Communicate benefits of micro-credentials to employers

Implement training, provide support, and encourage progress

- Support learners and employers to progress through the learning

Assess learning and skills acquisition and issue micro-credentials

- Assess knowledge and applied competencies

Consider practical assessments that are authentic to the workplace

Evaluate

Evaluate the training

- Conduct pre- and post-assessments
- Evaluate outcomes
- Evaluate incremental impacts
- Evaluate training ROI

SUSTAINABILITY

Sustain learner and employer engagement

Collect and share success stories

- Showcase positive ROI
- Communicate best practices, lessons learned

Ensure learners can use micro-credentials in their lifelong learning journey

- Align with career progression
- Align with learning needs

Strengthen employer buy-in and recognition

- Use case of micro-credentials in hiring, onboarding, and promotion practices
- Value of micro-credentials as a workforce development tool

EMC CANADA'S LARGEST MANUFACTURING CONSORTIUM · CAHRC-CCRHA Canadian Agricultural Human Resource Council / Conseil canadien pour les ressources humaines en agriculture · ICTC CTIC · BioTalent Canada · CCAA Aviation | Aerospace · SRDC SRSA INNOVATION + EXPERIMENTATION + EVALUATION

Sectoral Micro-credential RoadMap Methodology

Design

Gather skills and competencies data and resources: Use and reference National Occupational Standards (NOS), competency profiles, labour market information (LMI), emerging skills data, quantitative and qualitative data on skills and competencies needs, trends, forecasted demands

- Sources include: frameworks and standards specifying skill and competency requirements on the job; LMI data showing supply and demand trends, outlook, forecasts of specific industries

Conduct employer needs analysis and consultations: Identify skill and knowledge needs, priorities, strengths and assets, gaps and areas for improvement, and rapid training needs

- Consultations with employers necessary to accurately represent industry needs
- Consultations can include: focus groups, one-on-one interviews, discussion panels
- Identify potential modalities, validation
- Conduct market scan for existing available training to better understand skills supply
- Consult with existing training providers - scan for post-secondary institutions and other providers with existing training to communicate needs

Development

Determine use cases and target audience:

Consider Human Resources action and use of micro-credential

- Upskilling, re-tooling or re-aligning with new technologies and trends
- Recruiting and assessing job candidates

Determine the work-readiness and lived experience of your target learners

- Jobseekers, entry-level workers, rising supervisors and leaders?
- Equity-deserving groups, e.g., newcomers, Indigenous Peoples, racialized persons, persons with disabilities?

Develop content: Develop learning objectives, outcomes, modules, activities and exercises

- Address the competency needs of employers and industries
- Contextualize to be authentic to real workplace scenarios
- Ensure accessibility for all intended audience

Choose format: Choose training length, delivery mode, and course format

- Emphasize flexibility, e.g., consider online format, mobile app, hybrid delivery
- Maximize learner autonomy in choosing and pacing learning
- Facilitate easy integration with work for employed learners
- Provide opportunities to interact with other learners and/or instructors to foster a learning community

Set up the micro-credentials: Define the micro-credentials and what it takes to earn the micro-credentials

- Design the badge and accompanying training description
- Determine testing/assessment criteria, criteria to issue the micro-credential
- Determine what each micro-credential signifies, what a series of micro-credentials signify

Set up technology: Use LMS or micro-credential platforms to host, deliver, verify, and store micro-credentials

- Upload the micro-credentials and enable accessibility and sharing across multiple platforms (e.g., LinkedIn, other provincial micro-credential systems)
- Provide ongoing technical support
- Explore or leverage LMS or micro-credential technology to support alignment of learning and career development pathways

Delivery

Pilot test: Test the micro-credentials with a small group of learners, employers, and partners prior to larger-scale roll-out

- Implement proof-of-concept to verify technology, curriculum suitability, relevance to workplace needs
- Collect feedback and identify opportunities to improve

Implement:

Conduct outreach, recruitment, and engagement with employers, learners and other stakeholders

- Enroll learners in the training
- Communicate to learners the value of the training outcomes for their learning and career development pathways
- Communicate the resulting HR actions and benefits of micro-credentials to employers to raise awareness and generate buy-in

Implement the training, provide support, and encourage progress

- Support learners and employers to progress through the learning

Assess learning and skills acquisition and issue micro-credentials

- Assess both knowledge and applied competencies
- Consider practical assessments and/or testing that reflect authentic workplace scenarios or knowledge

Evaluate: Evaluate the training

- Conduct pre- and post-assessments to verify learning and suitability to the workplace
- Evaluate the outcomes on learners, employers, and other stakeholders
- Evaluate the incremental impacts above and beyond other learning formats
- Evaluate the returns on training investment

Sustainability

Sustain learner and employer engagement

Collect and share success stories, benefits, outcomes

- Showcase positive return on investment (ROI)
- Communicate best practices and lessons learned

Ensure learners can use micro-credentials to shape their own skills upgrading and lifelong learning journey

- Align with career progression
- Align with learning needs

Strengthen employer buy-in and recognition

- Illustrate the use case of micro-credentials in hiring, onboarding, and promotion practices
- Demonstrate the value of micro-credentials as a workforce development tool
- Showcase employer success stories, positive ROI

8. Conclusion and Recommendations

The Level Up: Skills Evolution project succeeded in applying a multi-sector collaborative approach to developing industry-driven, competency-based micro-credential training across five sectors and demonstrated the potential of micro-credentials to address critical workforce development needs. Working together to create and pilot rapid and relevant training to reskill and upskill workforces within each industry provided a rare opportunity to collectively define and design a micro-credential roadmap that can become the foundation for a valid and recognized approach to the creation of a larger micro-credential ecosystem.

Within a short time period, project partners were able to engage with large numbers of learners and employers, generating tremendous momentum across multiple sectors and facilitating active participation of multiple sectoral stakeholders in the micro-credential conversations. The industry-led nature of these micro-credentials emerged as a strength, as employers valued the ways they can use micro-credentials to address current skills gaps and meet future skills needs. Discussions on more concrete Human Resources use cases of micro-credentials started to emerge as a result.

The project also confirmed the feasibility of cross-sector collaboration on micro-credentials. All partners highly valued the opportunities to discuss common challenges, share promising practices, and brainstorm further solutions throughout project design, delivery, and evaluation. Collectively, a diverse suite of micro-credentials was offered, with each micro-credential being contextualized to meet the sectoral and regional priorities within which the training was implemented. At the same time, there were strong overlapping themes in the fundamental training objectives – for example, there was an emphasis on social emotional skills training aligned with occupation-specific job competency requirements. These overlapping themes highlighted the potential for deeper cross-sector collaboration in the future.

Training outcomes were positive as well. There was positive evidence of skills development among participants across all sectors. Feedback from employers and industry stakeholders showed early trends of promising results. Most appreciated the short and flexible nature of the micro-credentials, helping to minimize training opportunity costs for the employers while empowering the learners with the autonomy to take charge of their own skills development.

The project also produced valuable lessons learned that could inform future initiatives. Most importantly, it highlighted the needs to continue building recognition around the term “micro-credentials” among employers. Most participating employers recognized and appreciated the value of micro-credentials, having gone through the project. However, most also stated that more work was needed to better raise awareness and generate buy-in within and across sectors. Determining the common defining features of industry-led micro-credentials may help with this, but more work is needed to develop, pilot-test, scale up, and validate these features across more sectors. The project team hopes that the industry-led micro-credential roadmap coming out of this project will provide a starting point for this initiative.

Overall, the project team was pleased to be able to design and deliver competency-based, industry-specific micro-credentials across multiple sectors. Our strength is in our ability to quickly respond to evolving industry needs. We recognize that this is the beginning of the micro-credential discussions in Canada, and we look forward to further collaboration with other key governmental and post-secondary players within the micro-credential landscape.

Key project learnings:

- There is still work to do to make the case for employers to value and adopt micro-credentials in their HR processes.
- Employers currently value practical and effective training that meets their needs—they are open to investing if the training works.
- The value of training is deeply tied to the reputation of the training providers for learners and employers.
- The perceived value-add of incorporating digital credentials and open badging (i.e. transferable and shareable) varies across sectors, primarily based on exposure and familiarity.
- Employers consistently reinforce research findings that support the need for more rapid and targeted skills development.
- More self-directed training options are perceived as broadening access and learning opportunities, especially for under-represented groups.
- Digital badges that recognize learning at a modular level are viewed as potentially helpful for career development, but there is much uncertainty around the logistics and practicality.
- The proof of concepts across all sectors garnered positive feedback for the feasibility of micro-credentials within each industry.
- There is some unevenness across sectors for the overall perception and value of adopting micro-credentials as a training, planning and skills assessment tool.
- There is a notable shift in the attention and credibility being accorded to digital credentials in general and micro-credentials, specifically provincially and federally.
- Different provincial government bodies have demonstrated different levels of interest in genuinely collaborating with employers and industry organizations or have decided it is not in their scope of authority to play an active role.
- The Sectoral Micro-credential Roadmap that outlines our methodology and framework to develop competency-based rapid training and micro-credentials was well received at all three knowledge mobilization events and has started to generate and invite further discussion, contributions, and development among other sectoral groups, post-secondary institutions and other interested stakeholders to advance the work started through this project.

- As the micro-credential landscape progresses from the “Wild West,” sectoral groups are excited to play a role in helping micro-credentials become more recognized and supporting the development of relevant industry-led training that addresses the current and emerging skills needs for SMEs in Canada.
- Overall, the project met its objectives in a collaborative, innovative, and forward-thinking way. The key to the success of this work was each sector's ability to tap into the needs of their specific industries and bring lessons and insights to share. The cross-sectoral model is recommended for future projects.
- By fostering cross-sector collaboration and aligning training with industry needs, micro-credentials can play a significant role in building a skilled, adaptable workforce for the future.
- Through ongoing collaboration, evaluation, and knowledge dissemination, micro-credentials can become a cornerstone of workforce development strategies, driving economic growth and enhancing the competitiveness of various sectors.

Part Two

EMC Pilot Project in Detail

EMC

CANADA'S LARGEST
MANUFACTURING CONSORTIUM

1. Project Overview

Led by the Excellence in Manufacturing Consortium (EMC), *Skills Evolution* explored the feasibility of an industry-led model of skills upgrading, aiming to provide employers and industry stakeholders with timely solutions to address skills gaps, labour shortages, and key workforce development needs.

This report presents the results of the micro-credential pilot designed and delivered by EMC. We describe the background research that informed the development of the micro-credentials. We then provide an overview of the multiple micro-credentials that EMC piloted through this project. The analysis of their results is presented next, using both quantitative and qualitative data to paint a holistic picture of the success stories and lessons learned. Employer feedback is also included in this section. We conclude the report with some final remarks and suggestions for further work.

EMC and SRDC worked together on project objectives, leveraging experience from previous projects focused on workforce development, skills training, program and service delivery optimization, and innovative solutions to support populations at risk or with significant and/or multiple barriers to employment.

Skills Evolution involved the design, pilot-testing, and evaluation of micro-credentials tailored to the pressing skills needs of each of the participating sectors. EMC led this initiative within the manufacturing sector. The findings of *Skills Evolution* provided new insights for scaling up sectoral micro-credentials through the identification, validation, prioritization, and updating of occupational competency framework for manufacturing supervisors and production workers.

Manufacturing industry research

Highlights

- **Engagement with employers was the backbone of this project**
- **Focus groups conducted with 31 participants from 26 different companies based in ON, NS, and NB**
- **Employers' challenges include persistent post-COVID issues, supervisors with limited communication and soft skills, supply chain delays due to a lack of adaptability and problem-solving**
- **Identified need for training in Psychological Health and Safety and Time Management for supervisors**

Employer consultations

Employer focus groups

EMC identified early on that engagement with employers was the backbone of this project. With their existing suite of training tailored to the manufacturing sector, there were readily available curricula to pilot test as micro-credentials. To investigate the current and emerging needs of employers, EMC and SRDC conducted focus groups with 31 participants from 26 different companies based in Ontario, Nova Scotia, and New Brunswick. Focus groups occurred between November 8-24, 2022, and were facilitated in English over Zoom's virtual platform. Participants represented a variety of roles (e.g., manufacturing supervisors, middle management, and Human Resources personnel) but the focus of the discussion targeted supervisor experiences and their role within their companies.

