WESTAC

ADAPTING TO AUTOMATION AND TECHNOLOGY

INTERNATIONAL BEST PRACTICES AND LESSONS FOR BRITISH COLUMBIA'S FREIGHT TRANSPORTATION WORKFORCE

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About WESTAC

The Western Transportation Advisory Council (WESTAC) is a council of organizations in the transportation sector represented by senior decision-makers. WESTAC's members span all aspects of freight transportation in Canada. They include carriers and logistics providers, ports and terminals, shippers, labour unions, and three levels of government. Members represent a significant share of the western Canadian economy. We focus on critical issues that affect Western Canada's freight transportation network to ensure that it is safe, efficient, reliable and competitive.
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Canada BRITISH COLUMBIA

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CONTENTS

GENERAL TERMS

AI	Artificial Intelligence
EDGE UP	Energy to Digital Growth Education and Upskilling Project
EDI	Equity, Diversity and Inclusion
ELDs	Electronic Logging Devices
IoT	Internet of Things
OCR	Optical Character Recognition
PCP	Government of Singapore's Professional Conversion Program
PPT	Pasir Panjang Terminal
ROI	Return on Investment
STEM	Science, Technology, Engineering, Math
TEU	Twenty-Foot Equivalent Units

ORGANIZATIONS

BCIT	British Columbia Institute of Technology
BCMEA	British Columbia Maritime Employers Association
BC SLMP	British Columbia Sector Labour Market Partnerships
CED	Calgary Economic Development
CSA	Central Student Aid Board
FPSC	Food Processing Skills Canada
FSC	Future Skills Centre
GHP	Greater Houston Partnership
ICTC	Information and Communications Technology Council
IFAU	Institute for Labour Market and Education Policy Evaluation
ILWU	International Longshore Workers Union
ITT	Singapore's Institute of Technical Training
JSCs	Job Security Councils
LO	Swedish Trade Union Confederation
PCC	Pima Community College
PSA	Port of Singapore
PSAU	PSA University
SN	Confederation of Swedish Enterprise
SPWU	Singapore Port Workers Union
STAC	Skills Training Atlantic Canada
TRR	Trygghetsrådet (The Security Council)
TSL	Trygghetsfonden (The Security Fund)
TSN	Trygghetsstiftelsen (The Job Security Foundation)
WESTAC	Western Transportation Advisory Council

EXECUTIVE SUMMARY

Advanced technologies have arrived in the freight transportation sector. They are starting to change every facet from planning and logistics to operations and maintenance across all modes—road, rail, marine and air. The impacts are increasingly visible in British Columbia's freight transportation and logistics workforce. While technologies have yet to automate or digitize functions in every firm, their widespread implementation is inevitable. As a result, companies, labour unions and educational institutions need to begin preparing for and addressing the impact on workers.

The COVID-19 pandemic has accelerated technology adoption in the freight transportation sector. In 2020, WESTAC's annual Compass Survey of transportation leaders found that 44% of respondents introduced new technologies sooner than expected. Traditional occupations such as that of longshore worker, truck driver, and administrative clerk are taking on new technological responsibilities, and new positions such as data scientist and drone operator are gaining prominence in the freight transportation labour market.

This project aimed to draw lessons for British Columbia's freight transportation sector to ensure its workforce can transition to work with new technologies by examining cases from other jurisdictions to understand what they are doing to prepare their workers for jobs of the future. Six case studies were prepared based on 30 interviews, with two case studies from the freight transportation sector.

- PSA Singapore: Training for Automated Cranes and a Work-Study Diploma in Port Automation
- TuSimple/Pima Community College: Development of an Autonomous Vehicle Driver and Operations Specialist Certificate
- Food Processing Skills Canada: Upskilling for Frontline Workers and Supervisors in the Food and Beverage Manufacturing Sector
- Calgary Economic Development and Partners: Retraining Oil and Gas Professionals for Information Technology Jobs
- UpSkill Houston: Catalyst for Industry–Education Partnerships and Workforce Diversity
- Swedish Job Councils: Revamping and Changing How Workers Transition to New Careers

Five key trends arose from these case studies:

1. Organizations established an employer-led training program featuring a strong collaboration between industry, unions, educators, and economic development organizations.
2. Some successful programs were based on a learning framework developed through robust consultations with industry and educators.
3. Organizations built-in program sustainability by articulating the resources required and return on training investment.
4. Successful initiatives provided substantial financial support and individual guidance for learners.
5. Programs that have a diverse group of learners intentionally focused on diversity during recruitment and retention.

In addition to these case studies, a mini-report was produced to provide a snapshot of technology's current and future impacts on the trucking and ports sectors in British Columbia. This mini-report briefly illustrates how some companies are preparing their respective workforces for increased technological adoption. Data for the BC mini-report came from interviews with ten individuals representing port/terminal operations, a union and a post-secondary institution, and WESTAC's Compass Survey.

The trends from the case studies informed the development of recommendations most suitable to BC's freight transportation context. Two roundtables were held to discuss the findings and the draft recommendations. These roundtables included representatives from trucking, marine terminals, logistics, rail, Indigenous groups, and educational institutions.

The following are the recommendations addressed to employers, unions, and educational institutions:

1. Start preparing for technological change early, communicate often and build in long timelines.
2. Develop employer-led, competency-based skills programs through close collaboration with unions, educators, and government.
3. Establish a strategy and then develop a framework for upskilling that meets long-term economic development needs and has demonstrable outcomes.
4. Estimate the resources that are realistically required for program success and establish performance measures.
5. Ensure retraining programs also address workers' financial, learning and social needs.
6. Build in equity, diversity and inclusion into retraining program development and delivery.
7. Consider pilot programs.

The call to action is clear. Failure to manage technological adoption and retrain workers effectively will affect social and economic prosperity and impede British Columbia and Canada's competitiveness in the global freight transportation marketplace. It may also mean that companies will miss the opportunities arising from new technologies to attract workers who face barriers to traditional occupations in freight transportation and warehousing. Therefore, careful consideration needs to be given to the recommendations and applied in the development of future training initiatives for the industry.

1. INTRODUCTION

In 2019, WESTAC completed a project focused on identifying workforce development issues and gaps in labour market information research by engaging with key stakeholders in the transportation. The project was funded by the Province of BC and the Government of Canada through the Sector Labour Market Partnerships program. One of the project's key findings was that a better understanding of the impacts of automation in terms of timing, skills updates, and job losses specific to transportation is needed.

In the spring of 2021, this project on "Adapting to Automation and Technology: International Best Practices and Lessons for British Columbia's Freight Transportation Workforce" was launched to build on the findings and recommendations from the earlier project. It was designed to take a closer look at the impact of technology on the sector and produce recommendations for transportation firms, unions, and education providers so they could adjust to ensure current workers are positioned to acquire the skills they need.

Project Activities

This project involved extensive research—interviews, roundtables and several reports were produced leading up to the final report. They include:

- A secondary research report identified automation and technologies likely to be adopted in the freight transportation sector within the next ten years. It also briefly described how other jurisdictions are responding to the need to retrain workers as the result of new technologies and examined the availability of such information in BC. Finally, the report identified the criteria to select relevant case studies and provided a list of 19 potential case studies that could be pursued.
- A research methodology and tools report described the primary research questions and the research plan. It set out the sampling methods for the case studies (qualitative research using interviews and roundtables) and provided the interview guides for the case studies and the mini-report on BC.
- A case study report included the six completed case studies, key trends, and a mini-report on technology trends and their implications for the freight transportation sector in BC. This case study report was based on 40 interviews (30 for jurisdictions beyond BC and 10 in BC).[1]

An additional component of this project was conducting two roundtables. These were held virtually in February 2022 with representatives from industry, unions, Indigenous groups, and educational institutions. These sessions aimed to gather comments and suggestions on improving the draft recommendations. Comments related to technology issues and their impact on the freight transportation sector in British Columbia were also solicited. This feedback was then incorporated into the mini-report on technology trends in British Columbia (see Section 4).

A Governance Committee oversaw the project and held five meetings to review and comment on all reports. It prioritized the list of potential case studies and assisted in identifying potential interviewees for the study. The Committee was also helpful in identifying participants for the roundtables and actively participated in both. Following the roundtables, the recommendations were revised and reviewed by the Committee. The recommendations in this report reflect the Committee's discussions.

REPORT OVERVIEW

Case Studies

This section provides six detailed case studies from other regions in Canada, the United States, Singapore, and Sweden. It also summarizes the leading practices and themes from the six case studies most applicable to the British Columbian freight transportation context. These key trends informed the development of recommendations on ways the BC sector can best prepare its workforce for increased automation and technology.

CASE STUDY	SECTOR	INTERVIEWS COMPLETED	ORGANIZATIONS REPRESENTED
PSA SINGAPORE	PORTS	7	4
TUSIMPLE/PIMA COMMUNITY COLLEGE	AUTONOMOUS TRUCKS	5	2
FOOD PROCESSING SKILLS CANADA (STAC)	FOOD PROCESSING	5	3
CALGARY ECONOMIC DEVELOPMENT	OIL & GAS	3	3
UPSKILL HOUSTON	MULTIPLE	4	4
SWEDEN	MULTIPLE	6	6

Roundtable Session Summaries

This section reports on the findings from the roundtable sessions conducted to discuss the BC mini-report and the draft recommendations. They were designed to maximize opportunities for industry stakeholders to share their own experiences and expertise as part of the larger group and within smaller breakout groups. Participants were presented with the background of the project, a summary of case studies and draft recommendations.

Mini-Report on the British Columbia Freight Transportation Sector

This section explores the present and future impacts of automation and new technologies on the trucking and port sectors in British Columbia and educational institutions.

Recommendations

This section presents recommendations based on the leading practices and themes from the six case studies most applicable to the British Columbian freight transportation context. Participants at the two roundtable sessions validated these recommendations. In addition, industry and educators commented on actions the government could take to assist with these preparations.

BC's Transportation Workforce

In BC, the transportation industry has more older workers and fewer younger workers than the provincial average. As noted in the case studies, it often takes additional time for older workers to become more comfortable working with new technology.

	55+ YEARS	15 TO 24 YEARS
TRANSPORTATION & WAREHOUSING	27%	8%
ALL INDUSTRIES	22%	13%

Source: Statistics Canada. Table 14-10-0023-01. Labour force characteristics by industry (2021).

LIMITATIONS OF THE RESEARCH

Like any research study, this study has limitations inherent to qualitative research. To mitigate these issues wherever possible, the research team carried out supplementary secondary research, conducted additional interviews, and prepared two additional case studies. As well, two roundtables comprised of participants from industry, unions and educational institutions validated the interview findings for the British Columbia mini report and commented on the draft recommendations.

Data Collection

Data collection for the project has several limitations, which readers should consider when interpreting the project findings.

First, secondary research on human resources issues in the freight transportation sector in British Columbia is limited, apart from articles discussing an aging workforce, union-management disagreements in the ports and difficulties recruiting truck drivers. For specific topics like the impact of technology on jobs within the sector (within Canada and in British Columbia in particular), the literature is practically non-existent. The same may be said of global sectors. WESTAC's March 2021 research report for Asia Pacific Economic Cooperation, *Disruptive Technologies and the Changing Nature of Work in the Transportation Sector*, had over 3300 downloads as of March 2022, indicating considerable interest in the topic and suggesting a limited availability of comparable reports.[2] Similarly, it was challenging to find reports and articles outlining how educational institutions in British Columbia were changing their programming and approaches in response to new technologies. The researchers attempted to find secondary research exploring the impact of technological change specifically on Indigenous workers; again, data was limited. These gaps in the literature highlight the value of the data and findings this study offers to the British Columbia industry and education sectors.

Second, the researchers could not locate a comprehensive, publicly available list of organizations in Canada or elsewhere with programs designed to prepare workers for technological change or help them transition to new jobs or careers. Instead, the researchers developed a set of criteria then conducted extensive secondary research to find initiatives that matched these criteria. They also sought cases led by the private sector or non-profit actors rather than directly by government agencies. This constraint narrowed the number of potential cases, even though some of the government-led programs may have had valuable lessons to offer. Due to time and budget limitations, the researchers may have missed some useful examples when creating the list of potential case studies. In addition, some organizations were unresponsive to inquiries or unavailable to participate in the case study process, so some potentially informative cases had to be excluded.

Third, the data collection processes for the two roundtables attempted to encourage participation from individuals representing a wide range of organizations that varied in geography and industry subsector. However, they were not a random sample but rather consisted of individuals who had been interviewed. They were members of the project Governance Committee, representatives suggested by WESTAC members, WESTAC contacts, and invited individuals who represented key industry and educational organizations around the province.

Finally, the British Columbia mini-report had the most limitations from a data collection perspective. The research design for developing the case studies from other jurisdictions is robust and fit for purpose. For the BC report, the initial plan for three to five interviews was insufficient to determine trends in technology use in four sub-sectors. Although the researchers increased the number of interviews from five to ten and the provincial situation was one of the topics discussed in two roundtables, the findings of the BC mini-report should be regarded as anecdotal and indicative only of general trends. Roundtable participants briefly discussed the draft mini-report and made suggestions, but the report was not discussed at length. An additional five to ten interviews, specifically from the air cargo and rail sectors, would have made the BC mini-report more robust.

Case Study Limitations

Case studies can provide rich qualitative details on issues such as the retraining of displaced workers, but they have their limitations. These include:

- *Risk of researcher bias* - From reviewing files to conducting personal interviews, the concepts and themes of the case study method are heavily reliant on the level of effort each researcher is willing to put into each case. Every researcher will have their own unconscious bias. While the case study method is designed to limit the influence of this bias by collecting fact-based data, the data collector defines what a "fact" is and what is not. Therefore, the collected data may support the results the researcher wants to see. Multiple researchers participated in and conducted the interviews for the case studies for this report in an attempt to mitigate individual bias.

- *Ability to draw general conclusions from specific data* - Case situations are seldom completely comparable, and as such, the information gathered may apply only in certain circumstances. By preparing six case studies, the researchers developed a larger group of examples from which to identify general trends. Further, esteemed educational anthropologist Frederick Erickson argues that since the general lies in the particular, the discoveries from a particular case can be transferred to similar situations.[3] The reader, not the researcher, determines the information that can apply to their context.

- *Value of the case* – In his book on case study methodology, Hamel comments: "the case study has basically been faulted for its lack of representativeness...And its lack of rigor in the collection, construction, and analysis of the empirical materials that give rise to this study. This lack of rigor is linked to the problem of bias... introduced by the subjectivity of the researcher and others involved in the case."[4] In addition, no set guidelines exist for constructing the final case report. The researcher must rely on their own instincts and abilities throughout most of the research effort. As well, assuming time is available to produce a useful case study, the report may be too lengthy, too detailed, or too involved for busy policymakers and industry practitioners to read and use. The amount of description, analysis, or summary material is up to the investigator. For this report, the project Governance Committee reviewed the case study outline and the individual case studies produced to make the final products as useful as possible.

- *Focus on the positive* - Organizations are generally reluctant to discuss programs and initiatives that failed, even though much can be learned from them. To overcome this tendency, the researchers conducted multiple interviews with individuals representing different organizations that were involved in the case. Wherever possible, they avoided group interviews that mixed participants from different organizations (e.g., management and union in the same interview). Instead, they focused on individual or group interviews with one organization at a time. As a result, respondents tended to be more open and willing to critique elements of the initiative or program that had not gone as well as expected.

Despite the above-stated limitations, case studies can produce detailed and relevant evidence. The research can highlight the usefulness of certain approaches or programs seen repeatedly in varying circumstances. Most of the limitations can be mitigated if researchers are conscious of them and are well trained in current methods of collecting case data and in scientific techniques of assembling, classifying, and processing information. When developed by an experienced research team, case studies remain a robust tool for investigating complex processes like transitioning workers in the face of technological change.

2. CASE STUDIES: BEYOND BRITISH COLUMBIA

This section provides six detailed case studies from other regions in Canada, the United States, Singapore, and Sweden. They are presented on the case study report template developed in an earlier phase of this project.

1. PSA SINGAPORE: AUTOMATED CRANE OPERATOR RETRAINING PROGRAM AND PORT AUTOMATION WORK STUDY DIPLOMA

Overview

PSA Singapore (PSA) is responsible for most container handling in the Port of Singapore. In 2018, PSA began deploying automated cranes at one of its terminals. A new fully automated container terminal complex is being developed at Tuas (see box on next page).

In close conjunction with the Singapore Port Workers Union (SPWU), PSA developed a retraining program for manual crane operators to operate automated cranes. PSA also collaborated with a local training institution to develop a work-study diploma program that teaches maintenance staff to maintain automated cranes and other automated equipment. In both programs, workers earn full wages as they are being retrained on the job, as part of the programs are subsidized by the government.

PSA Singapore operates four container terminals in Singapore. In 2020 it handled 36.6 million TEUs, making Singapore the world's second-largest port for container traffic.[5]

PSA Singapore is part of PSA International, which operates container terminals and related businesses at more than 50 locations in 26 countries. In Canada, it operates Ashcroft Terminal (an inland terminal) and PSA Halifax (a container terminal). Its flagship operations are in Singapore and Antwerp. PSA International reported revenue of almost 4.2 billion Singapore dollars in 2020 (about $4.3B CAD).[6]

PSA International also has an in-house training and workforce development arm—PSA University. Since 1981, PSAU has been certified as an approved trainer by Singapore's Institute of Technical Training (ITT) and can provide a nationally recognized credential for some of its courses.[7]

Context & Rationale for Retraining

PSA has long been involved in retraining workers at all levels, including its management and engineering teams, in responding to increased automation. According to interviewees, some of its earliest efforts related to remote automation and retraining began in 1993. Since 2016, PSA has been developing and implementing retraining programs in response to the need for operators to run the automated cranes and for technicians to maintain these cranes and other automated equipment at its Pasir Panjang Terminal (PPT). PPT is equipped with automated quay cranes that can reach across 22 rows of containers. These cranes are controlled remotely, allowing each operator to handle up to six cranes, unlike the equipment in PSA's older terminals, where one worker is assigned to each crane.[8] Thus, about 30 people can handle PPT's 186 cranes.

The Singapore Port Workers Union (SPWU), one of two unions representing PSA workers, has collaborated with PSA in designing and implementing these and other worker retraining programs. For example, in May 2020, the Singaporean government established an "Emerging Stronger Taskforce" to identify systemic shifts arising from COVID-19 and provide recommendations to the council on how Singapore could refresh, reimagine, or reset its economic strategies.[9] The Chair of PSA International and the Executive Secretary of the SPWU sit as Taskforce members.[10] Interviewees mentioned that at the worksite, PSA and SPWU share a common understanding that if union members are willing to retrain, they will continue to have a job with the company even as the terminals progressively automate.

More automation is planned for PSA's terminals as they relocate to Tuas. PSA's future container terminal complex at Tuas will have almost 1,000 automated cranes, which will be managed by a combination of retrained and reskilled staff and new hires.[11]

Since 2012, the Government of Singapore has overseen a significant infrastructure project to move and consolidate the current five terminals into the new Tuas mega port, located at the western end of Singapore. Tuas Port is being built in phases; the first berths were expected to be operational at the end of 2021 (they will handle up to 20 million TEU), and all the terminals located in the city are slated to be moved by 2027. The final phase is scheduled to be completed by 2040, when all five terminals will have relocated. This consolidation will eliminate the need to move containers between terminals by trucks on congested roads. It will also increase overall container capacity from the present 50 million TEUs to 65 million TEUs, making Tuas the largest fully automated container port in the world.

The government's vision is to build Tuas as a smart, next-generation port "that increases productivity, optimizes land-use, improves safety and security, and enhances sustainability."[12] A key component of the new port will be automated wharf-side and yard operations. Technologies such as driverless trucks for port transport, drones and data analytics will be combined with digital platforms designed to reduce port congestion and reduce paperwork. Tuas may also consolidate warehouses and distribution centres into one location.

Target Participants

Automated Crane Operator Training

Target participants are manual crane operators currently employed at PSA and new hires. At present, these workers can choose to participate in the training. In the future, however, to work at the Tuas megaport, all existing operators will have to retrain to use the automated cranes to continue working in the occupation.

Work-Study Diploma in Port Automation Technology
Target participants are current PSA maintenance workers with a technical diploma. They are selected by PSA to participate in the program.

Key Features of the Program

Automated Crane Operator Training

PSA retrains existing workers to operate automated yard and quay cranes. Interviewees described the process in detail. Beginning in 2017, PSA collaborated with the SPWU leadership to develop the training program. Union leaders were among the first to volunteer to take the retraining and work in the crane control room as system implementers. In the new system for the automated cranes at PPT, crane operators work out of a central control room, using a digital console, cameras, and sensors to operate up to six cranes at a time. PSA deploys the cranes in a fully automated manner; operators are there to handle exceptions and problem-solve in unusual circumstances (for example, when the automated system cannot complete a task because it is unable to read the container number).

For the automated yard crane training, workers receive two weeks of theory classes at PSA, where they can use two crane simulators programmed with bespoke operating scenarios. Next, they begin on-the-job practical training with a mentor/coach guiding them, a fellow worker who has also switched from manual to automated cranes. On average, new operators require up to three months of training, though this length can vary. New hires may require additional time, as they are not familiar with operating manual cranes, and they often lack the situational awareness of dock operations that workers who operate manual cranes have developed. Some take longer to become comfortable with the technology and the way of working. Accordingly, no set time is mandated to complete this training; when workers believe they are ready, they can take a competency-based evaluation. If they pass, they can then work on their own.[13] Training certificates are granted for a term of two years; worker competency is assessed regularly and re-examined at the end of the two years when the certification expires.

The automated quay crane training takes six to nine months, with more extensive theory classes and on-the-job training than to operate automated yard cranes. PSA and the Institute for Technical Training (ITT) jointly developed the curriculum for the automated crane operator courses.

Work Study Diploma in Port Automation Technology

In this program launched in 2019, PSA maintenance workers with at least one year of experience and a relevant technical qualification are trained to supervise maintenance and repair work to network systems and automated cranes and vehicles.

Interviewees described how the local Institute for Technical Training developed the Work Study Diploma program in close consultation with PSA.[14] Course designers met extensively with PSA technical experts to discuss the skills workers needed and held several roundtables/focus groups with the company to finalize training objectives. They then pooled expertise from staff in multiple divisions within ITT to develop the courses, including electronics, networks, mechatronics, and mechanical engineering.

The Diploma program covers such topics as port and industrial automation, sensors and devices, electric motors, and network and security systems. Trainees also carry out a company project related to maintenance and present it to their peers. Graduates of the diploma program can apply to part-time or full-time degree programs at three Singaporean universities.[15]

Workers wishing to enroll in the program must meet entry requirements, provide a resume, and successfully pass a joint interview with PSA and ITT. The program lasts for 2.5 years, or five semesters, with a mix of on-the-job and classroom training at ITT. Throughout the process, PSA pays trainees their full salaries. Class sizes since 2019 have ranged from 14-16 participants, though the ITT could accommodate up to 40.[16]

The Work Study Diploma in Port Automation is one of 30 work study programs that ITT has developed for multiple sectors, with six new diploma programs scheduled to be launched in 2022. The national government strongly encourages and financially supports the creation and deployment of these work study diplomas as part of a movement to retrain the national workforce and maintain Singapore's global competitiveness. It recognizes that many mid-career workers would like to advance in their careers through additional education but need to be able to support themselves and their families financially; being a full-time student is not financially feasible. The work study diploma programs resolve this dilemma.

Program Providers

PSA works with the following providers:

- PSA University (PSAU) (an internal training arm of PSA) is a certified training centre, offering short courses to individuals outside the company in the maritime, shipping, logistics, warehousing, and transportation industries. PSAU also develops courses for PSA managers and workers in Singapore and at the company's global locations. PSAU offers a comprehensive suite of training and development programs to ready PSA's employees for the future. These include specific digital skills training programs, workshops to raise the "technology quotient" of staff members for the future digital workplace, and a program to cultivate an open mindset in embracing change. To provide the retraining for automated crane retraining courses, PSA draws upon:
  - Full-time staff from PSA University
  - Line trainers – experienced workers from port operations
  - Associate trainers – retired former PSA employees who can assist trainees
- For the Work Study Diploma in Port Automation, ITT instructors teach theory classes on campus and oversee any on-the-job training that occurs at its facilities. PSA provides the trainers for any worksite training.