The objectives of these focus groups were to:

1. **Identify learning** priorities for curriculum development,
2. Use common themes to **inform job performance statements** for skills assessment methods,
3. **Revise competency frameworks** to reflect employer perspectives for the supervisor and production floor worker job roles, and
4. **Align training** with the primary business objectives identified by employers.

Initial findings

Overall themes demonstrated the challenges manufacturing employers faced including persistent post-COVID issues, supervisors with limited communication and soft skills, and how supply chain delays escalate due to a lack of adaptation and problem-solving.

Employers emphasized that their new and even some more experienced supervisors have limited abilities in key job areas including employee stress and performance management, coaching or leadership, as well as organizational and time management skills.

The focus groups provided broader and nuanced details about company business objectives, their challenges, current mitigation strategies, as well as employee skills gaps that could be addressed through EMC's tailored training programs (e.g., Manufacturing Essentials Certification).

Business objectives in manufacturing are linked to the overarching goal of sustained financial profitability. Employers also stated that quality, safety, productivity, continuous improvement, staying competitive, as well as community and environmental impacts are crucial elements of success for their businesses.

> *"Productivity and quality, for us that goes hand in hand, especially right now with how much work we have in front of us. Whenever we have the quality issues, we don't have the time to be fixing things, let alone doing them again. So, trying to manage that, it's going to be big for us in the next couple of years."*

Quality can be directly linked to regulatory standards for some businesses (e.g., food manufacturing,

medical devices, biopharmaceutical industries, etc.). Quality issues create challenges for productivity if workers must take time to fix mistakes or redo tasks entirely. **Safety, quality, and productivity** were viewed as similarly interrelated with a need for supervisors to balance the growing pains of business development while still meeting quality standards and reducing the number of workplace injuries.

Continuous improvement involves keeping track of metrics and having systems in place for monitoring and implementing change (Ahmed, Loh, & Zairi 1999; Bhuiyan & Baghel, 2005). The resulting incremental improvements help companies stay competitive, but to do so, they must also consistently update and maintain equipment, utilize automation where possible, and manage skilled labour recruitment, training, and retention.

> *"We want to safely produce [our products] while being a valuable member of our community. We're in a small community, so it's important to be a good community member, and it's living up to our quality expectations. We have reputation in the industry, so it's making sure that we're continuing to produce the same amount of quality."*

Finally, companies frequently stated how **corporate social and environmental responsibilities** are critical in our evolving ecological and socio-political climates. Sustainability is challenging for some businesses who are smaller and may lack internal skills or capacity to hire reliable external partners. Businesses are also required to have a "solid social standing" by maintaining their professional reputation and getting involved with local community events and activities.

In sum, employers shared how interrelated organizational and supervisory challenges created significant problems for many companies as they grappled with production delays, labour shortages, immigration or other regulatory parameters, effective communication, post-COVID absenteeism, and shifting employee demographics and preferences.

Manufacturing competencies, skills gaps and other training needs

Employer participants were asked about their expectations and role competencies for floor supervisors. They emphasized that stress management was a critical emerging component of this role, particularly in the recent years after COVID-19. Stress and mental health supports were an issue for both supervisors and direct reports. They emphasized a need to build awareness about what resources are available, and whether they would access them internally through HR or through external services in the community.

Other issues they raised were **personnel allocation**, **delegation**, **task prioritization**, and getting to know employees and their capabilities to **appropriately match personnel to tasks**. Employers expected their supervisors to "lead by example," especially in relation to safety, and several employers mentioned the need for supervisors to **model the expected safety behaviour** in the workplace (such as always wearing appropriate PPE). Budgeting, fiscal awareness, and continuous improvement were other key areas that employers would like to see their supervisors develop further skills in.

> *"Being a supervisor is an entirely different cup of tea. So, it's finding somebody who is able to drive accountability in a respectful way and communicate to a lot of different people who's able to juggle a lot of different priorities. And I say pivot with creative solutions because we always have to pivot with creative solutions these days, it seems."*

Communication skills were emphasized by participants as key to continually developing emotional intelligence. Supervisors need the communication skills to ensure they can not only effectively train staff and provide clear instructions, but to also determine if staff have understood the training. This can be challenging with shifting communication needs in the workplace such as employees speaking multiple languages, or generational differences between younger entry-level employees who may prefer text-based communication compared to long-standing or older employees approaching retirement that may be more comfortable with face-to-face meetings. There are also a variety of platforms with differing and changing preferences, such as email, Slack, Zoom, Teams, Office 365, Signal, among others.

> *"For our supervisors, managers at our team, this understanding that there's this cross collaboration towards a common goal and then the communication piece is huge, like, really, really important for us."*

Employee engagement and performance management also require supervisors to link their communication and leadership abilities. Supervisors need to keep employees engaged with equitable people, time, conflict, and project management skills. This includes coaching and providing feedback. Supervisors need the ability to have performance discussions constructively, limit issues by addressing them early, and knowledge of how to effectively communicate with difficult personalities (both internally and externally). Lastly, it is important for supervisors to regularly, and meaningfully, recognize the contributions of colleagues and facilitate better collaboration across the organization to meet business needs.

Productivity issues can arise if supervisors are not effectively managing materials and personnel. Despite the labour shortages and challenges with absenteeism, production lines rely on each other and a delay in one area will inevitably create delays in other areas of the production line. Supervisors need to address the combined issues of an unpredictable supply chain and personnel coordination. Prioritization and adaptability are also important, as with other areas of supervisor's job performance, productivity is

> *"Prioritization management, being able to properly organize your day, understand what things are important, how to delegate those type of things, how to communicate to your folks on the shop floor."*

closely linked to effective time management, communication, organization, delegation, and being able to anticipate problems or recognize when and how operational processes could be improved for efficiency and safety. Success in all these areas will promote improvements for productivity.

Quality assurance and control involves supervisors ensuring that employees are correctly following their instructions and processes. There is a need to ensure they follow up with staff, especially after a change in procedures and for new staff as they are in-training.

Supervisors must have **awareness of regulatory or other quality control requirements**.

"Pointing out to a colleague an unsafe act that they may be doing, and we're also documenting that in our incident reporting system. So then we're able to draw on that data later as well to we have our processes involving our incident reporting program."

Safe work practices of supervisors go beyond setting a good example for floor staff, and employers stated that they needed their supervisory staff to ensure that standard operating procedures (SOPs) align with safe work policies, that employees are appropriately trained, and that employees are adhering to those SOPs.

Supervisors also need to know how to **manage the documentation and processes for safe work**. They must monitor, identify, and correct any unsafe work practices while also using it as a learning opportunity. These instances must be documented and monitored regularly as a part of their organisational key performance indicators (KPIs).

Learning priorities

Communication and performance management were identified as interconnected skills gaps that many manufacturing supervisors required further training on. Employers emphasized a need for supervisors to thoughtfully develop their human skills through coaching and mentorship. They also acknowledged that these human, or soft skills and leadership abilities are competencies that build over time through both training and workplace experience.

Supervisors require the communication skills for training employees and helping them understand the impact of their work. They need to coach effectively by knowing how to interact with people, learn differing communication styles and what works well with team members, understand how staff want (or don't want) to be recognized, and know how to provide feedback constructively. Communication strategies need to incorporate cross-cultural, diverse language-level, and generational needs and preferences.

"Supervisors not having the skills to provide feedback, often viewing it as a contentious conversation versus a development conversation, and then the ability to not take it personally."

Organization and time management were gaps that employers emphasized as a training need to help supervisors with competing demands of the manufacturing workplace. They suggested everything from scheduling personnel and coordination between departments, to the prioritization of tasks by setting and communicating goals to employees. Overall, training to build those soft skills and steps for steering the team to do the technical work needed.

> *"Mental health first aid, understanding your people and when they're struggling, and also substance use. Recognizing when there may be an issue, how to how to deal with it, that training's very, very valuable."*

Psychological health and safety in the workplace emerged as a common theme that supervisors struggled with. Employers needed training for supervisors to manage work-related stress for themselves as well as for direct reports and increasing awareness of mental health first aid. Employers generally perceived an overall drop in mental health as a persisting impact of COVID-19.

> *"Leadership teams are very busy, and they have many competing deadlines as well. So, just having that kind of training to get them more engaged, but at the same time, be able to manage competing deadlines. You can prioritize and or even compartmentalize priorities."*

The workforce also has shifting expectations for **work-life balance**, including hybrid and more flexible workplace policies (Howe, Chauhan, Soderberg, & Buckley, 2021). These shifting employee preferences were top of mind for participants in focus groups, and employers recognized a need for supervisors to have the skills to support employees while also managing expectations that may be unrealistic (e.g., manufacturing supervisors and floor employees cannot generally complete their work remotely for example).

These learning priorities emerged from focus groups and when this information is synthesized it highlighted three key areas for training:

- **Leveraging the Manufacturing Essentials Certification** (MEC) training currently offered by EMC to supervisors to address key supervisory and leadership abilities they need to develop;
- **Psychological Health and Safety training** for supervisors to manage their own personal and professional well-being, while also facilitating a workplace environment where there is space for discussing and asking for mental health supports; and
- **Supervisory Time Management training** to build the organizational and time management abilities within the manufacturing context.

The employer focus group also served as another source of data to update the competency frameworks for two occupational levels in manufacturing: production supervisors and front-line production workers. The next section describes these frameworks.

2. Developing Competency Frameworks Specific to Manufacturing

The competency frameworks are intended to provide a common organizing *structure and terminology* to document skills gaps, job performance metrics, and business outcomes, guiding further discussions on training solutions.

The primary objectives of the frameworks are as follows:

1. **Identify the skills and competencies needed** to successfully perform the role of supervisor and production/front line worker.
2. **Link key skills and competencies to business outcomes and identify gaps** where training will motivate employer investments.
3. **Clarify which of these gaps are best addressed through rapid skills micro-credential training** in order to provide a strong basis for the development of the training curricula and materials.

SRDC prepared the preliminary frameworks using our own **document review and environmental scan**.

EMC's previous competency frameworks served as the first building blocks. We then scanned other Canadian and international manufacturing competency frameworks and occupational profiles - most notable were the **National Occupational Standards** (NOC) in Canada, the **Advanced Manufacturing Competency Model** developed by the Employment and Training Administration (ETA) in the United States, and the **Environmental Key Performance Indicators Reporting Guidelines for Business** in the United Kingdom on the environmental impacts of manufacturing.

We also ensured that our drafts aligned with the manufacturing occupational standards of other sectors, such as aviation and aerospace (the national occupational standards from the Canadian Council for Aviation and Aerospace), food processing (the competency profiles from Food Processing Skills Canada), mining (the national occupational standards from the Mining Industry Human Resources Council), and wood manufacturing (the national occupational standards from the Wood Manufacturing Council).

The draft frameworks attempted to organize different performance standards into consistent categories and link them to several areas of business outcomes. The aim was to have a *manageable number* (6-8) of broadly defined business outcome areas and employee-level performance requirements which could then be linked together — such as acknowledging how *employee-level* workplace practices may influence business-level *health and safety* outcomes — and which could be further linked to the underlying occupational standards so that we remain grounded in the fundamental aspects of work.

As such, each framework is organized as follows:

I. Business-level outcomes are identified with three sub-levels:

1. **Broad business needs and priority areas** as might be described by employers including health and safety, product quality, productivity, human resources and staffing issues, environmental impacts, and revenues.

2. **Business level performance indicators** – distinct from the description of business priority areas are the *indicators* of successful performance in each of these areas. Examples might include, for health and safety: incidents, non-compliant events; for product quality: first-pass yield, scrap rate; for productivity: unit costs; human resource issues: indicators of worker morale, retention, wage costs, and skills development; for environmental impact: emissions to air, water and land; and for revenues: customer base.

3. **Examples of business-level performance measures** – provide an additional layer of specificity that facilitates discussion of measurement. Too often, KPIs, lack specificity and are, indeed, not measurable as they are expressed. True KPIs have a clear definition and scope (e.g. what's included and what's not) with a concrete method of quantification (e.g. per person, per project, per period).

II. Employee performance is identified with two sub-levels:

1. **Employee performance areas** – broad categories of occupational requirements that correspond to the business areas of interest (e.g. "safe working practices" consolidates a number of occupational safety requirements and can be linked to business-level health and safety outcomes).