Resources Required

Programs and activities vary in their costs. PSA promotes continuous learning and development as a key component of its training philosophy and funds many activities from internal budgets.[17]

- *Automated crane training* – PSA covers salaries and costs for this training and provides equipment such as the two crane simulators. In the past, some workers were supported by funding from the Government of Singapore's Workforce Singapore's Professional Conversion Programme (PCP). This program aims to reskill mid-career professionals, managers, executives and technicians for occupations or sectors with good employment prospects.[18]

- *Work Study Diploma in Port Automation Technology* – This initiative is supported by a mix of company and government funding. PSA covers the wages of its workers and trainers participating in the program. ITT charges SD$50,000 (approximately CDN$50,000) for the diploma program, with the government providing Singaporean citizens with a subsidy of SD$47,000 (CDN$47,000) and permanent residents with SD$42,000 (CDN$42,000). Workers have a strong incentive to pass the courses in each semester since if they fail, they can retake the course, but they will be responsible for paying the full cost of tuition and not be entitled to the subsidy.

Outcomes

PSA's investment in training programs, with the support of the SPWU, has resulted in the following outcomes:

- *Higher productivity levels* – In 2018, a PSA Managing Director commented that a trial of three cranes had led to a 20 to 25 percent increase in labour productivity.[19] Other ports have reported similar figures.[20]
- *Improved working environment* – A union leader interviewed mentioned several benefits related to automated cranes. Instead of working alone in a crane 17 stories about the dock, automated crane operators carry out their tasks in a control room alongside other operators. Having meals, using the toilet, and attending to other personal tasks are easier. Workers can also quickly receive help from shift managers located in the control room if they encounter difficulties. In manual operations, the shift managers were on the ground and could sometimes be hard to reach via radio. Automated crane operators carry out tasks in a comfortable, safe, and secure environment, less subject to weather conditions or human errors that could result in injuries.
- *Greater gender diversity* – Interviewees reported that some women who previously left the workforce are now more attracted to returning to work as automated crane operators in a control room.
- *Career mobility* – Workers can advance their careers. A prime mover driver at one terminal moved to the PPT terminal and shifted into the job of operations controller. He now oversees the operations of the automated yard cranes and supervises automated yard crane operators.[21]
- *On-site technical expertise* – The Work Study Diploma program helps PSA address a critical need for trained technicians and supervisors to repair and maintain its automated equipment, negating the need to rely on the equipment manufacturers to provide such support.

Challenges and Area for Improvement

PSA and the ITT review their training programs regularly. PSAU employs a training framework, which includes evaluations, refining programs, reviewing training materials regularly, discussing courses with trainers, and adjusting them based on their comments. ITT reviews its programs annually and generally returns to industry after about five years to undertake a significant overhaul of course content. Some of the challenges that have arisen with the programs discussed earlier include:

- *Overcoming fears of job loss* – Union leaders had to address concerns from members related to potential job losses and reduced incomes from automation.[24]

Comparison: Singapore and British Columbia

In 2019, the maritime industry in Singapore accounted for 7% of its GDP and 170,000 jobs.[22]

In comparison, transportation and warehousing (as a whole) accounted for 4.9% of British Columbia's GDP and 110,858 jobs.[23]

- *Lack of familiarity with digital tools* - Some workers found the expectation to start retraining later in their careers (many crane operators are in their 50s and 60s) to require a significant change in mindset. Some need basic computer training to become comfortable with the control room consoles used to operate the cranes. As a start to addressing concerns related to technology, PSA and the SPWU developed a one-day course called "Digitization for the Workplace." The course explains automation and new technologies in straightforward terms and allows workers to program and interact with robots to become more comfortable with digital technologies. The course has been well received, but both PSA and SPWU recognize that it takes time for some workers to become comfortable with new technologies.
- *Accommodating disparities in backgrounds* - With the Work Study Diploma for Port Automation, ITT discovered it had to schedule supplemental classes because of disparities in trainee knowledge. Often workers who had been out of school longer needed more time and tutoring to understand new material. PSA excused these individuals from work activities so that they could take these additional lessons.
- *Automation may not lead to a more diverse workforce in the short term* – Since PSA is retraining its existing (mainly male) workforce, automation does not necessarily mean more women will be employed to operate cranes in the control room. More positions for women will not become available until they shift their focus. However, as positions become available, more women may apply due to the new working conditions (working in an office environment), or if PSA prioritizes diversity in hiring new employees.
- *Automation alone will not attract younger workers* – Even though they are studying leading-edge technologies, some students drop out. According to interviewees, many young people do not want to work in an industry requiring shift and weekend work. Others do not want to do the physical work involved with being a technician, believing it has no prestige.

Keys to Success

Interviewees highlighted the following factors as key to the success of PSA's retraining programs:

- *A culture of communication and collaboration* – PSA and the SPWU are in ongoing communication, and PSA maintains a continual dialogue with the government. The company believes that its future competitiveness is tied to technology, and change is a constant. It trains its managers in change management and announces changes long before they are implemented, holding leader townhalls with workers and providing as much information as possible. Company and union leadership share a common goal of protecting workers' employment through retraining while using technology to keep the company competitive.
- *Taking a pragmatic approach* – PSA is aware of the importance of the Port to Singapore's GDP and so continually assesses the impact of its actions on local communities and communicates this information to the government. Automation must make economic sense and make sense locally. The company also works with the government to provide placements for workers from other sectors who may need reskilling opportunities. With unions, PSA shares evidence for the impact of automation on productivity, worker safety and comfort. Union leaders will take the lead on participating in retraining programs and create success stories to help overcome fears and concerns that workers may have.
- *An early start building-in long timelines* – PSA began retraining related to remote automation in 1993. Management applies a phased approach and builds in long lead times for deploying new automated equipment. Flexibility is built into project schedules for management discussions about concerns and questions that arise. The union and management also realize that retraining takes time and individuals acquire new skills at different paces; PSA builds these realities into project schedules.

2. TUSIMPLE AND PIMA COMMUNITY COLLEGE: DEVELOPMENT OF AN AUTONOMOUS VEHICLE DRIVER AND OPERATIONS SPECIALIST CERTIFICATE

Overview

TuSimple, an autonomous trucking software company, and Pima Community College (PCC) in Tucson, Arizona, collaborated over ten months between 2018–2019 to develop a certificate program to train drivers and operations specialists for autonomous trucks. The company and College developed competency-based training with support from a United States Department of Transportation grant.

Founded in 2015, **TuSimple i**s a publicly traded company that builds software for self-driving trucks. It has offices in the U.S. and China and operations in Arizona, Texas, China, Japan, and Europe. In July 2020, TuSimple launched the world's first Autonomous Freight Network in the United States, a transportation network enabling freight to be moved between cities using Level 4 (High Automation) autonomous trucks.[25] In April 2021, it became the first autonomous driving company to list on a stock exchange, raising US$1.08 billion. Additional investors are a commercial truck manufacturer and two large American truckload carriers.[26] As of May 2021, TuSimple had orders for 6,775 purpose-built Level 4 autonomous trucks.[27]

TuSimple has a fleet of 50 truck test vehicles deployed in the U.S. Southwest. Since 2019, the company has partnered with freight giant UPS to deliver parcels between Phoenix and Tucson and Phoenix and El Paso; UPS also has a minority stake in the company.[28] In addition, TuSimple has plans to begin runs between Phoenix and Orlando, Florida by the end of 2021.[29] It operates its tractor-trailer trucks with two people in the cab, one acting as a safety driver, although they do no actual driving. The other person is a software technician monitoring a server that builds a 3D model of the road that is constantly updated as the truck moves along. However, TuSimple plans to conduct a "driver-out" pilot program without anyone at the wheel in the fourth quarter of 2021 on an approximately 160-kilometre run between Tucson and Phoenix.[30]

Context & Rationale for Retraining

Autonomous trucks refer to those that can operate without full-time human interaction. They rely on a combination of technologies such as sensors (e.g., cameras, radars, GPS), advanced communications (e.g., 5G wireless systems) and software (e.g., algorithms, AI). They are being developed, and in some cases, are already being tested in China and the southern United States.

According to interviewees from the sector, the transition to automated trucking will take place over many years, and fully automated trucks may never be used on busy city streets. Instead, the focus of private companies has been on automating trucks that travel long-distance routes on straight stretches of highways or on short specific routes within cities.[31]

Despite concerns about widespread job losses, truck drivers will continue to be needed, albeit with additional skills, and the transition to automated trucks will take many years (or decades). Some organizations have already started developing retraining programs for commercial truck drivers. For example, since 2018, the European Union's Erasmus Program, as part of the "Steer to Career" project, has been studying the types of skills drivers will need as trucking becomes more automated. An interview with the lead researcher revealed that the project had identified four categories of knowledge as vital to a successful truck driver career in the future: the maintenance, safety, and security of autonomous vehicles; managing connected digital tools and records; customer service; and fleet and hub management.

The Erasmus Program considers professional and social skills development in response to today's reality that many drivers work in isolation and with minimal customer interaction. With autonomous trucks, drivers will have more interactions with others, so they will need to develop awareness, conflict management and duty of care skills to make the transition.[32]

In the United States, TuSimple and Pima Community College have developed such training. This case study provides more details on these organizations and their successful partnership to develop an Autonomous Vehicle Driver and Operations Specialist Certificate.

Pima Community College awards associate degrees, certificates, and post-degree certificates. It has five campuses throughout the Tucson area and, in the 2019-2020 academic year enrolled approximately 20,000 students.

In 2015, PCC established the position of Executive Vice Chancellor, Workforce Development, as part of its senior executive team. The objective of this role was to strengthen ties with industry and situate the College as a strategic partner to businesses seeking training and upskilling for their workforces. Since then, PCC has sought to develop partnerships to jointly develop programs with employers rather than only providing companies with custom, non-credit short courses for existing workers. By August 2021, PCC's had more than 700 partnerships with businesses and 40 with community-based groups and organizations.

Program Development

Executives from TuSimple and PCC first met at a ribbon-cutting ceremony at the opening of the company's research and development warehouse in Tucson in August 2017.[33] At the time, TuSimple employed about ten workers at the facility with plans to hire up to 100 by 2022. The two parties were introduced by Sun Corridor Inc., an economic development organization that brings together private, public, academic, and non-profit groups to promote Southern Arizona as a single economic entity. At the invitation of Sun Corridor, PCC executives regularly attend company openings as a way of introducing the College to prospective clients.

Subsequently in June 2018, TuSimple informally approached PCC about developing a program to enable truck drivers to work as operations technicians in the automated trucking sector. TuSimple was aware of PCC's partnership with Boeing and Raytheon (see box below) and believed the College would have the approach and capabilities it required.

The first formal meeting of PCC and TuSimple took place in August 2018. Both organizations designated program development teams that held approximately ten hours of meetings between October and March 2019, with informal meetings and phone calls to supplement the official sessions. Early meetings included senior deans and executives from PCC to help sort out the roles and responsibilities of various departments and instructors. PCC approved the program design in June 2019 and launched the Autonomous Vehicle Driver and Operations Specialist Certificate program in September 2019. This timing was aided by the program designers including four courses that had previously been developed and approved; only the course on autonomous vehicles was an entirely new curriculum. PCC and TuSimple have remained in regular contact since the formal development process ended.

Program Providers

A joint team of college instructors and TuSimple staff developed the Autonomous Vehicle Driver and Operations Specialist Certificate program. Twenty people from PCC participated, including course instructors for automotive technicians, automated industry technicians, and information technology (IT), as well as representatives from PCC's commercial trucking school and logistics and transportation departments. The TuSimple team consisted of individuals from government/public relations, transportation logistics and engineering.

PCC provides the instructors for four of the courses in the Certificate program. In addition, it hired an employee from TuSimple to teach the Introduction to Autonomous Vehicles course.

Target Participants

To enroll in the Autonomous Vehicle Driver and Operations Specialist Certificate program, individuals must possess a Class A Commercial Driver License and meet PCC's general admission requirements.[34] There is no selection process by either TuSimple or PCC. TuSimple's target program participant was someone currently working as a truck driver, interested in transitioning into the autonomous vehicle industry.[35]

Key Features of the Program

In developing the Certificate program, PCC focused on providing competency-based training based on the needs of the employer. The program consists of five required courses totaling 12 credits, including:

- *Industrial Safety (1 Credit)* – Basic safety procedures when dealing with electrical and electronic systems, confined space, fall protection, safety rules and regulations, etc.
- *Electrical Systems I (3 Credits)* – Overview of the area of electrical systems of a manufacturing facility.
- *Introduction to Autonomous Vehicles (AV) (2 credits)* – Includes history of AV, levels of autonomy, introduction to the technology utilized, ethics, laws, and security.
- *Computer Hardware Components (3 Credits)* – Skills and abilities required to support PC hardware, software and peripherals, mobile device hardware, networking and troubleshooting hardware, and network connectivity issues. Configure operating systems, review security and the fundamentals of cloud computing.
- *Transportation and Traffic Management (3 Credits)* – A study of the domestic freight transportation system. Includes demand for freight movement, laws, regulations, pricing and policies, traffic management, customer service, security, and international transportation issues.

Graduation requires a grade of C or better in each course. Learners can complete the Certificate in one college semester.[36]

PCC originally designed the Certificate program to be conducted in classrooms and labs. However, due to COVID-19, courses in the Spring 2020 semester had to be moved online, as were the labs. Courses in the fall of 2021 would continue to be offered online.

Resources Required

Developing the Autonomous Vehicle Driver and Operations Specialist Certificate program required a mixture of federal funding and contributions from PCC and TuSimple. These included:

- *Staff time* – TuSimple assigned two workers to meet regularly with PCC during the five-month certificate development period, one from transportation logistics and another from government relations. They consulted with a TuSimple engineer internally to determine the competencies new autonomous vehicle technicians would require. When the certificate program began, the logistics expert from TuSimple became the instructor for the Introduction to Autonomous Vehicles course, paid by PCC as a regular college instructor. PCC designated a project manager from its Workforce Development department to assemble and coordinate more than 20 people, including the relevant deans, instructors, and subject matter experts.
- *Program Costs* – PCC received a grant from the United States Department of Transportation of US$455,797 (CDN$566,787) total over five years (2016-2021). The College used a portion of this funding to develop the Introduction to Autonomous Vehicles course, adjust the content of existing courses and move four of the five program courses online due to the COVID-19 pandemic. As part of its general administration costs, PCC covered the salaries of the project manager and instructors involved in developing the program, as did TuSimple for its staff.
- *Student tuition fees* – Program participants pay tuition fees to PCC. For the semester beginning September 2021, to take all five courses (12 credits) required for the full Certificate, Arizona residents would pay US$1,004 (CDN$1,250) and non-residents US$3,702 (CDN$4,600).[37]
- *Additional In-kind donations* – TuSimple donated a truck and trailer to PCC, one that it had used for early testing of its autonomous driving software. The vehicle operates as a regular truck and is used by participants in the Certificate program and PCC's commercial truck driver training school.

Outcomes

By August 2021, PCC had offered the Introduction to Autonomous Vehicles class three times, with 16 students in total. Another class started in September 2021. No one had yet completed the full certificate program. In an interview, a commercial trucker who had taken the course remarked that it had increased his understanding of the vehicles and decreased his fears about losing his job. He was more aware of the job opportunities potentially available to workers who had upskilled to work with autonomous vehicles. As part of its normal process, PCC will formally evaluate the Certificate program in 2022.

PCC obtained an additional new business partner because of the TuSimple collaboration. In July 2021, the workforce development team was starting a new initiative with another company planning to introduce automated equipment and vehicles in their operations. The company was familiar with the PCC/TuSimple partnership and wanted to replicate the process and have PCC develop a program specific to their needs.

As of July 2021, TuSimple had not yet hired anyone who had taken the course (interviewees provided no explanation for this) but had asked their human resources department to prioritize applicants who noted it on their resumes. In addition, by working with PCC, their largely IT-oriented, technical staff gained a better understanding of the culture and practices of the long-distance trucking sector.

Challenges and Areas for Improvement

Interviewees for this case study identified the following as challenges with the certificate program development:

- *Determining program length/content* – PCC and TuSimple needed time and considerable discussion to accurately determine required skills and competencies and develop an appropriate length for the Certificate program. Initially, TuSimple thought a bachelor's program might be necessary, but PCC convinced them that a shorter certificate program would suffice. By July 2021, TuSimple's views had evolved further. Based on experience, it was believed that the original course covered too much material and was too complicated for students to understand. Staff had come to think that for the new testing sites the company was developing in Texas and Louisiana, the necessary content for training operations technicians could be covered through courses held over a few intense weekends. The company was developing these shorter programs with local colleges in Dallas and Baton Rouge.
- *Concerns about autonomous trucking and job loss* – The PCC workforce team faced internal and external resistance when developing the certificate program. They relied on the strong support of Pima's Chancellor and Vice Chancellor to mediate interdepartmental rivalries and overcome concerns about creating an autonomous vehicle program. Regional trucking schools were equally skeptical. At a meeting with 15 schools to discuss the new certificate program, engineers from TuSimple invited to speak faced an adversarial atmosphere. Representatives from the trucking schools were highly critical of the job loss they predicted would result from the greater use of autonomous trucks. PCC saw its role as highlighting how an autonomous vehicle certificate program could help upskill and retrain workers to fill new jobs. For its part, TuSimple believes its software can help address the chronic shortage of long-haul truck drivers in the United States and that truckers can be retrained to take on higher-skilled jobs with Level 4 trucks.

Keys to Success

From the initial meeting between PCC and TuSimple to the first student enrollment, project completion took about nine months, a point of pride for PCC. Interviewees cited the following success factors for this rapid certificate program development and launch:

- *High levels of engagement and commitment from senior executives* – Senior leaders from TuSimple and PCC were engaged from the beginning in the Certificate development process. College executives helped assemble the appropriate faculty and resolved interdepartmental tensions. At TuSimple, executives ensured that subject-matter experts were available when needed and provided targeted information on the skills and knowledge that technicians would require. The relationship between the two organizations grew naturally and was not forced.
- *A willingness to tolerate risk and ambiguity to be innovative* – TuSimple is breaking new ground by the nature of its work developing innovative technology. PCC leadership believes the College must be similarly "dedicated to the idea and practice of innovation" when building its partnerships with business and industry. Both parties began their collaboration with no predetermined outcome. They did not know all the risks in advance, nor did they know the job categories or type of program they would have at the end. As a result, the College could not use a traditional cycle of program development and outcomes but instead had to work with TuSimple through an iterative process to develop training that would meet its needs. College leadership thought that if they were uncomfortable working with this risk and ambiguity and demanded that TuSimple follow standard program development processes and procedures, they would frustrate their industry partner. To enhance its chances in an increasingly competitive educational marketplace, they believe PCC needs to be prepared to challenge the status quo and focus on meeting the needs of businesses that come to them.
- *Avoiding bureaucracy* – PCC collaborated closely with TuSimple staff to move the course development process forward rapidly. The College minimized bureaucracy for the company and focused on listening to its needs and responding to them quickly.

3. FOOD PROCESSING SKILLS CANADA: UPSKILLING FOR FRONTLINE WORKERS AND SUPERVISORS IN THE FOOD AND BEVERAGE MANUFACTURING SECTOR

Overview

In March 2021, the Food Processing Skills Canada (FPSC) launched Skills Training Atlantic Canada (STAC) as a pilot program. STAC is an online program that provides short courses covering a range of technical and emotional intelligence skills for new hires and seasonal workers, frontline workers, and supervisors in the food processing industry. Training is available to employers at no cost. STAC's competency-based training is based on the industry- and educator-validated Learning and Recognition Framework, which FPSC developed over four years. The Future Skills Centre is providing $1.62 million to carry out STAC's two-year pilot.

Food Processing Skills Canada (FPSC) is a non-profit that serves as the Canadian food and beverage manufacturing industry's workforce development organization. It provides leadership in professionalizing the food and beverage manufacturing industry so that the most important resource – people – are the best in the world. FPSC has developed a national skills strategy that other Canadian professional sectors have successfully employed. The strategy builds collaborations with industry, government, academia, unions, associations, community organizations and other stakeholders.

Context and Rationale for Retraining

Short and longer-term trends in the Canadian food processing industry have been driving forces for retraining. Short-term issues include low investment and difficulties recruiting new workers to the food processing sector. FPSC labour market analysis estimated that by 2025, approximately 44,000 people, or 16 percent of the national food manufacturing workforce, will retire—this number is magnified in Atlantic Canada. In 2019, 34 percent of manufacturing employment in the region was in food manufacturing, much higher than the 15 percent in the rest of Canada. Most Atlantic food processors employ between 100-200 workers, with a few large firms employing 500-800 people. A declining regional population and difficulties attracting workers, especially in seafood processing, are ongoing concerns.[38]

A longer-term trend affecting food and beverage processing is changing technologies. In 2018, FPSC convened 32 representatives of food processors, educational and research institutions, and technology and equipment companies for a two-day meeting related to innovation and new technologies. The goal was to identify the skills and knowledge required to facilitate innovation in the food-processing industry within a three-to-ten-year time frame. Session participants identified changing technologies as one of the trends driving the need for upskilling workers. These technologies included increasing automation (e.g., robots, automated sorting machines, automated filling machines), biotechnology and nanotechnology, packaging and data, and data collection.[39] [40]

Since 2017, to respond to the short-term challenges with recruitment and longer-term technological changes, FPSC has undertaken skills initiatives for the food processing sector under an umbrella program called "Professionalizing the Food and Beverage Industry."[41] As one activity, between 2017 and 2020, FPSC developed a Learning and Recognition Framework to support competency-based training for new and existing workers in the sector. Funding for this Framework development came from the federal government's Sector Initiatives Program.[42] Under the direction of a steering committee of industry and educational institutions, FPSC undertook extensive industry and educator validation of the Framework and received strong support. In a press release, President of the bakery Fancy Pokket, Mike Timani, commented:

> Competency-based training is fundamental to solving workforce challenges. When people have the right technical and emotional intelligence skills, they are more likely to find their job rewarding and commit long-term. Companies with a culture of continuous learning are also more attractive to job seekers, especially iGens and Millennials.[43]

An employer interviewed for this case study felt that many people have a negative impression of the food processing industry and have no desire to work in it. She believed the Learning Framework, which would support the development of specific training courses, would show prospective workers that a career path existed in the industry and thus make it more attractive to them.

The Learning and Recognition Framework has five levels:

- Workplace Essentials – For new workers entering the sector with little work experience.
- Level 1: Foundations – Existing food industry workers with less than one year of experience in the industry.
- Level 2: Occupations - For those in the process of acquiring their specific technical skills in the sector and directly involved in food and beverage production. This level develops specific technical/occupational skills and establishes a comprehensive base of knowledge.
- Level 3: Supervisors - For those currently holding, or transitioning to, supervisory positions.
- Level 4: Management - For those currently holding, or transitioning to, management positions.

In 2020, FPSC received two years of funding from Future Skills Canada to develop training courses based on the Learning and Recognition Framework and pilot those courses with food processing employers. The course content was based upon the skills identified in three levels of the Framework: Workplace Essentials, Level 1: Foundations and Level 3: Supervisor. FPSC chose to pilot the courses in Atlantic Canada and named the program "Skills Training Atlantic Canada" (STAC). It spent approximately one year developing the online courses for the pilot program and used the Learning and Recognition Framework to guide content creation. Recruitment of employers commenced in November 2020, and the first cohort of workers began training in March 2021.

Target Participants

Food and beverage manufacturers and related businesses (e.g., cannabis producers) in Nova Scotia, Prince Edward Island, New Brunswick, and Newfoundland and Labrador are eligible to apply and can enroll an unlimited number of workers in STAC. Companies determine which workers will participate.

The STAC pilot program targets three groups of workers:

1. New hires and seasonal workers - to pilot the Workplace Essentials courses
2. Frontline workers - to pilot the Level 1: Foundations courses
3. Supervisors – to pilot the Level 3: Supervisor courses

FPSC has three staff members in Atlantic Canada actively recruiting employers for the pilot and administering the STAC program. Their target is to train 750 workers during the pilot in three cohorts of 250. They have encouraged organizations to enroll their supervisors first, believing they can serve as role models for other workers. Due to enhanced knowledge, supervisors are also better placed to help frontline and new hires with their training.

Key Features of the Training

The STAC program begins with a live one-hour onboarding session for participating companies to review key features of the training. In addition, FPSC also sends them kits with workbooks and other printed materials such as certificates of completion. FPSC purchased 160 Chromebooks, which it lends to employers that need them. Companies also receive access to a company-specific dashboard that provides information on enrolments and courses taken and completed by the group (i.e., frontline worker, supervisor). They can also print course materials, including transcripts of course videos, to help in learning.