2. **Employee-level performance indicators** – these are the performance indicators that consolidate a much richer set of occupational requirements from the multiple documents we scanned. The challenge here was coming up with a manageable set of indicators that both effectively integrates existing resources and facilitates discussion about skills and performance gaps with employers. We aimed to ensure that these indicators reflected the critical groups of performance requirements. We also used language that employers would recognize.

III. Skills for Success is identified to narrow down the key social-emotional skills areas to guide training development decisions, with three sub-levels:

1. **Skills** – these are the major skill headings to show the key skills focus (e.g., collaboration, adaptability)

2. **Component** – these provide further details on the specific aspects of the skills that support successful employee performance (e.g., under collaboration, a skill component could be managing difficult interactions with other people)

3. **More details** – we further elaborate on the ways the skills can be applied on the job

After the focus groups with employers, we updated these frameworks with more concrete examples of performance indicators and skills details or applications.

We also tightened the alignment across three major columns (business outcomes, employee performance, and skills). At this stage, the frameworks were not intended to be used as standardized definitions of business or performance outcomes, KPIs, or what measurement strategies should be.

We aimed for the frameworks to serve as “content drivers” for the eventual curricula and learning objectives in the micro-credentials that EMC would later develop, as well as to inform the design of the evaluation tools quite directly.

3. Research Methodology

This analysis was conducted using a variety of methodologies where the primary source of data are participant surveys with learners, supplemented with data from employers.

Descriptive statistics of respondents’ demographics were used to better understand who participated in the micro-credential training. Learners’ gender, age, and linguistic, ethnocultural, and immigration indicators were examined to provide a profile of the participants.

Additionally, the surveys delved into participants' educational backgrounds, professional experiences, and awareness of micro-credential training. Mostly-quantitative survey data were supplemented with qualitative data that gave respondents the opportunity to articulate their experiences, challenges, and perceptions in more depth. Open-ended questions in the survey provided a platform for participants to share narratives, anecdotes, and specific examples related to their engagement with the micro-credential training. This qualitative data enriched our understanding of the quantitative findings, offering valuable insights into the nuanced aspects of the learning experience. The combination of quantitative and qualitative data provided a more holistic view of the impact and effectiveness of the micro-credential program from the perspective of the learners.

The data collected from employers included feedback on the perceived impact of the acquired skills and knowledge on employee performance and the overall organizational outcomes. This multi-faceted approach not only facilitated a nuanced exploration of the learners' characteristics, but also allowed for a robust evaluation of the practical implications and effectiveness of the micro-credential program in meeting both individual and organizational needs.

Outcome data were collected through self-reports from participants, and *t*-tests were used to examine whether skills outcomes difference before and after micro-credential training.

All of these were summarized across participants, both for the entire sample and for some sub-group analyses separately to better understand whether the length of the training and the size of the company impacted learners’ experiences with micro-credential training.

4. Pilot Overview

Highlights

- **Primary source of data was participant surveys with learners**
- **Supplementary data gathered from employers**
- **Demographics included gender, age, and linguistic, ethnocultural and immigration status**
- **Also collected data educational backgrounds, professional experiences, as well as feedback about and awareness of micro-credentials**

Based on the responses from the focus groups with employers and manufacturing production workers, EMC reviewed and finalized updates to their existing **Manufacturing Essentials Certification (MEC)** training and aligned the assessment and certification approach to emerging standards for micro-credentials based on the environmental scan, feedback from experts, and industry input.

Building on the existing MEC training for manufacturing supervisors, training around mental health and time management were developed based on the needs identified by employers during the initial focus group sessions.

Additionally, although employers were asked about how environmental sustainability plays a role in their businesses, there were few existing examples of training to help supervisors contribute to developing business practices that align with environmental protection and sustainable manufacturing. This course was added to the suite of training offerings through this project.

Table 1 presents a summary of the format and learning objectives from the pilot.

Table 1 Rapid Training and Micro-credential overview

Course name	Learning objectives	Duration	Format*	Awarded
Manufacturing Essentials Certification (MEC)	Leadership, problem-solving, collaboration, communication, coaching and supervisory competencies	8+ weeks	Hybrid in-person and online facilitated	Micro-credential
MEC Green Skills	Leadership, problem-solving, collaboration, creativity and innovation, specific green manufacturing competencies, sustainability in manufacturing (awareness and strategies)	8+ weeks	Hybrid in-person and online facilitated	Micro-credential
AMS Time Management	Time management, delegation, leadership, communication	4 weeks	Virtual facilitated	Micro-credential
AMS Psychological Health and Safety	Mental health awareness, stress management, coaching, providing effective feedback	4 weeks	Virtual facilitated	Micro-credential
Workshop Time Management	Time management	Half day	Virtual facilitated	Badge
Workshop Psychological Health and Safety	Stress management	Half day	Virtual facilitated	Badge
E-learning Time Management	Time management	1 hour	Virtual self-directed	Badge
E-learning Psychological Health and Safety	Stress management	1 hour	Virtual self-directed	Badge

** Note: facilitated micro-credentials involved synchronous learning, while e-learning formats were* asynchronous self-directed

5. Analysis and Results

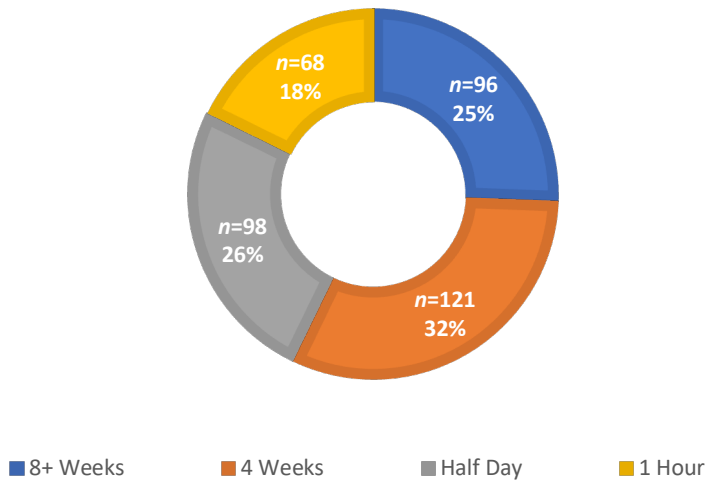
Highlights

- **Micro-credentials are increasingly being recognized as a valuable and strategic complement to traditional educational pathways.**
- **The effectiveness of training is often measured by its relevance and practical application in today's dynamic workplaces.**
- **Learners reported a high degree of overall satisfaction with the micro-credentials offered by EMC .**
- **As individuals gain exposure to training, their trust in micro-credentials tends to grow.**
- **Enhancing communication between industry and education stakeholders is crucial.**

Participant profile

Participants were learners from small (less than 100 employees), medium (100-499 employees), and large (over 500 employees) companies who participated in micro-credential training ranging from one-hour to over eight weeks (see Figure 1). A quarter of the learners enrolled in the longer courses lasting 8 to 10 weeks. About a third (32%) enrolled in 4-week courses. Another quarter (26%) enrolled in half-day workshops, while the remaining 18% participated in the online e-learning.

Figure 1 **Learner distribution across types of training**



Learners in the 1-hour and half-day micro-credential training completed two follow-up surveys: the first follow-up took place immediately following training while the second took place approximately one-month after training. Learners in the four and over eight-week micro-credential training completed a baseline survey before training started as well as the two follow-up surveys. By September 6, 2023, 295 participants had completed a baseline survey, 214 had completed the first follow-up survey, and 105 had completed the second follow-up survey.

Participant population

This section highlights participants' key baseline characteristics, including their demographics, education, and employment journeys.

Demographics

As shown in Table 2, participants were equally distributed by gender, with 49% identifying as male and 51% identifying as female or non-binary. Most participants were within the Canadian core working demographic of ages 25-54 (83%), with some younger and some older participants (4% in the 18-24 age group and 13% in the over 55 age group, respectively).

Table 2 Participant baseline demographics

Characteristic	#	%
Gender (*n* = 287)		
Female/Non-Binary/Prefer to Self-Describe	147	51%
Male	140	49%
Age group (*n* = 290)		
18 to 24	11	4%
25 to 29	35	12%
30 to 34	36	12%
35 to 44	94	32%
45 to 54	76	26%
55 and over*	38	13%

Source: Baseline survey.

*Note: * Data collapsed across two categories due to the small numbers of participants in one of the categories.*

Table 3 shows participants' varying linguistic, ethnocultural, and immigration backgrounds. Most participants reported English as their primary language of comfort (96%) with a smaller proportion reporting comfort in both official languages (4%). The majority were born in Canada (70%). Of those who

were born outside of Canada, most had moved to Canada more than 10 years ago (63%), while a smaller proportion were newcomers who had been in Canada less than 5 years (15%) or had been in Canada between 5 and 10 years (16%). Most participants identified as being of White/European background (71%), with the rest identifying with various racialized identities including Indigenous (Inuit, Métis, or First Nations), Black (African or Afro-Caribbean), Asian (Chinese, Bangladeshi, Indian, etc.), Latin (Latin American or Hispanic), or Middle-Eastern (Egyptian, Iranian, etc.).

Table 3 Participant linguistic, ethnocultural and immigration indicators

Characteristic	#	%
Language (*n* = 294)		
English	283	96%
French	0	0%
I am equally comfortable in both official languages	11	4%
Born in Canada (*n* = 292)		
No	88	30%
Yes	204	70%
Moved to Canada (*n* = 83)		
Less than 5 years ago*	15	18%
Between 5 and 10 years	16	19%
More than 10 years ago	52	63%
Race/Ethnicity (*n* = 294)		
White/European Person	208	71%
Racialized Person*	86	29%

Source: Baseline survey.

*Note: * Data collapsed across multiple categories due to the small numbers of participants in one or more of the categories.*

Education

As shown in Table 4, the majority of participants had either completed a bachelor's degree (38%) or college, CEGEP or some other non-university certificate or diploma (26%). Many had a graduate degree (10%) or had completed some university courses (9%). Some had completed apprenticeships or trades training (3%), while others had their high school diploma or less (13%).

Table 4 Participant educational experience

Characteristic	#	%
Educational attainment (*n* = 286)		
High school diploma/equivalent (e.g., GED) or less*	36	13%
Apprenticeship or trades/vocational diploma or certificate	10	3%
College, CEGEP or other non-university certificate or diploma	74	26%
Some university courses or diploma (below the bachelor level)	27	9%
Bachelor's degree	110	38%
Master's degree or Doctorate	29	10%

Source: Baseline survey.

*Note: * Data collapsed across two categories due to the small numbers of participants in one of the categories.*

Employment

The majority of participants were full-time employees (98%) who had been at their current company between one and five years (40%). Another 30% had been with their current employer for more than ten years, while a smaller proportion had been there less than a year (16%) or between five and ten years (15%). The largest industry represented by participants was the food, beverage, and tobacco industry (20%). Other industries with large representations included the machinery industry (12%) and the fabricated metal industry (13%), while 19% of participants indicated that they worked in an industry other than the ones included in Table 5. Many participants worked in development, engineering and quality control (16%), were Production Supervisors (14%), or indicated that they worked in a functional group other than the ones included in Table 4 (38%).

Table 5 Participant baseline employment status

Characteristic	#	%
Employment Status at Company (*n* = 295)		
Full-time employee	289	98%

Characteristic	#	%
Employment Status at Company (*n* = 295)		
Part-time/freelance/on-call/contract/temporary employee	6	2%
Time at Company (*n* = 294)		
Less than a year	46	16%
Between 1 and 5 years	117	40%
Between 5 and 10 years	43	15%
More than 10 years	88	30%
Industry of Company (*n* = 292)		
Food, beverage, and tobacco	57	20
None of the above	56	19
Fabricated metal	38	13
Machinery	34	12
Plastics and rubber	27	9
Motor vehicle and parts	18	6
Aerospace	14	5
Miscellaneous	12	4
Furniture	12	4
Textiles, clothing, and leather	8	3
Primary metal	5	2
Computer and appliances	*	*
Non-metallic mineral	*	*
Chemical, petroleum and coal	*	*
Wood and paper	*	*
Occupation's Functional Group (*n* = 290)		
None of the above	109	38
Development, Engineering and Quality Control	46	16

Characteristic	#	%
Employment Status at Company (*n* = 295)		
Production Supervisor	42	14
Production Manager	33	11
Administration Manager	33	11
Shipping and Receiving	17	6
Maintenance Trades	6	2
Sales and Business Development	*	*
Production Machine Operator or Assembler	*	*

Source: Baseline survey.