Training is primarily self-paced and online, enabling participants to complete the courses during work hours or at home, depending on individual employer arrangements. Courses that make up each level average three hours to complete. Depending on the level (e.g., Workplace Essentials, Level 1: Foundations or Level 3: Supervisor), courses cover such topics as:

- Essential skills like “Numeracy” and basic workplace skills, “Working with Others”
- Technical knowledge needed for all food processing workers through courses such as “Food Safety”, “Quality Assurance” and “Sanitation”
- Operational and leadership skills for supervisors through “Supervise Employee Performance” and “Monitor Budget Performance” courses. For supervisors, emotional intelligence skills such as adaptability and empathy through the Acahkos Program (a program FPSC developed to build emotional intelligence and leadership skills using live coaching)

To complete the Workplace Essentials or Level 1: Foundations program, new and frontline workers take 25-31 courses for about 88.5 hours of training. These courses are further divided into those for workers with high school diplomas and those without. Participants without a high school diploma take additional classes to review essential skills like reading and numeracy.

The Supervisor Framework level consists of 32 courses for a total of 98.5 hours of training. In addition to higher-level food, workplace and occupational safety courses, supervisors receive training in coaching workers, the regulatory environment, budgeting and building a respectful workplace. Once they complete the self-paced courses, supervisors participate in three live 90-minute webinars related to social/emotional intelligence. These webinars include break-out rooms so that participants can discuss issues with fellow supervisors, role play and interact with each other.[44]

The STAC pilot program has been organized into 30-day semesters. New and frontline workers have three months or three semesters to complete the required courses for their level, and supervisors have four semesters. Some employers have asked STAC staff for help setting up training centres at their workplaces; others have used boardrooms or enabled workers to complete the courses at home while being paid.

Upon completing the program, participants receive a graduation package and a micro-credential from Food Processing Skills Canada. In 2021, FPSC continues to develop more formal accreditation for the STAC program with a target completion date of 2022.[45]

Program Providers

FPSC created the courses for the STAC pilot with the help of consultants with extensive experience in the food processing sector and the development of workplace-based online learning. It believed that it would be more efficient for FPSC to hire consultants directly rather than to collaborate with a public or private training institution that might have to hire consultants themselves. A related goal was to ensure that the online courses used the latest tools and techniques and engaged learners. A private consultant designed and delivered the webinar session on emotional intelligence.

Resources Required

The STAC program required a mixture of government and employer funding and in-kind contributions from employers. These include:

- *Program Costs* – To develop the Learning and Recognition Framework on which the STAC pilot is based, FPSC received funding from 2017 to 2020 from Employment and Development Canada's Sector Initiatives Program. In 2020, it received $1.62M from Future Skills Centre, a federal government initiative, for the two-year STAC pilot. The funding was used to develop the courses and materials and to purchase Chromebooks. FPSC also hired three staff in Atlantic Canada to administer the program and a consultant to facilitate live webinars on emotional/social intelligence. Most companies cover the costs of wages and salaries while workers take the training. As a result, workers face no costs or expenses to take the training.
- *Employer in-kind* – The STAC program is free for employers with no cap on the number of workers per company that can participate. However, employers must organize workers to take the training, distribute course materials, and track individual progress. In some workplaces, employers are organizing groups of workers to take the training together at a learning centre. They must also respond regularly to evaluation surveys from FPSC to help meet the evaluation requirements of Future Skills Centre, the funder.
- *Staff-time* – To complete the course, workers need time during work hours or at home to complete the online training and participate in live webinars. Up to August 2021, all workers had taken the courses on paid time.

FPSC values the STAC program training at $15,300 per worker.[46]

Future Skills Centre – Federal Funder of Canadian Upskilling Initiatives

The Future Skills Centre (FSC) initiative is a major federal research program designed to address the need for changing skills to meet labour market demand. FSC prototypes, tests, and measures new and innovative approaches to skills development and training. It regularly collaborates with the Conference Board of Canada, Ryerson University, other universities and colleges and a broad array of non-profit, employer, union, Indigenous and educational organizations.[48]

Outcomes and Benefits

FPSC believes the STAC program provides direct benefits to employers and workers. For employers, these include:

- A workforce with increased skills and an improved workforce culture
- Enhanced employee commitment
- Lower absenteeism and enhanced productivity, with lower turnover rates
- Improved recruitment

For workers, the benefits are seen as:

- Increased skills in areas of focus
- Higher job satisfaction
- Improved personal resilience and team-building skills/participation in strengthening the workplace culture
- Career development and advancement

As of August 2021, 51 employers and 471 workers had participated in the STAC program. Most were supervisors, as the result of STAC staff targeting this cohort. No formal evaluation had been carried out at the time, but anecdotal evidence indicated that the courses/webinars related to emotional intelligence and supervisory skills were well received and seen as valuable and useful. Interviewees commented that many participants had been lead hands and were promoted to supervisors but had received little or no formal training for the role. They appreciated the opportunity to interact with a coach/facilitator and other supervisors through the live webinars. An employer noted that her more experienced supervisors thought the course on managing a diverse workforce was informative and helpful in their daily work.

As part of its agreement with Future Skills Centre, FPSC conducts an ongoing program evaluation to improve the pilot program as it proceeds. Employers respond to regular surveys, and participants complete evaluations upon completion of their training.[47]

Challenges and Areas for Improvement

At the time of the interviews in August 2021, the STAC program had been delivering training for four months. As a pilot program, it provided an opportunity for FPSC to make changes and improvements after each cohort had completed the training. Some challenges observed included:

- *Availability for training* – Many food processors operate seasonally, with exceptionally busy periods when food is being harvested. Some companies are only able to participate in training activities at certain times of the year. For example, a seafood processing company shifted its participation in STAC from May to October 2021 since staff were only available for training later.
- *Tech support* – Some workers are unfamiliar with computers; STAC program staff dealt with more technical inquiries and calls for support than they had originally anticipated. These difficulties signalled that a basic computer skills course might have to be developed and added to the STAC program for participants who need it.
- *Time available to complete the training* – Some participants are eager and progress rapidly through the training. Others move more slowly; STAC staff had to meet regularly with some employers to encourage them to keep workers motivated and progress through the courses steadily. The three-to-four-months originally allocated to complete the program might need to be lengthened, given practical experience with the time constraints workers and employers face.

Keys to Success

Interviewees highlighted the following success factors in the development of the STAC pilot program:

- An early start is crucial since years of development and industry validation time may be required. Creating a learning and recognition framework, validating it, developing courses based on it, recruiting employers, and piloting the courses with workers takes considerable time, much more than most organizations anticipate. As one interviewee said, “start early and expect the process to take far longer than you first thought.”
- The Learning and Recognition Framework, with its strong support from industry and educators nationally, formed a solid foundation for developing the courses in the STAC program. The national course program was then adjusted in consultation with Atlantic regional partners to suit the needs of employers there.
- Employer commitment and participation are essential to program success. Even with training available at no charge, employers still must administer and promote the program, cover wages, schedule training, monitor progress and respond to evaluation surveys. These activities take staff time and effort

4. CALGARY ECONOMIC DEVELOPMENT AND PARTNERS: RETRAINING OF OIL AND GAS PROFESSIONALS FOR INFORMATION TECHNOLOGY JOBS

Overview

Calgary Economic Development (CED) coordinates a program called Energy to Digital Growth Education and Upskilling Project (EDGE UP) to provide short-term training for displaced oil and gas professionals. First launched in 2019 and then expanded in 2021 with federal government funding, EDGE UP involves education and industry partners working to upskill workers for information technology jobs in Calgary and across Canada.

Managed by an independent Board of Directors, **Calgary Economic Development (CED)** is a not-for-profit corporation funded by the City of Calgary, community partners, other orders of government and the private sector through the Team Calgary program. Calgary Economic Development works with business, government, and community partners to position Calgary as the location of choice for attracting business investment, fostering trade and growing Calgary's workforce.

Context & Rationale for Retraining

In 2014, direct employment in the oil and gas exploration, services and pipeline sectors in Canada was about 226,000 people, with most employment in Alberta. According to the Bank of Canada, the sectors faced a series of global economic shifts and technological changes that led to significant reductions in their workforces.[49] These included an oil glut, fluctuations in China's demand, challenges building pipelines and the rise of oil and gas fracking technologies in the United States. Three Canadian pipeline projects were delayed, resulting in the Alberta government implementing a production curtailment program in 2018.[50]

Industry woes worsened in the spring of 2020 with the near shutdown of the global economy due to a combination of the COVID-19 pandemic and an oil price war between Saudi Arabia and Russia. By May 2020, employment in the oil and gas sector had fallen to 162,748, a loss of approximately 60,000 jobs compared to 2014. Cities like Calgary were particularly affected over these six years. In 2015 and 2016, for example, 40,000 jobs were lost in the energy sector, unemployment peaked above 10 percent, and more than 25 percent of downtown offices were vacant.[51]

Program Development

Given the extent of the decline in oil and gas sector employment, CED undertook two major initiatives:

- *Calgary PivotTECH Conference 2017* – CED, a local innovation agency, and the Government of Alberta hosted this one-day event. Its aim was to inform unemployed workers about emerging opportunities in Calgary's information technology sector and alert them to the support and training available to help transition into it. The conference attracted nearly 1,000 people, including unemployed skilled professionals, entrepreneurs, start-ups, companies, post-secondary institutions, and workforce support organizations.

- *Calgary in the New Economy 2018 report* – CED oversaw this revision of the economic development strategy for Calgary, which focused on shifting the economy in a digital age.[52] The strategy has four pillars: talent, innovation, place, and business environment. The report argues that "our ability to create or expand partnerships with the business community, governments and community partners will be critical to success." One of four initiatives under the talent pillar was to create Canada's largest talent accelerator in Calgary. Specific actions to realize this goal included:
    - Expand work-integrated learning programs
    - Collaborate with post-secondary institutions and other providers to design programs aligned with business workforce requirements
    - Enhance program access to diverse communities
    - Pilot/scale nimble short-term programs to re-skill workers

Building on these initiatives, in 2019, CED received a grant of $1.5 million from the federally-funded Future Skills Centre to pilot a work-integrated learning program called Energy to Digital Growth Education and Upskilling Project (EDGE UP). The pilot, which took place from 2019–2021, had two phases:

1. *Pilot Design*: CED consulted with local employers to ascertain the fastest growing tech sectors and the most in-demand technical skills. Based on this research, participating post-secondary institutions developed a training curriculum for high-demand occupations. Almost 100 participants (from a pool of over 1,300 applicants) were selected to participate in the training pilot.
2. *Pilot Implementation*: The first cohort of 49 displaced professionals started the training program in February 2020 and finished in June 2020. The second cohort of 49 went through the program from June to October 2020. Classes switched to an online format in April 2020 due to COVID-19.

In April 2021, Calgary Economic Development received additional funding from Future Skills Canada to roll out a revised EDGE UP 2.0 for two more years. This program could train up to 320 participants.

Program Providers

EDGE UP 2.0 is a collaboration between CED, the Future Skills Centre, the Information and Communications Technology Council (ICTC)[53], Riipen[54], and Calgary-based post-secondary institutions (University of Calgary Continuing Education, SAIT, Bow Valley College and Mount Royal University). ICTC conducts selection interviews, teaches the transition to technology training course, and manages the wage subsidy program at the end of the program. Riipen organizes EDGE UP participant placements with local and national IT companies. To make these arrangements, Riipen provides an online website that matches students seeking paid and unpaid internships with employers searching for assistance with business challenges.

Target Participants

EDGE UP 2.0 targets unemployed or underemployed professionals from the oil and gas sector and related industries. Program applicants must meet the following criteria:

- Be a Canadian citizen, Permanent Resident or eligible refugee who meets the program's English language requirements and lives in the Calgary region.
- Hold a post-secondary degree or diploma in engineering, earth sciences, or a related technical science, technology, engineering, or math (STEM) discipline.
- Be a mid-career worker in the oil and gas industry with a minimum of two years of related professional work experience.
- Alternatively, applicants can have a non-STEM degree or diploma and be a mid-career worker in the oil and gas industry with a minimum of five years of related professional work experience.[55]

No nominations or references are needed to apply for the program. The application process is completed online. Applicants are advised to use a skills mapping tool designed to help oil sector professionals determine how their existing skills match those needed in high-demand IT occupations.[56] From the long list of applicants, representatives from ICTC and a post-secondary institution interview a smaller group of individuals for 30 minutes to choose the program participants. A particular emphasis is placed on ensuring a diverse participant group in age, gender, cultural background and so forth, consciously including EDI strategies into the program. EDGE UP 2.0 began in August 2021 and was scheduled to run until December 2021. Another cohort would start in early 2022.

Key Features of the Training

The table below outlines the major phases of the EDGE UP 2.0 training program scheduled to run from August to December 2021.

Table 2: EDGE UP 2.0 Participant Work Integrated Learning (WIL) Schedule Fall 2021[57]

PHASE	WORK INTEGRATED LEARNING OPPORTUNITY	TIME REQUIRED
I	Transition to tech	2-3 Weeks;part-time
II	Foundations of digital transformation training	1-2 Days; full-time
III	Tech training (university of Calgary, SAIT, Bow Valley College)	3-4 Months; full time weekdays
IV	Work-integrated learning part 1: Capstone project (overseen by riipen)[58]	2-3 Weeks; full-time; paid with a stipend of $1400 at the end
	Work-integrated learning part 2: digital wage subsidy program (overseen by ICTC)	3-4 Months; full-time; wages paid by employer with a wage subsidy

ICTC delivers "Transition to Tech," a three-week work-readiness training course. The sessions provide participants with a framework for identifying and developing career pathways to in-demand IT occupations in Calgary. Topics include:

- Tools to make a career transition (resumes, cover letters, LinkedIn profiles, etc.)
- Orientation to the digital economy and tech sector, including current labour market information
- A pathway to move from education to employment, including individual coaching

ICTC uses a "flipped classroom" teaching approach to deliver the work-readiness training. Participants are introduced to the material at home before class with access through ICTC's Learning Management System. This format ensures that class time is used to deepen understanding of concepts through small group discussions and problem-solving activities that instructors facilitate.

Following a two-day Introduction to Tech training course, participants enroll in one of the following programs, which last from three to four months each:

- *Information Technology Project Management Program (University of Calgary Continuing Education)* – helps participants acquire IT Project Management knowledge and skills.
- *Data Analytics Program (SAIT)* – develops the knowledge, skills, and aptitude for participants to apply fundamental principles of data analytics to support business decision-making processes.
- *Full-Stack/Software Development Program (Bow Valley College)* – provides front-end and back-end programming skills, alongside skills in full-stack development. The course also covers web fundamentals (HTML, JavaScript, etc.) and database theory (SQL, etc.).

Resources Required

The development and implementation of the EDGE UP 2.0 program relied on a mixture of federal funding sources, including:

- *Training program costs* – For the two-year pilot phase of EDGE UP from 2019 to 2021, CED received a grant from Future Skills Centre for $1.5 million. It used the funding to design the program in consultation with employers and engage with post-secondary institutions to develop the curriculum for the short programs. CED then ran the one-year pilot of the training in 2020, with almost 100 participants. For EDGE UP 2.0, Future Skills Centre provided an additional $5.4 million for training 320 participants from August 2021 to August 2023.
- *Participant support costs* – EDGE UP 2.0 programs are provided at no cost to participants, but they must secure their own access to a personal laptop and high-speed internet. While in training, students must support themselves financially for up to six to eight months. After completing the Capstone project, participants receive a stipend of $1,400 with funding provided through the federal government's Work-Integrated Learning Initiatives program. Subsequently, most individuals will start their new IT jobs with a WIL Digital placement wage subsidy funded by the federal government's Student Work Placement Program.[59]

Outcomes and Benefits

Interviewees highlighted the following outcomes and benefits:

- High rate of job placement: By August 2021, 70 percent of graduates of the EDGE UP pilot had found jobs in the IT sector.
- Portability: Interviewees believed that the EDGE UP program model could work in other sectors, including transitioning blue-collar workers with a high school diploma into IT or other sectors.
- Fostered diversity: The pilot EDGE UP program met its goals to promote diversity. According to an interviewee who attended the pilot graduation ceremony, "graduates were like a United Nations—very diverse by age, sex and cultural background." The average age of graduates was 41 years old.

> Pedro Barata, Executive Director of Future Skills Centre, which funded the pilot program and then EDGE UP 2.0, commented that:
>
> "Expanding this program will give us valuable insights into the ways that faster skills intervention can help workers, employers and industries to adapt effectively to changes in order to thrive in the economy of the future."[63]

Areas for Improvement

Future Skills Centre employs a third-party evaluator to review programs that it funds. A 2020 evaluation report commented on the EDGE UP pilot program:

- Through the ongoing evaluation process of the EDGE UP Program, initial lessons learned that have contributed to the improvement of the program include:
  - Importance of monitoring implementation fidelity across training sites,
  - Establishing strong relationships among partners, and
  - Ensuring the program is as streamlined as possible to facilitate participant success.[60]

In addition, interviewees identified challenges during the pilot program, which led to changes in the EDGE UP 2.0 program. These included:

- *Including post-secondary institutions in the candidate selection process* – A post-secondary institution requested that one of its representatives sit on the selection panel for EDGE UP participants. It believed the panel would benefit from someone experienced in assessing if a candidate could cope with full-time studies at an intense pace for four to five months.

- *Lengthening and adding content to the Transition to Tech course* – Evaluations revealed that participants needed a better understanding of the industry they were transitioning into. Generally, IT is much faster paced than the petroleum sector, with more short-term deadlines and tighter project turnarounds; there are no second Fridays off each month. EDGE UP graduates usually obtain an IT job at a far more junior level than the oil and gas position they left. They needed to become familiar with the pace and tasks they would perform. As well, the digital realm changes rapidly and some older professionals out of school for many years required a more thorough explanation of key technologies used today. In EDGE UP 2.0, one post-secondary institution has decided to ask each participant in their program to prepare a white paper at the start of courses. The student will have to analyze the IT sector in Calgary and identify possible jobs available so that they can identify careers of interest to them early on.

- *Increasing mental health supports* – Before starting the pilot program in 2019, some participants had been unemployed or underemployed for four to five years. Commenting on the selection interviews for the pilot, ICTC noted that approximately 80 to 90 percent of applicants said they faced financial stress. Some worried about supporting their family while in training full-time. Many shared stories of layoffs that involved being escorted out of buildings, in some instances being locked out without notice. Educators noticed that some individuals struggled with professional self-confidence after years of being in a low-paid job or unemployed entirely. Participants stated that they had to shift their thinking from a "state of lack (lack of jobs, lack of confidence)" in the oil sector, to the tech sector, where many open positions and career possibilities exist.[61] As a result, enhanced training in stress management was added to the curriculum for EDGE UP 2.0, and instructors will highlight mental health supports available locally and through the post-secondary institutions.

- *Adding in a wage subsidy program* – In the pilot EDGE UP program, participants entered the IT job market having only completed a two-three-week group Capstone project. Some employers hesitated to hire them, believing this short group project provided insufficient IT industry experience. To address this concern, in EDGE UP 2.0 ICTC will be overseeing a wage subsidy program, with the expectation that companies will be more willing to take on program graduates with this financial support.

- *Considering credentials* – As structured in 2021, graduates of the EDGE UP program only receive a certificate of completion at the end of the program. This may limit their ability to leverage their training for other credentials in the future. An opportunity may exist for the EDGE UP partners to enhance the training program's value by issuing micro-credentials related to it. In the fall of 2021, post-secondary institutions began offering micro-credentials for many courses (including IT courses) through the Government of Alberta's micro-credential initiative.[62]

Keys to Success

Interviewees cited the following as success factors for the EDGE UP program:

- *Addressing a clearly identified market need that supports a broader economic vision* – Beginning in 2017, Calgary Economic Development explored labour market trends and needs and took an evidence-based approach to develop a career transition program. Transitioning oil workers into the growing IT sector helped meet identified objectives in the City of Calgary's economic development strategy. EDGE UP provides short, targeted training that builds upon the participant's existing skill sets and includes a strong component of on-the-job learning. To ensure relevant training for in-demand occupations, CED consulted extensively with IT employers about their needs.
- *Sufficient, dedicated funding support from federal government programs* – An interviewee estimated that the EDGE UP 2.0 training program costs between $7,000-15,000 per participant, depending on the course they select. In addition, funding for the Capstone project and the wage subsidy program are additional costs that the federal government covers.
- *Strong, coordinated partnerships* – CED has effectively managed partnerships and collaboration between the post-secondary institutions, Riipen, and ICTC. As well, the post-secondary institutions involved in the program meet monthly and coordinate their activities. Riipen has worked well to secure Capstone projects with local and national employers.

5. UPSKILL HOUSTON: CATALYST FOR INDUSTRY-EDUCATION PARTNERSHIPS AND WORKFORCE DIVERSITY

Overview

The Greater Houston Partnership (GHP), the largest chamber of commerce in the Houston region, established UpSkill Houston in 2014 to bring employers together and strategically expand the talent pipeline for the high-demand careers in the industry sectors considered the drivers of the region's economy. UpSkill Houston is a coordinating body and catalyst for encouraging training and upskilling initiatives by its 200 plus member organizations. Its goal is to help address the skills mismatch in middle-skill jobs by increasing the abilities of Houston's home-grown talent, especially the unemployed and underemployed, low-skill youth and adults, and Houston's communities of colour.

Examples of UpSkill Houston's recent initiatives include an upskilling program for college instructors and efforts to assist laid-off workers transition to new jobs in information technology and other in-demand occupations. UpSkill Houston is funded by the private sector and grants from charitable foundations.

UpSkill Houston brings together senior leaders from the private and public sectors, including petrochemicals, construction, healthcare, transportation, and colleges and provides them with resources and networking opportunities to lead to the development of worker upskilling programs. Overseen by a 68-member Executive Committee, UpSkill Houston holds regular conferences and monthly webinars on workforce development topics, sponsors labour market research and has developed an online platform outlining career pathways in sectors like transportation and construction.

Context & Rationale for Creating UpSkill Houston

In 2013, Houston employers struggled to fill certain jobs, particularly those labelled "middle-skill", occupations requiring a high school diploma and technical training but not a four-year university degree.[64] They believed that regional competitiveness and growth were at risk because of these shortages of qualified workers. In response, ExxonMobil, a major local employer in the petrochemical sector, donated US$1 million to create the Community College Petrochemical Initiative, a consortium of nine regional colleges. The goal was to increase college collaboration so that they could better work with companies to train workers for the petrochemical industry.[65] Other sectors were equally concerned about shortages of middle-skilled workers. Therefore, the Greater Houston Partnership convened a Regional Workforce Development Task Force. This group of 79 people, representing large employers, unions, education, training, and social service providers, evaluated the demand for middle-skill workers and developed strategies for increasing the supply. Meeting over six months, the Task Force released a five-year plan in April 2014, "Addressing Houston's Middle-Skills Jobs Challenge". The report identified the high-demand industries and middle-skill occupations crucial to regional growth and recommended the next steps.[66]

About Greater Houston

Population: over 7.1 million people (2020)

GDP: US$512.2 billion (2019), ranking it as the seventh-largest metro economy in the United States.[71]

A key recommendation was to set up a coordinating body to oversee the implementation of the report's action plan. In response, in 2014 the GHP established UpSkill Houston as its workforce development arm and hired an executive director. The JP Morgan Chase Bank subsequently donated US$5 million, which among other activities, funded a case study of the Houston economy and identified the steps the region needed to take to remain globally competitive (*Preparing Houston to Skill Up*).[67] The local resources from JP Morgan helped bring the industry partners together to form this new coordinating body. Executives, education members and the community became core constituents who met regularly to talk about jobs and workforce issues. Through this initial project, UpSkill Houston became organized, structured, and took flight.[68] In 2021, it was overseen by an Executive Committee of 68 members, supported Sector Councils in construction and petrochemicals and had three full-time staff members and over 200 member organizations.[69]

From its start, UpSkill Houston was focused on issues of global competitiveness and economic development but also had a lens on equitable development so that residents of the Houston region shared in the prosperity. UpSkill Houston deploys the following pillars/approaches in its activities:

- *Employer-led/sectoral approach* – UpSkill Houston is grounded firmly in employer leadership and responsibility. It works with established employer associations and sector councils, like the East Harris County Manufacturers Association. It believes this approach builds on existing structures where leaders in a sector already have developed business relationships and can discuss workforce issues with a common understanding and can lead workforce development efforts from a position of strength.
- *Prototyping ideas that move the region forward* – UpSkill takes the lead on piloting new workforce initiatives that might help its members better address workforce development and regional competitive challenges. Considerable attention is paid to developing prototype programs that can be scaled up to involve more participants.
- *Workforce development as a supply chain issue* – UpSkill wants to ensure that employers think about acquiring and developing talent as a supply chain problem—building pipelines of well-qualified individuals to meet their labour needs.[70] Companies need to define their requirements well enough so that colleges, community, and workforce development organizations can align their programs around employer goals and objectives. In addition, all parties need regularly updated, forward-looking labour market information to ensure that they effectively respond to regional needs. Peter Beard, GHP's Senior Vice-President Workforce Development, commented in a speech to the Aspen Institute:

> We have an economy that is changing much more rapidly than it has ever changed before from a technological perspective. We have got to be building resiliency into our workforce to adapt to that. What's going to happen to transportation, distribution, and logistics when you have robots moving things around, and how are we thinking differently about that? And where are the technicians, technologists, and engineers we are going to need to support that kind of economy? So we're working with organizations like United Way of Greater Houston to actively coordinate and collect the non-profit organizations. We also work with San Jacinto College that represents the nine community colleges in the region. We really think about (workforce development) as a supply chain problem.[72]

Target Participants

UpSkill Houston develops initiatives in conjunction with eight sectors, including petrochemicals, construction, healthcare, transportation, colleges, schools, community-based organizations, and public policymakers. Its explicit goal is to address the skills mismatch in middle-skill jobs by increasing the skills of Houston's underused, home-grown talent, especially the unemployed and underemployed, low-skill youth and adults, and Houston's communities of colour.[73]

Target participants for programs and activities include:

- Youth entering the workforce – UpSkill coordinates with school districts and community colleges to develop programs to attract young people to middle-skill occupations.
- Underemployed and unemployed adults and young adults – UpSkill partners with State workforce organizations and community-based organizations on programs targeted to these individuals.
- Incumbent workers – UpSkill believes it is essential that employers are thinking about increasing pathways within their companies that allow workers to progress in their profession and develop a career with upward mobility that provides a living wage.[74]

Examples of UpSkill Houston Sponsored Initiatives (2019–2021)

UpSkill Houston directly organizes educational events for its members and seeks foundation or government funding to sponsor initiatives that help promote middle-skill jobs in the region. Below are three examples of these types of activities.