*Note: * Data not shown due to small numbers of participants in the respective categories.*

Learner feedback

Learners said the training helped improve their skills and was useful.

Participant feedback on the training was gathered as part of the first follow-up immediately following the training and was overwhelmingly positive (see Figure 2). The majority of participants agreed (46-55%) or strongly agreed (35-43%) that the training objectives were clear and met, that the training helped improve their skills and was useful, and that the topics were relevant to their job, and they would be able to use the training at work. Most notably, 90% of participants agreed or strongly agreed (46 and 44%, respectively) that they would recommend the training to others.

> *"The meetings felt like a safe space to learn and share."*

Figure 2 Participant training feedback overview

We also asked the participants to provide open-ended comments on the micro-credentials. These comments were overwhelmingly positive as well. Participants who offered open-ended comments spoke very highly of the facilitators, praising their communication skills, attitude, and availability /responsiveness to answering questions from learners. Participants also praised facilitators' knowledge, pacing, and approachability.

Below are more examples of these comments:

- ***"[Facilitator] was a good instructor. Listened intently and gave good feedback on discussions."***
- ***"[Facilitator] was wonderful and always very positive. He was always available or questions and answered emails in a very timely manner."***

- ***"[Facilitator] showed great enthusiasm for the subject matter and did a great job of keeping everyone engaged."***

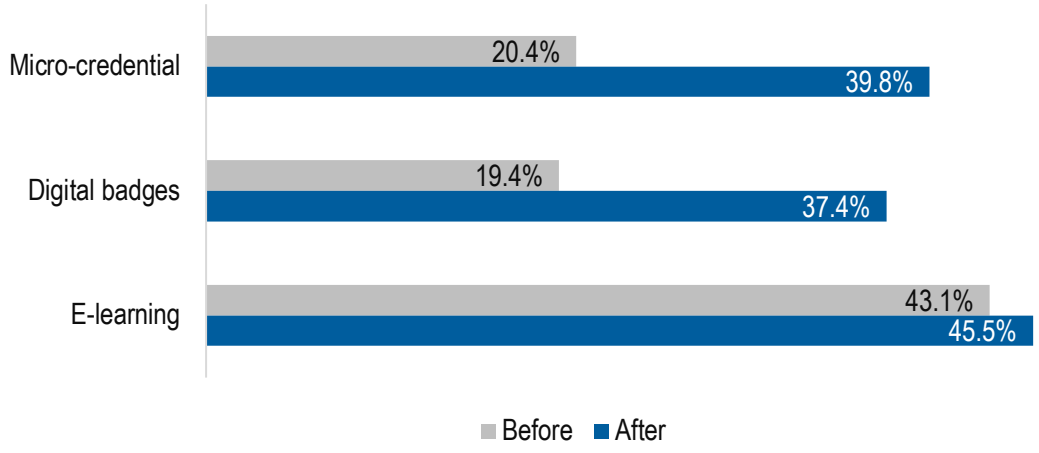
Some respondents included constructive suggestions, recommending the incorporation of additional scenarios and step-by-step real-life examples to enhance the content. While most participants who offered open-ended questions appreciated the level of the material (e.g., "I felt that the content was exactly what I was looking for."), some felt the material was too basic, while others felt that the material and workload was hard to manage with other commitments. Some participants also recommended adding more interactive components to the learning (e.g., videos, hands-on learning opportunities that could be implemented in their workplace). A few participants had recommendations specific to remote learning (e.g., having more people keeping their cameras on, fewer break-out rooms).

Micro-credential awareness

Awareness increased across all types of learning formats.

We asked the participants about their awareness of micro-credentials, digital badges, and e-learning before and after the program. Participants reported if they were extremely, very, moderately, slightly or not at all aware of these learning formats. Overall, awareness increased across all types of learning formats, nearly doubling for micro-credentials and digital badges. As shown in Figure 3, about 40% of participants reported that after the training they were at least moderately aware of micro-credentials, an increase from 20% prior to the training. Awareness of digital badges also increased, from 19% to 37%. Awareness of e-learning started at 43% before the training and increased to 66%after the training.

Figure 3 Awareness of different types of learning before and after the training



Skills outcomes

In this section, we discuss how the training influenced differences in participants' self-reported outcomes. Skills outcomes measured included **Psychological Health and Safety** (creating a supportive environment, creating a healthy work culture, supporting employees, supporting myself), **Collaboration** (effective feedback, coaching, conflict management, cross-departmental collaboration, leadership, perspective taking), **Communication** (communication adaptation, listen with intention, persuasion), **Planning, Management, and Adaptability** (planning, time management, responsibility management, goal management, adapting to changes), **Problem Solving** (identifying problems, addressing problems, proactive problem solving, evaluating solutions), **Green Skills** (climate, environmental awareness, environmental planning, monitoring environmental impact, creating sustainable systems), and **Career and Learning** (job satisfaction, attitude toward learning). These skills were measured by a variety of questions drawn from the research literature and created by SRDC to align with EMC's curriculum. Using a 5-point Likert scale (ranging from "not at all well" to "extremely well"), questions asked how well participants perceived their ability to complete various tasks within these skills.

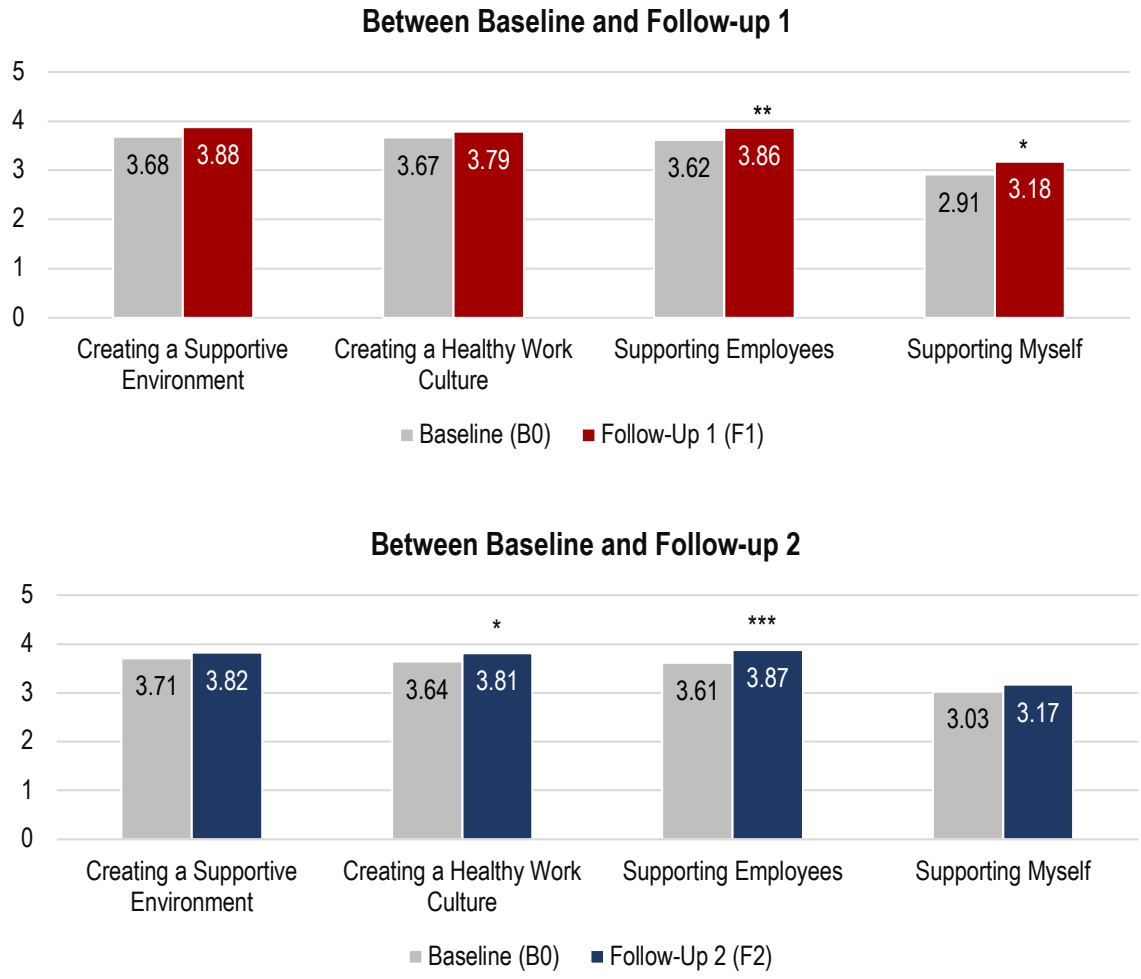
We compare how well the participants see themselves performing various tasks related to these skills before the training (at the baseline survey) with how well they see themselves performing these same tasks immediately after the training (at the follow-up survey F1), as well as 1-month following training (at the second follow-up survey F2). Differences in participants' self-reported skills before and after training are calculated using paired samples *t*-tests. Importantly, baseline data were not collected for courses shorter than 4 weeks (i.e., 1-hour and half-day courses), leading to smaller samples sizes for those analyses and potentially inadequate statistical power to detect differences between pre- and post-training survey results. We therefore indicate findings that may have been significant if the sample size were larger using a "*t*," while significant findings are indicated using asterisks (* = $p < .10$; ** = $p < .05$; *** = $p < .01$; where "*p*" indicates the probability of finding a significant result by chance).

In general, participants reported significant gains across all types of skills.*

Specifically, from baseline to the follow-ups, participants reported increases in their confidence, ability, and skills needed to support their employees (see Figure 4), and in their coaching, conflict management, leadership, and perspective-taking skills (see Figure 5).

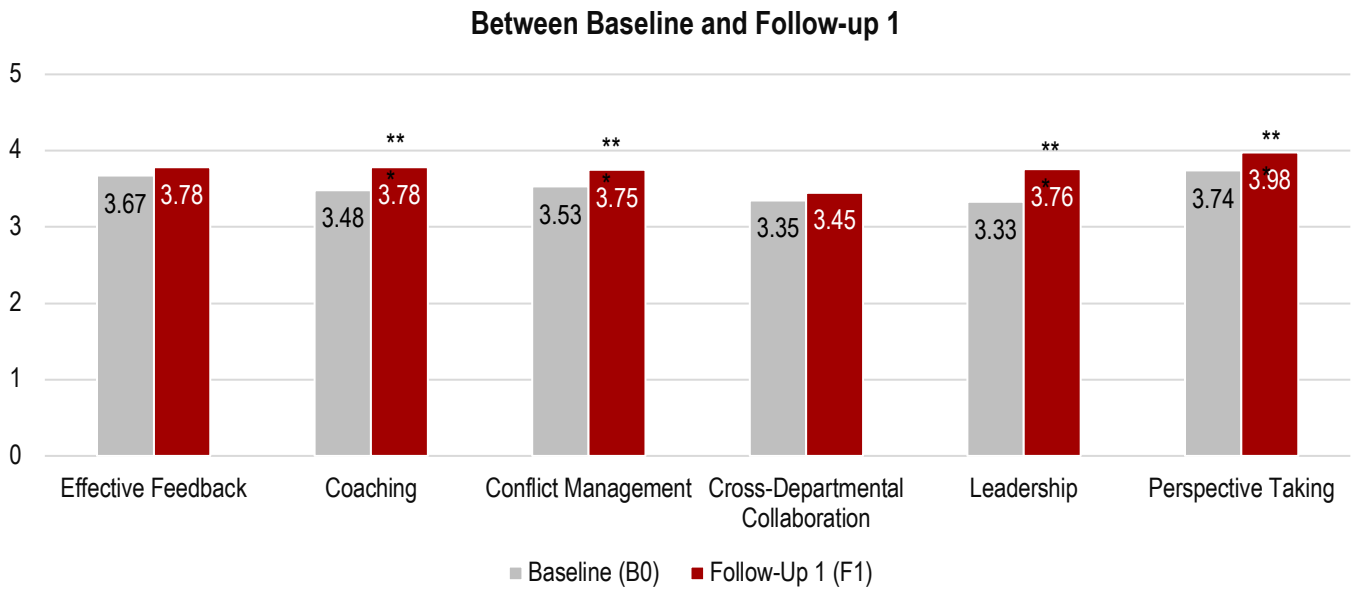
* See Appendix B

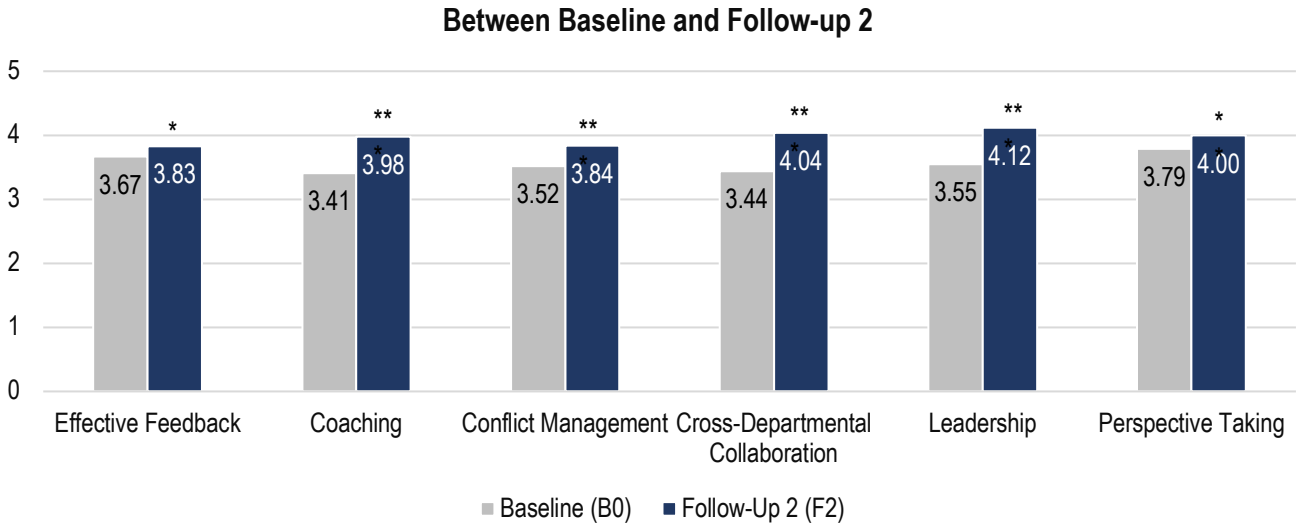
Figure 4 Psychological Health and Safety: Pre- and post-training survey results



*Notes: Statistical significance is denoted by asterisks: * - 90%, ** - 95% and *** - 99% confidence that the differences are not random chance.*

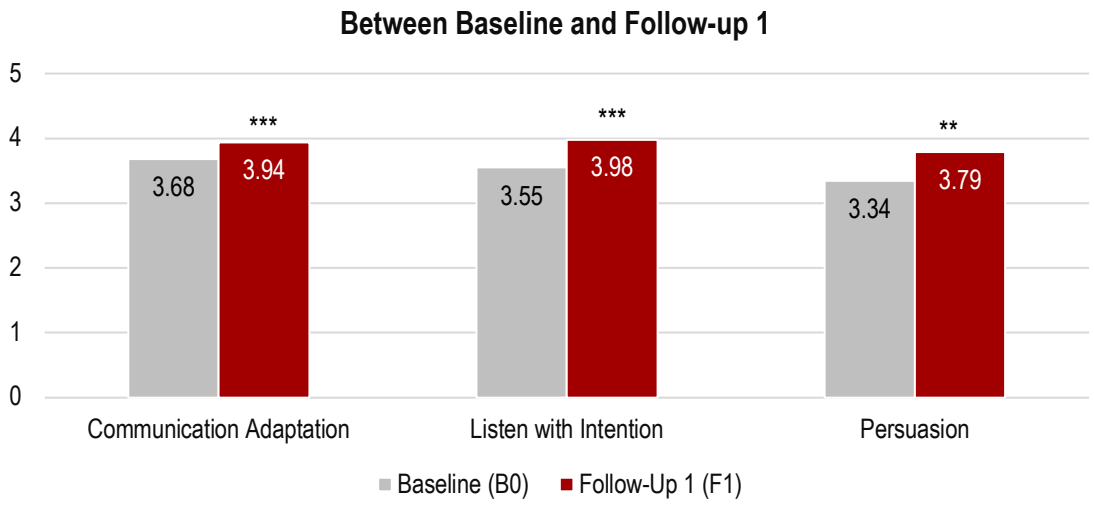
Figure 5 Collaboration: Pre- and post-training survey results

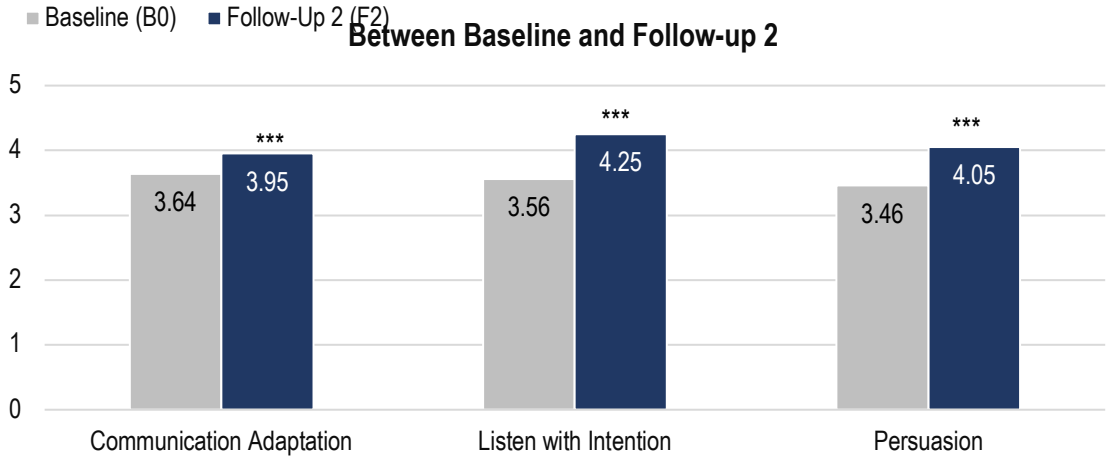




*Notes: Statistical significance is denoted by asterisks: * - 90%, ** - 95% and *** - 99% confidence that the differences are not random chance.*

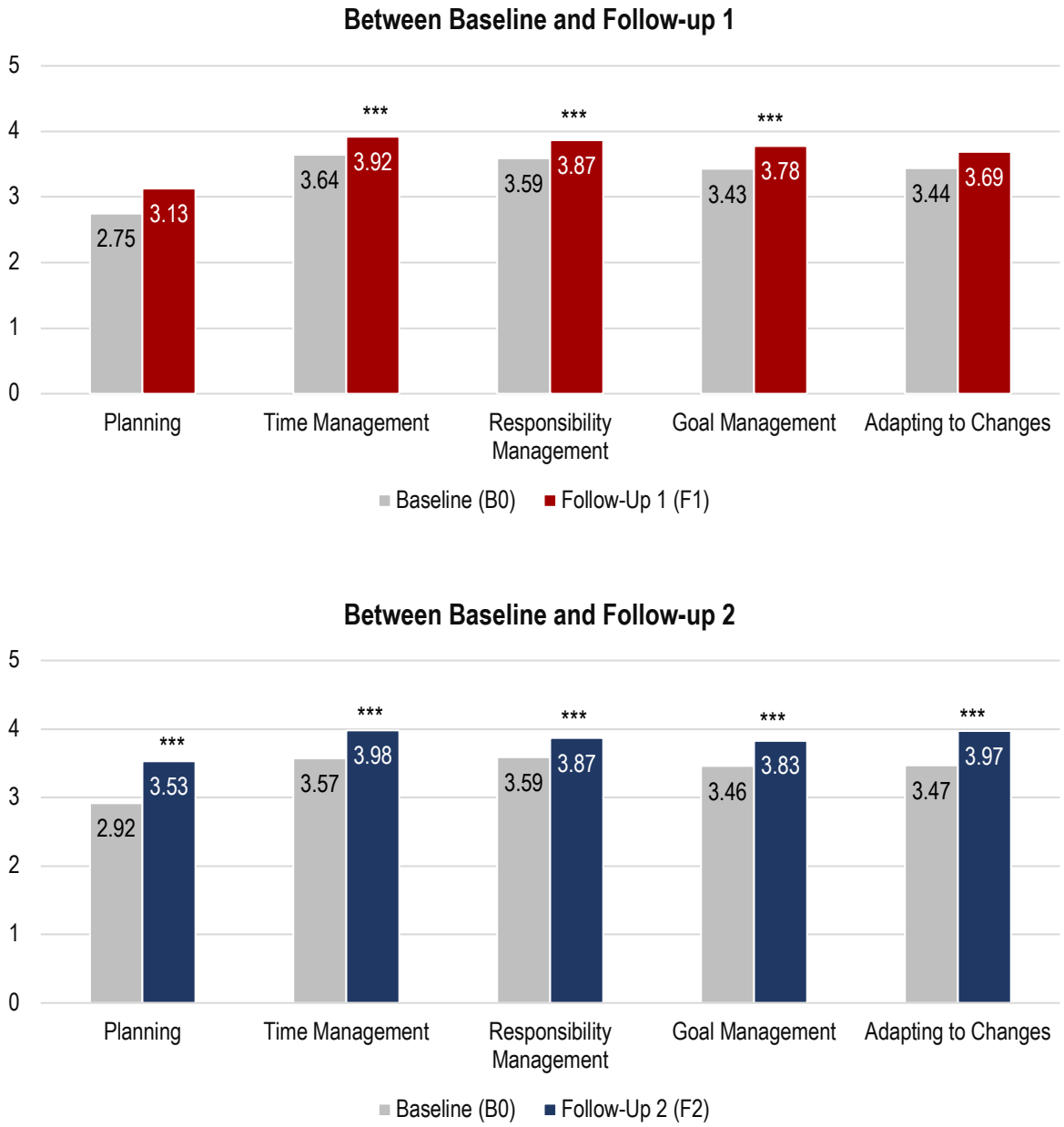
Figure 6 Communication: Pre- and post-training survey results





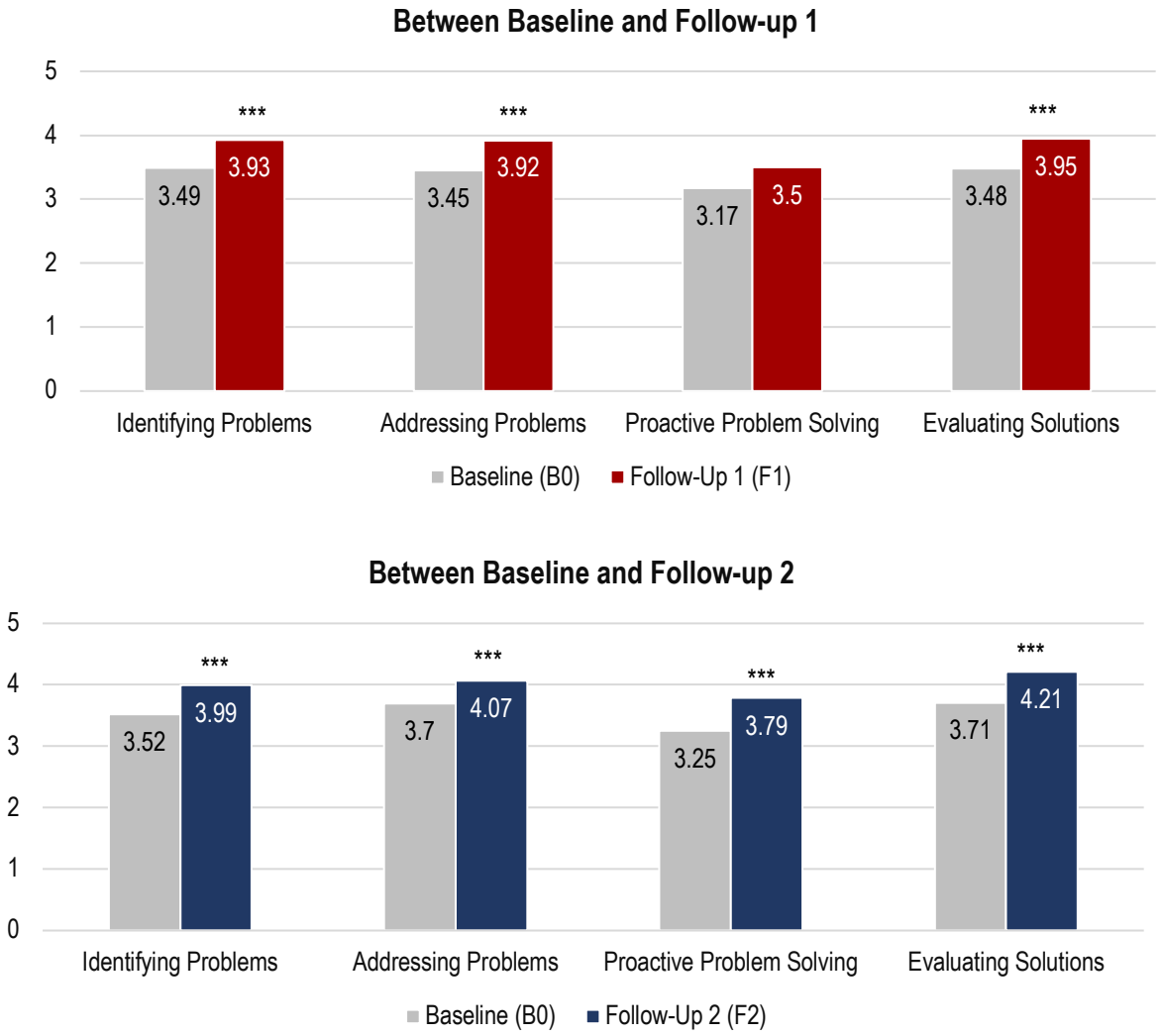
*Notes: Statistical significance is denoted by asterisks: * - 90%, ** - 95% and *** - 99% confidence that the differences are not random chance.*