1. *UpSkill Works Forum Meetings and Webinars*

   UpSkill regularly convenes forums on workforce development issues that feature local and national speakers for regional business and community leaders, policymakers and educational organizations. These meetings began as in-person gatherings of several hundred people that moved to an online format in 2020 due to COVID-19. These public webinars covered three themes: "Future of Work", "Skills Matter", and "Career Coaching to Support Workers and Learners". Sessions in 2020-2021 explored the potential of apprenticeships, the role of community colleges, readiness for the future of work and upgrading career prospects for middle-skilled workers, among others. In September 2021, two special events discussed strategies and approaches employers in the region could use to support a more inclusive economic and workforce recovery from COVID-19.[75]

   In addition, UpSkill organizes member-only "Councils", which feature discussions with thought leaders on cutting-edge topics and offer networking opportunities. For example, a Council in September 2021 explored the actions employers could take to recruit a more inclusive workforce and focus on needed skills. A key theme was the importance of employers taking action to ensure ongoing upskilling of their existing workforce over the long term.

2. *Career Pathways Exploration Website - What are You Up for?*

   UpSkill Houston recognized the need for awareness of career pathways not requiring a college degree. It launched an online platform with resources about varied middle-skilled careers in sectors like construction, petrochemical manufacturing, and healthcare. For each pathway, users can explore how well it fits their needs and what to expect from different roles within the pathway. In addition, they can find more information about ways to prepare for careers in the field. The website uses a variety of media—including video interviews from real workers—to communicate about opportunities in middle-skill occupations.[76] It also has downloadable career fact sheets and sections with targeted information for parents and educators.

3. *Targeted Labour Market Reports Addressing Key Regional Issues*

   In response to changing regional needs, UpSkill Houston collaborates with Rice University and private companies to produce occasional reports on critical labour market issues facing middle-skill employers. For example, in 2020, UpSkill sponsored two pieces of research:

   - *Middle Skills Matter to Greater Houston* is a long-term strategic document that seeks to identify high-priority occupations that will contribute to regional competitiveness over a two-to-five-year period.
   - *Navigating the Changing Nature of Work* outlines steps for the region to begin addressing the economic impact of COVID-19 and the increased automation many industries are experiencing. As stated in its introduction "Today, it is essential for the Greater Houston region to identify and map viable and desirable job transition and upskilling opportunities that provide career and skills progressions for workers displaced by the pandemic and workers in occupations at risk of technological disruption."[77]

Houston's **San Jacinto College** serves over 45,000 students and is nationally recognized for quality programs and its efforts to reach out to communities of colour. In May 2021, the Aspen Institute recognized San Jacinto as "A Top 5 Community College" among 1,100 colleges across the United States.[87] The College received a grant of US$30 million from Amazon co-founder MacKenzie Scott in June 2021 to recognize and support its work with chronically under-served minority communities.[88]

UpSkill Houston as a Catalyst

UpSkill Houston also serves as a catalyst, creating opportunities for senior leaders from the public and private sectors to interact, build trust and subsequently develop their own programs to meet their workforce needs. Below is an example of one of these partnerships.

'Externship' Program to Upskill San Jacinto College Instructors

In 2019, building on relationships established through the Community College Petrochemical Initiative and nurtured through UpSkill Houston's Executive Committee, San Jacinto College and petrochemical employers launched an externship program for instructors in its Center for Petrochemical, Energy & Technology. Many instructors have years of experience teaching but may not have worked in industry for some time. Faculty are required to participate in an externship, which sees them placed with regional petrochemical firms, such as INEOS, Dow Chemical and LyondellBasell.[78] The purpose is for the instructors to be introduced to new technologies and ways of operating and better understand the most valuable knowledge and skills for students to bring their future employers.

Interviewees for this case study described the externship program in detail. Starting in 2018, a joint committee of industry volunteers and San Jacinto instructors developed the program over 18 months. Before they start the externship, instructors write a white paper outlining their background, the technical knowledge/areas they would like to refresh/upskill, and an outline of the benefits they see from participating. An industry coordinator then matches them with a company and an appropriate work site, matching the instructor's areas of interest.[79] An externship can last from one to six weeks, depending on the upskilling needs of the College instructor; they often take place during the summer and frequently start when a company is training a cohort of new hires. San Jacinto covers the instructors' salaries; the companies provide the externship opportunity at no charge to the College.

During the externship, instructors job shadow supervisors and workers, become familiar with the latest machines, learn troubleshooting, view control rooms, and generally update their understanding of how modern chemical plants operate and the skills and knowledge that workers need.[80] They are also invited to spend up to two weeks in the company's training facilities where programs for new hires take place. In this phase, the College instructors observe how industry trainers structure their classes and how they tend to use demonstrations, hands-on exercises, and group learning rather than lecturing to trainees.[81]

Once they complete their time on-site, instructors write a second paper outlining their experiences and make suggestions for improvements in the externship program. Many go on to reshape their curriculum and change elements of their classroom teaching. In interviews, an employer remarked that " Since the externships started, we are seeing a much more seamless transition of College graduates to our training programs and then to processing operator positions. They're far better prepared and more workforce-ready than they were in the past."

Program Providers

UpSkill Houston works with various partners to develop and implement its educational initiatives, depending on their nature and purpose. For example, a large consulting firm or a local college might sponsor and present at an educational forum or workshop. A company human resources department may provide information for developing career-education materials. UpSkill also acts as a catalyst, creating opportunities for colleges and industry or community organizations and schools to come together to develop programs needed to address Houston's labour force issues. In these cases, the employers/college partners determine the program providers and sources of funding.

Resources Required

UpSkill Houston is privately run and does not receive government funding for its day-to-day operations. Instead, to fund its activities, UpSkill Houston draws upon several sources of private financial and in-kind support, including:

- *Membership fees* – Participants pay membership fees to the Greater Houston Partnership. In 2021, these ranged from US$1,000 (CDN$1,250) for an Associate Member to US$120,000 (CDN$150,000) plus for an Executive Member.[82] GHP helps cover the costs of the three staff that UpSkill employs.
- *Foundation and company grants*– From its inception, UpSkill Houston has benefited from contributions from foundations and companies to support its activities. In 2014, a US$5 million (CDN$6.24 million) grant from JP Morgan Chase helped launch initial regional labour market research that produced *Preparing Houston to Skill Up*. The U.S. Chamber of Commerce Foundation provided US$90,000 for a 2015 pilot program on developing a talent pipeline. Other organizations such as Phillips 66 and the United Way are major ongoing financial partners. Companies may make smaller grants for specific programs or sponsor online events.[83]
- *In-kind leadership* – UpSkill Houston's Executive Committee meets monthly and sub-committees have meetings in-between. All Executive committee and sub-committee participants volunteer their time.

Outcomes

UpSkill Houston has been cited as an exemplar model by the U.S. Chamber of Commerce Foundation's Talent Pipeline Management Initiative, the Communities that Work Partnership of the U.S. Department of Commerce, the Aspen Institute, the Global Cities Initiative of the Brookings Institution, JP Morgan Chase, and United Way Worldwide.[84]

In 2016 UpSkill Houston released *Building Momentum: A progress report*. The report primarily outlines the organization's efforts to serve as a catalyst for creating partnerships in the region and emphasizing the importance of middle-skilled jobs. Leaders of various organizations comment on the benefits of participation in UpSkill Houston. The report also discusses potential activities that sector councils in the region might carry out in the future related to middle-skilled workers.[85]

Interviewees described some of the longer-term benefits they believed resulted from UpSkill Houston's activities and programs. A senior college leader listed the following:

- Enhanced linkages to and understanding of employer needs so that courses and programs can be better tailored to industry needs and more useful.
- Understanding that for credibility, colleges need to sort out any differences privately and present a cooperative face to industry.
- Developing a better understanding of the role of non-profit community organizations and so cooperating more effectively with them to move underemployed workers into appropriate training programs.
- Obtaining better and more equipment for labs and facilities by leveraging company procurement ties to secure vendor discounts, stretching the dollars available. Industry partners also contribute millions to constructing new facilities, topping up the public funds raised through bond issues.
- Creating greater diversity in hiring in targeted sectors. For example, in construction and petrochemicals, up to 35 percent of new hires come from traditionally underrepresented groups versus less than five percent before broader, more organized educator/industry partnerships and interactions started in 2013-2014. Community organizations collaborate with the colleges to help attract and recruit more diverse individuals into college programs like San Jacinto's petrochemical process operator, which places 92 percent of its graduates into the industry. Colleges also create opportunities for these students to interact and network with industry leaders at events like golf tournaments, providing coaching and mentoring beforehand.

Employers cited some of the benefits of increased interaction and collaboration through UpSkill Houston activities and programs, including:

- Better prepared new hires because college students are using modern equipment in state-of-the-art facilities. As well, industry's greater influence on course content and instructor selection at colleges (evaluating teaching skills and not solely industry experience) has resulted in higher retention rates in programs and students graduating with more relevant skills. As a result, employers avoid having to significantly reskill graduates when they enter the workplace.
- Improved understanding of the needs of under-served communities and greater success at identifying, hiring, and retaining a more diverse workforce by collaborating with community organizations. Better knowledge of ways to navigate into the education system and achieve results, at the school and college levels.
- Improved insight into regional workforce development issues across industries, and the benefits of learning from and interacting with a network of workforce development professionals from multiple sectors.

Challenges and Areas for Improvement

Interviewees outlined some of the key challenges they have faced as they have participated in UpSkill Houston activities. These include:

- *Learning to cooperate and not compete* – Colleges and community organizations had to learn to understand and appreciate each other's roles. Over time, they saw that cooperating instead of competing for students/funding meant that employers stayed more engaged with workforce development programs. They also recognized that they could best support the individuals they were trying to move into training for middle-skilled jobs by taking turns on leadership, depending on the individual's needs. For example, community organizations were often better placed to offer basic life skills training or an introduction to workplace norms. On the other hand, colleges could provide more formal training.
- *Ensuring long-term viability* – To date, UpSkill Houston has had only one executive director; interviewees stressed the importance of his leadership to its success. Many senior industry and education leaders involved in founding and developing UpSkill are still active, but they will inevitably retire. UpSkill has no source of ongoing funding for its program initiatives and must rely on private sector project contributions and foundation grants. Some risks may exist for the organization when a few key individuals retire or move on; will others take over the work with equal commitment and enthusiasm? Will industry continue to fund initiatives?
- *Shifting from attracting middle-skill workers to reskilling laid-off workers and upskilling existing workers* – The Houston economy faced three significant challenges in 2021:

    1. Transitioning into carbon-free sectors, like hydrogen and carbon capture.
    2. Helping workers displaced by the COVID-19 pandemic to find pathways to better jobs.
    3. Dealing with the increasing use of automation and artificial intelligence in the workplace and its effects on skills requirements.

UpSkill Houston and its member organizations must develop solutions and identify funding for new projects that address these issues.