Figure 7 Planning, Management, and Adaptability: Pre- and post-training survey results



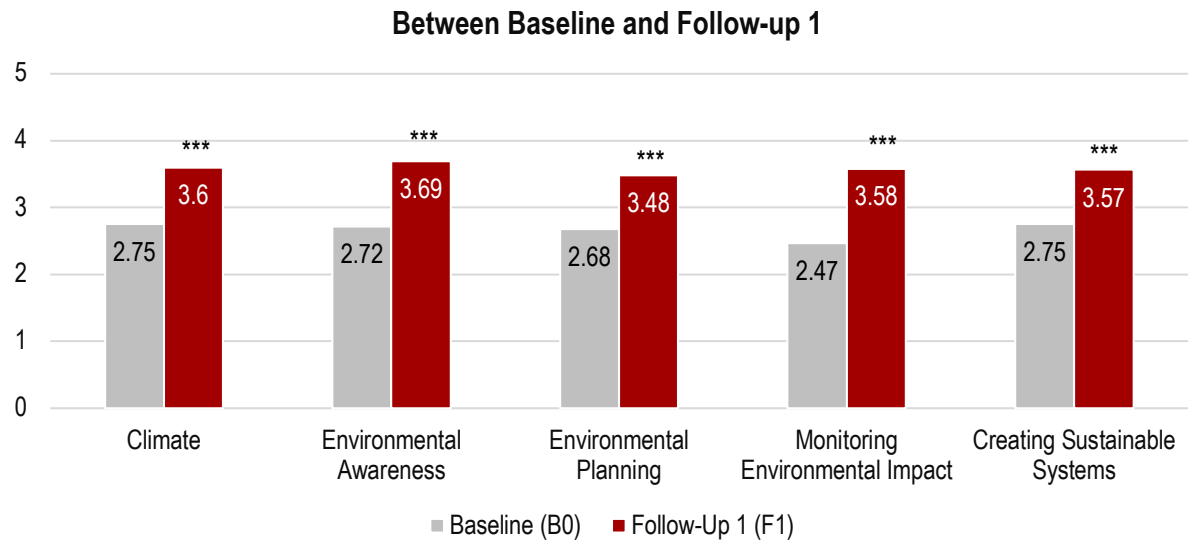
*Notes: Statistical significance is denoted by asterisks: * - 90%, ** - 95% and *** - 99% confidence that the differences are not random chance.*

Figure 8 Problem Solving: Pre- and post-training survey results



*Notes: Statistical significance is denoted by asterisks: * - 90%, ** - 95% and *** - 99% confidence that the differences are not random chance.*

Figure 9 Green Skills: Pre- and post-training survey results

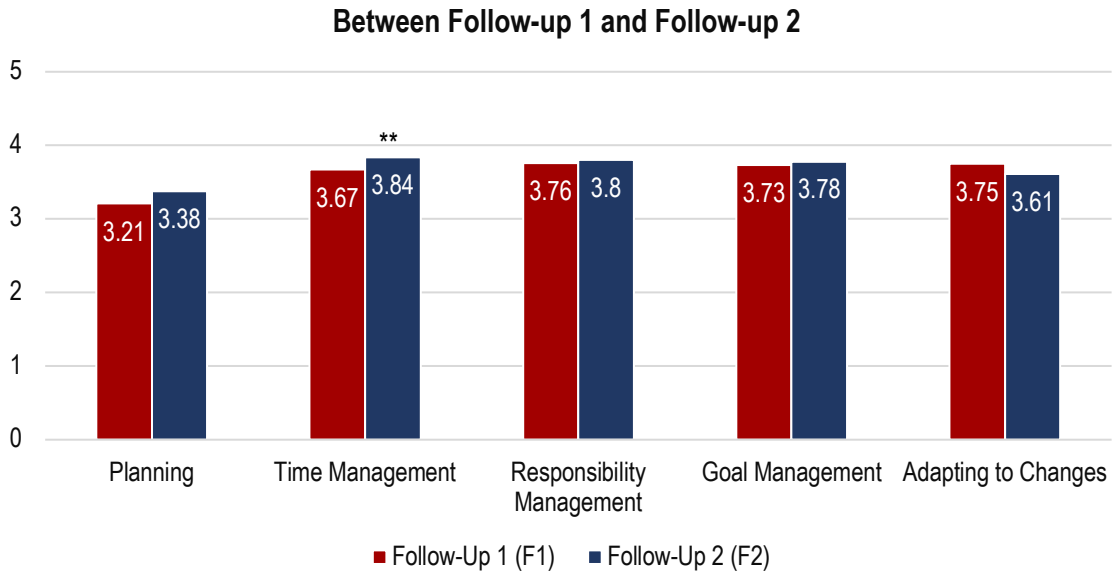


*Notes: Statistical significance is denoted by asterisks: * - 90%, ** - 95% and *** - 99% confidence that the differences are not random chance.*

Participants were able to maintain their skills gains

Across most skills, participants also reported no significant reduction in their skills from the first to the second follow-up survey, indicating that participants were able to maintain their skills gains even at one-month post-training (see Appendix B for details). Interestingly, participants reported improvements in effective feedback and cross-departmental collaboration from baseline to the second follow-up, but not at the first follow-up (see Figure 5 above). Participants also reported further improvements in time management beyond the skills gains reported at the first follow-up (see Figure 10 below). These improvements at the second follow-up one-month post-survey suggest that perhaps effective feedback, cross-departmental collaboration, and time management skills require on-the-job applications to be fully, or better in the case of time management, understood and internalized by participants. Perhaps with continued opportunities for onsite application, these skills will continue to improve.

Figure 10 Planning, Management, and Adaptability: Differences between Follow-Ups



*Notes: Statistical significance is denoted by asterisks: * - 90%, ** - 95% and *** - 99% confidence that the differences are not random chance.*

These results are highly promising and indicate that not only can micro-credentials make a positive difference in participants' skills, and the improvements in skills are either maintained or improved at one-month post-survey.

Even for skills with very few respondents, such as the green skills, participants reported very significant skills gains from pre- to post-training. These findings are very encouraging and suggest micro-credentials can transform employee skills in a targeted manner and within a short amount of time.

Subgroup differences in training results

Overall, we assessed for differences in training experiences and micro-credential awareness with a series of demographic indicators, as well as length/type of training, and size of employer. Demographic characteristics included testing for differences based on gender (comparing men to women), immigration status (comparing immigrants with those born in Canada), and ethno-racial background (comparing those racialized as Indigenous, Black, and other People Of Colour to people who are racialized as white/European ancestry only).

There were no statistically significant patterns to differences based on demographics.

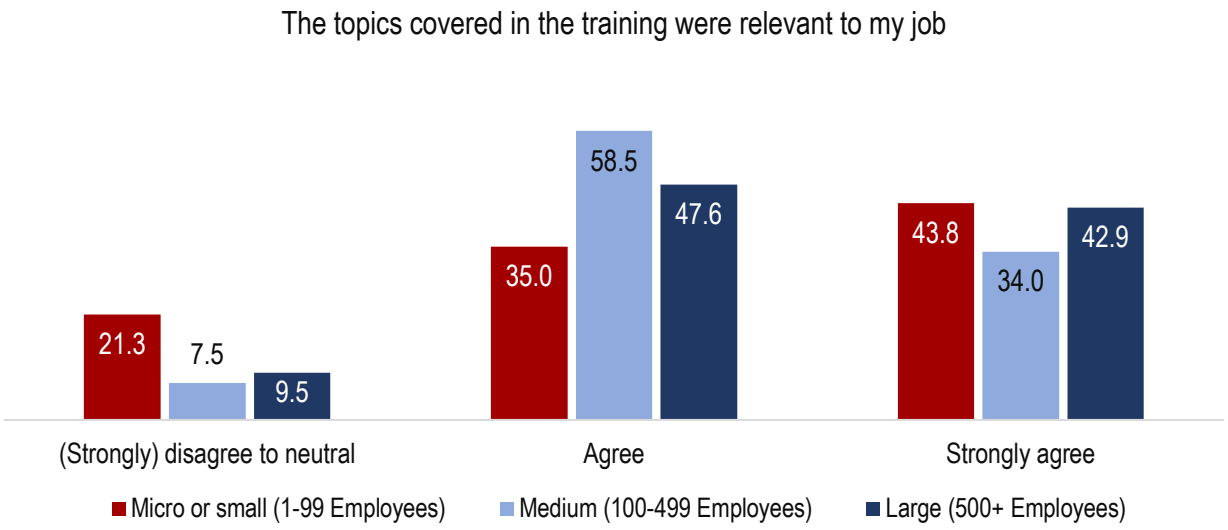
Although there were some examples where women reported a higher likelihood of taking additional training, or higher awareness of micro-credentials amongst immigrants when compared to those born in Canada. However, the overall patterns did not provide strong evidence of differential results based on learner demographics. There were some statistically significant differences in training satisfaction, whether participants would seek additional training, and overall awareness of micro-credentials.

Training satisfaction

Learners reported a high degree of overall satisfaction with the micro-credentials offered by EMC.

A remaining question examined whether there were differences in satisfaction by the size of the employer. Employees from micro- and small-sized employers were slightly more likely to be neutral or disagree with the statement that training covered topics relevant to their job (see Figure 11). This may be because of the highly specific nature of the skills requirements of small- and medium-sized businesses, where employees typically need to "wear multiple hats" and have flexible definitions of roles and responsibilities.

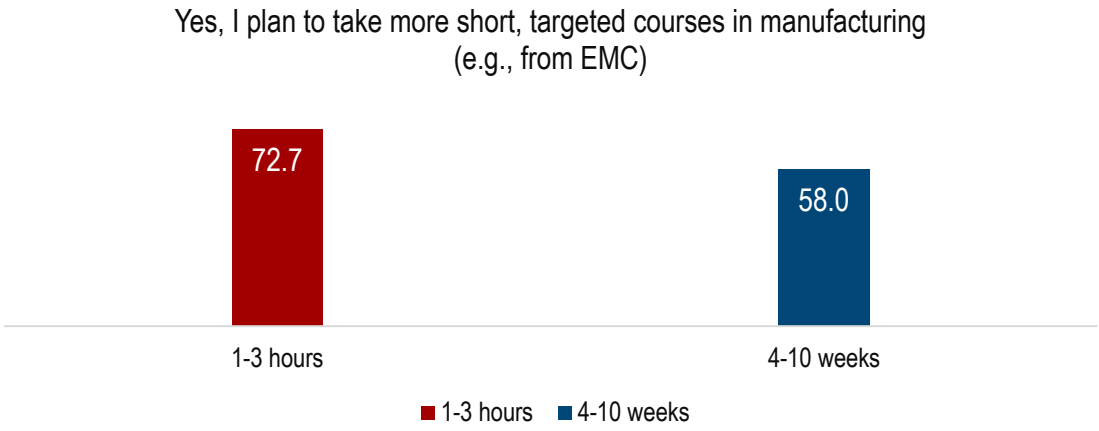
Figure 11 Training relevance by size of employer



Future training goals

Participants in shorter training (72.7%) were more likely than those in longer courses (58.0%) to report yes when asked about their plans for taking further short, targeted courses from EMC. This highlights the demand for short, targeted courses such as micro-credentials. The size of the organization did not impact the likelihood of the participants' plans for future training from EMC.

Further micro-credential training by course training length

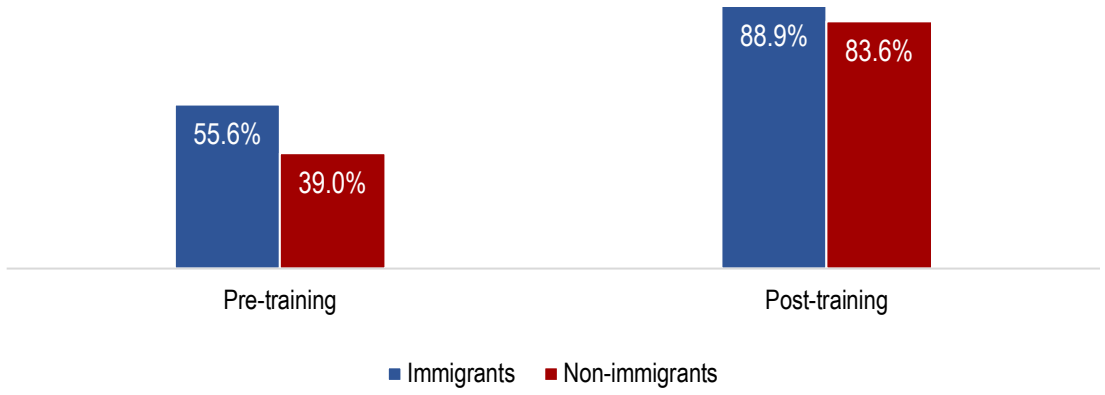


Micro-credential awareness

One area where there were demographic differences related to awareness of micro-credentials was amongst immigrants when compared to learners who were born in Canada.

Although the survey cannot answer why this is the case, it is potentially due to the higher overall education level that immigrants and newcomers acquire when compared to the Canadian-born population, a pattern that was also demonstrated within this sample of learners (Statistics Canada, 2023). After completing the training, the overall awareness of micro-credentials increased for both groups which illustrated that the training provides participants with a broader understanding of micro-credentials and other short, targeted training opportunities.

Awareness of micro-credentials by immigration status (at least moderately aware)



Employer feedback on micro-credentials

Micro-credentials are increasingly being recognized as a valuable and strategic complement to traditional educational pathways.

Before embarking on EMC training, many employers had limited familiarity with micro-credentials, with their knowledge primarily surrounding LinkedIn certifications. However, EMC's micro-credential training has transformed their perceptions. Micro-credentials were summarized by employers as "bite-sized training" that is time-efficient and maximizes employee learning capabilities. One main selling point of micro-credentials, repeatedly voiced by employers, was the short and distributed nature of the courses. As one participant described, "as far as employee knowledge retention is concerned, if they learn something and then sleep on it a couple of times and refresh the memory, a week or two later, they're more likely to actually retain it and apply it and recall it in their head." This approach not only allowed employees to digest material well, but the concise nature of these courses ensures that the cost of sending employees to training sessions is not too burdensome.

Moreover, employers expressed appreciation for the opportunity for teams from the company to attend micro credential trainings together, which allowed seamless dissemination of knowledge and promoted a shared enthusiasm around the course content. Employers reported that EMC training kindled acceptance and interest from employees on micro-credentials, including those who had never been exposed to this form of education format before.

"As far as employee knowledge retention is concerned, if they learn something and then sleep on it a couple of times and refresh the memory, a week or two later, they're more likely to actually retain it and apply it and recall it in their head."

This growing interest has sparked consideration on integration of micro-credentials into professional development pathways to create flexible and accessible approaches to training.

The effectiveness of training is often measured by its relevance and practical application in today's dynamic workplaces**.** Employers across a wide range of industries have come together to recognize the value of micro-credentials. Feedback from interviews have underlined the importance of training that resonates with employees that can be actively applied to daily tasks in the workplace. Micro-credentials, such as those offered by EMC, have shown great promise in achieving this goal.

Employers consistently emphasize the need for continuous upskilling in the face of rapidly changing industry landscapes.

In today's economy, many organizations (especially smaller scaled ones) discussed struggle with tighter budgets and working with fewer employees than before. Employers expressed that they were constantly faced with the challenge of training employees to keep up with the demands of production in a competitive market. One employer emphasized ""It's stuff that we'd never think of sending anybody to because our money's so limited, because we're a small, privately owned company." EMC's micro-credentials hold a transformative potential for smaller businesses by providing them with a cost-effective solution to compete effectively with other businesses without compromising training quality. By offering flexibility to learn while accommodating priorities of manufacturing, micro-credentials have become an asset for industries like manufacturing where continuous learning is essential to keep up with the ever-evolving demands of the industry.

> *"Not everybody could just go take $400 or $600 courses. So, the company, they can say "we can't support education, but we can give you a couple hours a week for you to do this course." And then after that, it's up to the people. So that's where I think this is. It's really helpful for small businesses."*

Trust in micro-credentials

As individuals gain exposure to training, their trust in micro-credentials tends to grow.

> *"It was the time management one and this guy is our director of supply chain. He was our company controller…, he brings his CPA and CGA and all these big credentials behind his name. And he personally called me after the 'take control of your time in three steps' [training] and said he really appreciated being included in that training and that he found it extremely beneficial."*

Initially, there has been some skepticism and uncertainty surrounding the value and significance of micro-credentials. However, as employees completed EMC's micro credential training and experienced the practical benefits firsthand, their trust in micro-credentials has rapidly grown. The trust that employers have themselves in micro-credentials also increased, as they noticed that employees who completed the course through EMC not only showed improvement in skills such as Time Management and Psychological Health and Safety but also had enhanced collaboration and productivity. These tangible benefits have played a crucial role in solidifying the trust of both employers and employees in micro-credentials as a valuable educational pathway.

There's a growing demand for wider recognition and acceptance of micro-credentials in professional circles.

EMC has been an instrumental player in driving the demand for micro-credentials programs. These programs have been increasingly integrated into career development pathways and employer training plans which has allowed for greater validation on their importance.

Employee experience and satisfaction

Companies are consistently receiving positive feedback from their employees regarding training and skill development. One employer stated “the feedback was very supportive. I trust that they wouldn’t hold any punches; they’d be honest”. This trust extends to the organization’s commitment to employee growth and development. Participants stated that employees appreciated the organization’s investment in their personal growth. The investment in skill development have also been reported as a catalyst for creating open communication and transparency between employers and their employees. Thus, training goes beyond just enhancing skills. It builds trust within organizations and strengthens bonds.

In addition, participants indicated that employees have expressed that training provides them with the tools they need to excel in their roles. “Some of the folks who were involved in that training have a significant impact on the business. As with most training, what I find it does is it gives people permission to become very open and transparent, and this is now a tool in my chest, and I feel comfortable using this tool." Not only does training improve skillsets, but it enhances curiosity and drive to explore different horizons within the workplace. One employer stated, “they got to learn more about those areas, and then that led to 'Oh, maybe I want to venture out a bit more.'” This newfound confidence has reported creating a ripple effect in their contribution to the organization, by influencing their interactions with other employees and their overall contribution to the workplace.

> *“They did have to put together a PowerPoint presentation and present it back to the group. To me, there was much more value in them doing that because it was working on presentation skills and soft skills and technical skills and putting together a PowerPoint presentation. Whether their solution to the problem was successful, they would have developed all these other skills as a result of what they had to do to earn their certificate.”*

Employees highly value training that has direct applicability and relevance to their day-to-day tasks. Employers reported that employees showed appreciation towards the real-world projects that were incorporated into the training programs by EMC. This allowed them to directly apply the skills they learned into a meaningful workplace context. One employer stated, "We have a little bit of a debrief throughout and afterward, and then their direct supervisor would have a more in-depth conversation and go over the project and that kind of stuff." This sort of collaborative approach with active discussion and review of projects from the micro credential training not only allows employees to better retain the knowledge from the training but also understand its applicability in their organization.

An emphasis on flexibility in workload management has been greatly appreciated, leading to improved morale and job satisfaction.

Participants expressed that employees highly value the freedom and flexibility to balance their learning and development with their regular work responsibilities. It creates a sense of trust and autonomy, and employers feel valued and respected in their roles in an organization.

Participants found that the introduction of EMC micro-credentials placed an emphasis on flexibility and improved job satisfaction.

This allows for increased engagement and motivation. One employer reported boosted morale leading to promotions, “One of my direct reports has now been promoted, part of it is because of her eagerness that came out of this training because she was bored. Which is one of the reasons I sent her on the training because she wasn't on a trajectory yet to go in to manage any sort of level of management. But we wanted her to be. And we kind of hoped she wanted to be. And then after this, it really came to light and she's now a production supervisor.” This anecdote illustrates how micro-credentials not only improve employee satisfaction but can also serve as a pathway for career advancement. When employees are motivated and engaged in their professional development, they are more likely to step into more challenging roles, which can be beneficial to both their personal growth and the organization’s overall success.

Skills assessment

Micro-credentials are emerging as a powerful tool for evaluating the skills of future job applicants.

In today’s dynamic job market, the value of micro-credentials cannot be overstated. Employers are increasingly recognizing the value in using micro- credential training to assess potential hires. When one employer was asked if they would favour a job applicant with micro-credentials when comparing them to an applicant without micro-credentials from an HR perspective, they stated “I would lean more towards the person that's continually growing themselves. The person that's just plateaued, I know you're not supposed to judge that, but I do because that's our world. I want to make sure they are keeping up with today." This sheds light on a shift in the hiring landscape to favour forward-thinking candidates that continue to shift with the changing businesses and technologies.

Employers often view the pursuit of micro-credentials by potential employees as a clear indication of their intrinsic motivation and ambition for career advancement.

Rather than seeing micro-credentials as just another checkbox on a resume, hiring managers found micro- credentials to be valuable indicators of an individual’s commitment to personal growth and their desire to contribute more to an organization. Thus, showing this drive towards advancing their professional development can make an applicant’s resume more eye catching. One employer expressed that, "It'll give people more ideas of what to do for personal growth. "

The acquisition of micro-credentials by employees is increasingly perceived as a testament to their commitment to skill enhancement and personal development. The employer also explained that the micro-credential serves as a credible and tangible representation that the individual has truly gained the skill. They stated, “The micro credential shows us proof that they didn’t just go on an online thing and finish up or somebody finished a quiz for them."

Micro-credential training can also demonstrate a willingness to learn by the employees. One employer stated, "It's all about time and money. And attitude actually. I train for skill and hire for attitude because, yeah, if they come with a bad attitude, we can train all you want but that's not going to change."

Participants expressed that those who showed more interest in training were more likely to rewarded for opportunities for career progression. One common need that was expressed was the necessity of making micro-credentials more known to the industry and potential hiring managers on both a general and global scale. As they grow in value, it was seen as important to spread more awareness and information about them.

There's a pressing demand for a broader array of training topics to cater to diverse industry needs.

Micro-credentials possess the capacity to revolutionize how industries may approach training and development. One employer highlighted that, “EMC micro-credentials have been instrumental in bridging the gap between traditional training and the specific skill sets required in our industry. They offer a diverse range of topics that align with our unique needs, ensuring that our workforce is well-equipped with the necessary skills to excel”. This statement highlights EMCs ability to meet industry-specific demands for training and contributing and enhance the existing landscape of micro-credentials.

As society shifts away from the “one-size-fits-all” approach to training, micro-credentials can fill the gap by offering specialized, tailored training in various unique areas of demand.

Fit with organization

Micro-credentials have proven to be a valuable addition to traditional training methods, fostering enhanced collaboration and accountability among employees. Employers reported seeing tangible shifts in behaviour such as increased accountability amongst employees due to the group-based approach of some micro-credential courses. This heightened sense of accountability was observed as employers collaborated on shared learning objectives.

Appreciation was also expressed regarding the cross-company collaboration in the courses. These programs allowed participants to break free from the confines and perspectives of their own workplace organization to develop a broader network of professional contacts with other companies. This collaborative aspect was especially beneficial during the limited interactions during the COVID-19 pandemic.

Furthermore, the interactive nature of the micro-credential training has demonstrated the capacity to maximize employee engagement and retention. One employer stated, “So one of the teachers when we did the micro credential for time management, he was great, very interactive so people had to get engaged. There was homework, you had to get it done. You were forced to do it. So, it got people engaged.” This interactive approach significantly contributed to the effectiveness of micro-credential training, ensuring that individuals actively participated and engaged with the content.

6. Conclusions

EMC was able to pilot an impressive suite of micro-credentials through this project by leveraging and updating existing training as well as adding new courses based on employer demand.

Multiple training topics were offered, and for some key topics such as psychological health and safety and time management, multiple learning formats were available. This allows for interesting comparison of micro-credential formats, stake, and intensity. EMC was also able to engage with a wide range of employers of various business sizes.

There were some interesting early trends around the relevance of micro-credentials for small- and medium-sized businesses versus larger employers.

The potential for further customizing micro-credentials to meet the unique skills needs and training capacity of small- and medium-sized businesses is an interesting area for future work.

One key feature that stood out from EMC pilots compared to other partners' pilots in this project is that EMC focused solely on upskilling current employees. This provides targeted data on this particular use case of micro-credentials. An area for future exploration for EMC could be designing and delivering micro-credentials for jobseekers to support their entry into the sector.

Collaboration with educators (PSEs) is another key area for further exploration.

As part of the consultation phase, EMC and SRDC interviewed subject matter experts from several post-secondary institutions that are leading the innovations in the micro-credential landscape. These discussions highlighted some interesting areas for further collaboration that would be worth pursuing in the future.

As the manufacturing sector continues to evolve, the need for rapid upskilling and reskilling are more critical than ever.

The current project provides early evidence of success as well as key areas for further exploration, especially around training implementation and future partnerships, that could inform strategic decision-making around future training focus.

Appendix A: Research Protocol Overview

Protocols for participant surveys, key informant interviews, and focus groups with employers, supervisors, and production floor workers are available upon request.

Participants enrolled in at least four weeks of training completed a baseline survey prior to entering the micro-credential program. Learner participants enrolled in shorter duration training (half-day workshops and 1-hour e-learning modules) completed follow-up surveys immediately after training completion, and then approximately one month after completion to determine the longevity of skills development in the workplace setting after the training. We excluded these latter participants from the overall pre- and post-training survey design due to the short duration of training making the baseline and follow-up 1 surveys redundant. In addition to measures of learning objectives, surveys included demographic questions, information about education and current employment, satisfaction with the training, and overall awareness of micro-credentials.

Research survey overview

Course name	Baseline (pre-training)	Follow-up 1 (end of training)	Follow-up 2 (one month after training)
Manufacturing Essentials Certification (MEC)*	✓	✓	✓
MEC Green Skills	✓	✓	✓
AMS Time Management	✓	✓	✓
AMS Psychological Health and Safety	✓	✓	✓
Workshop Time Management		✓	✓
Workshop Psychological Health and Safety		✓	✓
E-learning Time Management		✓	✓
E-learning Psychological Health and Safety		✓	✓

** Note: Participants going through the Manufacturing Essentials Certification also had their direct supervisor complete an employer survey, including an assessment of any observed change in workplace performance (where possible).*

Appendix B: Self-Reported Differences in Participant Skills Outcomes

	Baseline (B0)		Follow-Up 1 (F1)		Follow-Up 2 (F2)		B0 v. F1		B0 v. F2		F1 v. F2	
	M	*SE*	*M*	*SE*	*M*	*SE*	*t*	*n*	*t*	*n*	*t*	*n*
Psychological Health and Safety												
Creating a Supportive Environment	3.68	0.44	3.88	0.51			1.69	25				
	3.71	0.36			3.82	0.51			1.17	33		
			3.78	0.51	3.71	0.49					-1.50	64
Creating a Healthy Work Culture	3.67	0.48	3.79	0.48			1.08	25				
	3.64	0.53			3.81	0.57			1.95 ^{t}	33		
			3.78	0.51	3.72	0.53					-1.03	64
Supporting Employees	3.62	0.55	3.86	0.52			2.09*	25				
	3.61	0.55			3.87	0.62			2.74**	33		
			3.78	0.58	3.82	0.60					0.73	63
Supporting Myself	2.91	0.81	3.18	0.66			1.76 ^{t}	25				
	3.03	0.71			3.17	0.75			1.13	33		
			3.20	0.72	3.17	0.79					-0.42	63

	Baseline (B0)		Follow-Up 1 (F1)		Follow-Up 2 (F2)		B0 v. F1		B0 v. F2		F1 v. F2	
	M	*SE*	*M*	*SE*	*M*	*SE*	*t*	*n*	*t*	*n*	*t*	*n*
Collaboration												
Effective Feedback	3.67	0.70	3.78	0.65			1.59	63				
	3.67	0.65			3.83	0.60			1.97^{t}	53		
			3.72	0.62	3.83	0.59					2.03*	82
Coaching	3.48	0.81	3.78	0.73			2.91**	63				
	3.41	0.80			3.98	0.64			6.56**	52		
			3.71	0.66	3.84	0.67					1.92^{t}	81
Conflict Management	3.53	0.63	3.75	0.55			3.36**	63				
	3.52	0.66			3.84	0.58			4.10**	54		
			3.70	0.56	3.78	0.56					1.44	82
Cross-Departmental Collaboration	3.35	0.38	3.45	0.25			0.52	4				
	3.44	0.49			4.04	0.64			5.00**	18		
			3.50	0.66	3.52	0.64					0.21	33
Leadership	3.33	0.87	3.76	0.68			4.39**	56				
	3.55	0.75			4.12	0.59			4.56**	22		
			3.96	0.71	4.12	0.57					1.75^{t}	23

	Baseline (B0)		Follow-Up 1 (F1)		Follow-Up 2 (F2)		B0 v. F1		B0 v. F2		F1 v. F2	
	M	*SE*	*M*	*SE*	*M*	*SE*	*t*	*n*	*t*	*n*	*t*	*n*
	3.74	0.59	3.98	0.57			3.39**	63				
Perspective Taking	3.79	0.55			4.00	0.58			2.64*	52		
			3.86	0.58	3.88	0.60					0.33	81
Communication												
	3.68	0.65	3.94	0.58			3.56**	62				
Communication Adaptation	3.64	0.60			3.95	0.56			4.10**	52		
			3.85	0.61	3.86	0.58					0.36	80
	3.55	0.74	3.98	0.66			3.87**	38				
Listen with Intention	3.56	0.76			4.25	0.60			4.19**	19		
			4.14	0.63	4.25	0.60					1.29	19
	3.34	0.71	3.79	0.68			4.74*	57				
Persuasion	3.46	0.85			4.05	0.64			4.71**	21		
			4.06	0.60	4.05	0.64					-0.09	21
Planning, Management, and Adaptability												

	Baseline (B0)		Follow-Up 1 (F1)		Follow-Up 2 (F2)		B0 v. F1		B0 v. F2		F1 v. F2	
	M	*SE*	*M*	*SE*	*M*	*SE*	*t*	*n*	*t*	*n*	*t*	*n*
Planning	2.75	0.65	3.13	0.48			-	-				
	2.92	0.67			3.53	0.56			4.30**	19		
			3.21	0.73	3.38	0.60					1.68	33
Time Management	3.64	0.80	3.92	0.65			3.28**	60				
	3.57	0.74			3.98	0.69			3.48**	40		
			3.67	0.72	3.84	0.66					2.35*	53
Responsibility Management	3.59	0.68	3.87	0.68			3.87**	85				
	3.59	0.62			3.87	0.69			3.52**	72		
			3.76	0.67	3.80	0.65					0.71	114
Goal Management	3.43	0.77	3.78	0.80			4.20**	81				
	3.46	0.73			3.83	0.74			3.63**	53		
			3.73	0.78	3.78	0.74					1.09	80
Adapting to Changes	3.44	0.43	3.69	0.66			-	-				
	3.47	0.43			3.97	0.67			4.42**	19		
			3.75	0.72	3.61	0.59					-1.32	33

	Baseline (B0)		Follow-Up 1 (F1)		Follow-Up 2 (F2)		B0 v. F1		B0 v. F2		F1 v. F2	
	M	*SE*	*M*	*SE*	*M*	*SE*	*t*	*n*	*t*	*n*	*t*	*n*
Problem Solving												
	3.49	0.72	3.93	0.59			5.29**	61				
Identifying Problems	3.52	0.69			3.99	0.66			4.45**	41		
			3.84	0.68	3.80	0.65					-0.61	55
	3.45	0.77	3.92	0.53			5.61**	61				
Addressing Problems	3.70	0.58			4.07	0.53			4.04**	40		
			3.81	0.66	3.79	0.60					-0.21	55
	3.17	0.53	3.50	0.45			-	-				
Proactive Problem Solving	3.25	0.57			3.79	0.68			4.36**	19		
			3.52	0.59	3.48	0.56					-0.35	33
	3.48	0.68	3.95	0.59			6.01**	57				
Evaluating Solutions	3.71	0.57			4.21	0.52			4.53**	21		
			4.08	0.62	4.21	0.52					1.14	21
Green Skills												
Climate	2.75	0.97	3.60	0.63	-	-	4.00**	19				
Environmental Awareness	2.72	0.98	3.69	0.59	-	-	5.06**	19				

	Baseline (B0)		Follow-Up 1 (F1)		Follow-Up 2 (F2)		B0 v. F1		B0 v. F2		F1 v. F2	
	M	*SE*	*M*	*SE*	*M*	*SE*	*t*	*n*	*t*	*n*	*t*	*n*
Environmental Planning	2.68	1.00	3.48	0.65	-	-	3.24**	19				
Monitoring Environmental Impact	2.47	1.16	3.58	0.80	-	-	4.25**	19				
Creating Sustainable Systems	2.75	1.05	3.57	0.51	-	-	4.02**	19				
Career and Learning												
Job Satisfaction	4.01	0.59	3.98	0.62			-0.75	85				
	4.03	0.56			4.07	0.67			0.69	71		
			3.99	0.63	4.01	0.62					0.45	107
Attitude Toward Learning	4.38	0.50	4.33	0.49			-1.03	83				
	4.46	0.51			4.39	0.58			-0.94	33		
			4.39	0.52	4.28	0.64					-1.53	71

*Notes: Baseline data was only collected for 4 week and 8+ week courses. t-Statistics were calculated using paired samples. [t] = p < .10 * = p < .05, ** = p <.01. Dashes indicate cells with too few respondents, including Green skills which were not measured at the second*

Appendix C: Manufacturing Skills – Big Data Insights

As part of the LevelUp project, EMC retained Vicinity Jobs Inc. (VJI) to design a “proof the concept” to test a scalable approach to develop and validate current and emerging skills (or work requirements) for two occupations central to Canadian manufacturing: i) Production Supervisor and ii) Production worker. This work resulted in the “Manufacturing Skills – Big Data Insights” tool. The Manufacturing Skills – Big Data Insights tool used Vicinity Jobs’ technology and big database with Natural Language Processing (NLP, which underpins the ability of artificial intelligence to understand and generate human language using linguistic and machine learning techniques), to extract information about occupation, location, and work requirements (including skills) from each job posting found online.

With 12.9 million unique job postings collected over the last five years, Vicinity’s big database allowed for detailed analysis at a granular level, while maintaining large sample sizes. Focusing on Manufacturing-related NAICS codes 31, 32, 33 and 95 two-digit manufacturing occupations, as defined by the 2021 National Occupational Classification (NOC) system, the Manufacturing Skills – Big Data Insights generated and validated a list of current and emerging skills (or work requirements) critical to manufacturers across Canada. EMC leveraged this data during employer focus groups and interviews to identify and prioritize emerging skills needed by manufacturing supervisors. Data Insights from the tool helped streamline the identification process and supported EMC’s efforts to update its MEC Supervisor training and develop the new Time Management and Psychological Heath and Safety micro-credential courses. A detailed Manufacturing Skills – Big Data Insights report from Vicinity Jobs is available upon request.

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