Keys to Success

Interviewees highlighted the following factors as key to the success of UpSkill Houston:

- *A spirit of collaboration from the outset* – UpSkill Houston came into being because the Greater Houston Partnership brought together public and private sector leaders to address critical regional workforce needs. UpSkill Houston works with established groups, associations and sector councils and makes no attempts to create new organizations. As a founding activity, it brought in an outside facilitator for a one-day session for senior leaders on the "Collective Impact Model," a structured method to address a large-scale social problem. UpSkill Houston meets many of the model's conditions that distinguish it from other forms of collaboration; a common agenda, shared measurement systems, mutually reinforcing activities, continuous communication, and the presence of a backbone organization (UpSkill Houston itself).[86]
- *Engaged, credible leadership* – The Greater Houston Partnership is a well-respected organization and so its sponsorship provides credibility to UpSkill Houston. UpSkill brings valuable ideas and solutions to its members, backed by timely and pertinent labour market research from Rice University. As labour market needs change, it recruits new members to its Executive Committee.
- *Connecting employers to what they need* – UpSkill Houston is funded by the private sector and focuses on meeting employers' needs. But to create "talent pipelines," it recognized early on that non-profits and schools had to be involved in workforce development conversations, in addition to colleges. UpSkill helps employers navigate these systems, "translates" between groups, strengthens connections, and promotes collective learning—and ultimately encourages progress on regional workforce issues in Houston.

6. SWEDEN: REVAMPING AND CHANGING HOW WORKERS TRANSITION TO NEW CAREERS

Overview

In 2021, about 90 percent of workers in Sweden are covered by collective agreements. Under these agreements, employers and unions have established non-profit Job Security Councils (JSCs). The JSCs administer and deliver adjustment assistance to workers who have been laid off for economic reasons. Their services include individual job counselling, short-term training, and a top-up of government unemployment payments. The Swedish government plays no role in this system, which is funded entirely by a payroll tax on employers.

A significant weakness of the JSCs, however, is in addressing the need to upskill employed workers in the face of climate change and increased automation. In 2021, the Swedish government is considering a major overhaul of the legislation governing employment, based on changes to the job transition model that unions and employers negotiated in 2020. If passed, the new law would see the government become a major funder of retraining for all workers aged 65 and under and would represent one of the most significant reforms of Swedish labour law in decades.

Sweden's Labour Market and Retraining Model in 2021

In Sweden, the labour market model is based on discussion and negotiation between employers and unions ("social partners") on collective agreements rather than through government regulation. The model was established through a central agreement reached in 1938 between the Swedish Trade Union Confederation (LO) and the Confederation of Swedish Enterprise (SN). The agreement specified the rules of the social partners, such as how to resolve matters of dispute, the dismissal of workers, industrial action and so on.

Under the collective agreements, the partners have established Job Security Councils (JSCs) which operate on an ongoing basis. The JSCs were set up by the social partners under the so-called transition agreements to administer and deliver adjustment services to workers who have been laid off for economic reasons. The JSCs: are overseen by a joint union/management board, are financed through contributions from employers, and have no government involvement in or regulation of their activities. The JSCs offer laid-off workers free-of-charge benefits such as different kinds of short-term training (30 days or less) and individualized counselling/coaching to obtain a new career, either in a new job or by starting their own business. Negotiated clauses in the transition agreements also top up government-funded unemployment insurance from 50 to 60 percent of wages to 70 to 80 percent, depending on the agreement. The JSC system has worked well for Sweden, with an estimated 80 to 90 percent of workers who use the services reemployed within eight months, one of the highest success rates in the world.[89]

JSC's provide an insurance-based system that is:

- Independent of government involvement, funding, or regulation and so are unaffected by the state of public finances
- Set up through negotiated collective agreements
- Financed through a payroll tax of 3 percent on employers (subject to the collective agreement);
- Overseen by a joint union/employer board;
- Focused on providing short-term training (30 days or less) to quickly move workers to similar jobs or help them start their own businesses.

The four largest JSCs cover the needs of about 80 percent of the Swedish labour force. These include:

- Trygghetsstiftelsen (TSN) – for government workers
- Transition Fund – for local and regional government workers
- Trygghetsfonden (TSL) – for private sector blue-collar workers
- Trygghetsrådet (TRR) – for private sector white-collar workers[90]

The JSC system has also worked well in instances of mass layoffs due to factory closures or similar events. For example, in December 2011, car manufacturer Saab Automobile AB filed for bankruptcy and laid off 3,064 employees at once. Under Swedish labour law, unions must be provided early notice of layoffs, so they and other organizations had already begun to prepare.[91] The TRR and TSL Job Security Councils coordinated with unions and local governments to set up a local transition office before the layoffs occurred, hired job coaches from across Sweden in advance and focused on finding new jobs for workers. Many found employment in the health care sector.[92]

A New Transition Model: Proposed Key Changes to the Swedish Employment Act for 2022

The Swedish model described above has been under pressure. Global competition, increased automation and the impacts of climate change have changed the circumstances of the labour market. For decades, Swedish politicians, employers, and unions have been concerned with the need for on-the-job-training and better possibilities for people to change careers during their work life. For example, a national system for individual "competence accounts" was financed and nearly implemented in the early 2000s. However, the reform never became a reality, as employers and unions could not agree on the details.[93]

The JSCs are strong at moving a laid-off individual from one position to a similar position elsewhere. But paradoxically, JSC's have been better at providing reskilling opportunities for the unemployed than up-skilling at-risk workers who still have a job. In a world of increasing automation, and with climate change affecting many industries (interviewees cited mining and car making as examples), workers frequently require significant reskilling to meet the requirements of their current job. They might also need to switch to another occupation if they are laid off as companies struggle in the face of global competition. However, with their current emphasis on short-term training, the JSC's are often unable to meet these needs. In addition, the social partners have struggled to successfully negotiate a path between employers' desires for greater workforce flexibility (particularly the requirement that the last worker hired be the first laid off) and the unions' preferences for strong job security measures along with on-the-job retraining for existing workers.[94]

In 2015 and again in 2018, the Swedish government declared its intention to bring forward legislation to change the transition model. The social partners rejected their proposition and increased the pace of negotiations they had already started in 2017; both were reluctant to have the government intrude or interfere in a system where it had been long absent. Unions and employers collaborated to develop adjustments to the Swedish model that would simultaneously strengthen the country's competitiveness and provide employees with security and good working conditions. By December 2020, they had come to an agreement and sent their proposal for a new model to the government.[95] In January 2021, the government sent this proposal for public consultations, which were completed at the end of September 2021. The next step would be for Parliament to pass amendments to the Employment Act in the spring of 2022, with the new system beginning operations in October 2022. Interviewees were confident that Parliament would pass the legislation since it had the strong support of employers and labour unions, and no political party was challenging it.

The proposed agreement rests on four pillars. These are job protection, support for retraining, the right to skills development and economic security during periods of unemployment. The new agreement will also cover part-time employees and those working for companies outside of collective agreements. The major proposed changes include:

- *Government-funded retraining for all workers* – The agreement suggests major government funding for retraining for all people under the age of 65, with or without a job. Interviewees saw this change as historic and one of the most significant reforms in Swedish labour market regulation in decades. Workers who have been with an employer for at least eight years can retrain for up to one year while receiving 80 percent of their salary. Unions and employers may negotiate further increases through collective agreements, potentially increasing the coverage to 90 or 95 percent. While the requirements are not yet completely settled, retraining should be primarily focused on making workers more skilled in their present occupation rather than switching them to an entirely new career. Workers can study part-time, for example, spending three days on the job and two days at school. Alternately, they can take a leave of absence from their employment to pursue their studies full-time.
- *Government-funded transition agency* – The Swedish government will establish and fund a public transition agency, which will help workers not covered by collective agreements. Employed workers and those laid off would be eligible to access retraining, paid for by a mixture of government grants and loans. The legislative proposals significantly improve the financial and practical opportunities for training during working life - both for employed workers and those between jobs.
- *Change in layoff rules* - Under Swedish law, the worker in the position that has become redundant is not automatically the person laid off. Instead, layoffs follow an order of priority. Thus, a longer-term employee will have priority to continue their employment over someone who has been with the company for a shorter period, the "last in, first out" principle. With the proposed new legislation, all employers, regardless of their number of employees, would be entitled to exclude three employees from these rules (instead of the two in the current system) before determining the order of priority. The change will give employers a greater ability to select which individuals remain with the organization.[96]
- *Increased role for the education system* – While not explicitly stated in the proposed agreement, interviewees noted that public educators would have an increasingly important part in retraining. Partnerships between companies, the JSCs and educators will need to be created and will become important as workers embark on longer-term training. These partnerships are predicted to reshape education and training in Sweden. As one interviewee noted, the public education system, including universities, must stop viewing its role as providing students with skills for specific careers. Instead, the education system must prepare students for a culture of lifelong learning and give them the ability to adapt, remain resilient to change, and up-skill and reskill throughout their working life.

Target Participants

The new system would cover employed workers and those workers seeking employment under the age of 65. The system would apply to Swedish citizens and certain foreign nationals.

Program Providers

As is the case with the current system, public post-secondary institutions and private companies will be eligible to retrain workers. Post-secondary education is free in Sweden, and private trainers will also provide retraining at no charge to workers.

Resources Required

Individual workers will not be required to contribute financially to their retraining costs. If passed, the new labour transition system will be funded from the following sources:

- *Government funding* – The Swedish government will provide 11 billion Swedish krona or approximately CDN$1.5 billion annually for the worker retraining fund.[97]
- *Increased payroll taxes* – Payroll taxes for white-collar employers will increase from 3 to 4 percent. For blue-collar employers, the rate will go from 3 percent to 3.4 percent.

Potential Benefits

In December 2020, PTK, a cooperative association of 25 unions in Sweden, described the agreement reached between the social partners as "a new and more proactive system for security in the labour market." In addition to job security, people will have the chance to develop their skills for the job they have or will have in the future. Furthermore, skills development opportunities will be improved by giving individuals economic support for shorter or longer-term training.[98]

For its part, the Confederation of Swedish Enterprise, representing employers, commented that "The conditions negotiated for skills development and employment protection are a sensible response to the challenges and problems that currently exist in today's labour market. They will also help equip companies and employees for the future. The conditions will give employers increased flexibility and predictability, as well as enhancing employees' employability and security in the labour market.[99]

Interviewees saw the changes as a "win" for the JSCs, giving them much larger training budgets and increased influence on skills retraining in Sweden. Of course, what remains to be seen is how the changes roll out over the coming years and whether this new, government-funded restructuring of the transition system in Sweden works well in practice, not just in theory.

Potential Risks with the New System

Interviewees identified some potential risks with the proposed changes to the Job Security Councils and Sweden's labour transition practices. These include:

- *Training fund usage* – An open question is whether older workers will take advantage of the funding available for retraining in advance of layoffs. At present, the wages of more highly educated workers in Sweden are roughly equivalent to those with fewer credentials. As a result, individuals may see a limited financial benefit from the time and effort expended for retraining. As well, some workers may be reluctant to return to formal learning programs after many years away. Some employers were disappointed that the decision to seek retraining is left to individual workers; they would have preferred the right to select and send individuals for retraining to meet business needs better.
- *Stability of government funding* – The government is allocating significant funding for retraining costs. Some question the stability of this funding in the years ahead, with concerns that employers will be expected to cover more of the costs in the future. No interviewee thought workers would be expected to contribute to their retraining, as the government or employers have always covered these costs.

- *Impact on public education institutions* – In consultations on the proposed new system, educational institutions said they would need increased budgets to deal with a larger number of trainees than previously. Employers thought the new system might encourage public institutions to develop programs better suited to retraining older workers but were uncertain if these changes would occur or if the private sector training companies would continue to lead in the area.
- *Effectiveness of the new transition system: theory versus practice* – Given its new funding role in the system, the government will closely monitor the effectiveness and impact of the large amount of money it is providing for transition support. As part of the legislation, the Swedish government is mandating that its Central Student Aid Board (CSA) carry out an in-depth review of transition study support and its introduction as well as its effects on the regular student support system. The CSA is to follow up and propose measures to reduce the risk of cheating and overpayments of the new student aid. The government will also task the Institute for Labour Market and Education Policy Evaluation (IFAU), the research arm of the Swedish Ministry of Employment, to monitor and evaluate the new retraining initiative and its effects. The IFAU will assess whether the reform strengthens the position of individuals in the labour market.[100]
- *Potential loss of autonomy* - For many years, labour and employers operated largely independently of government. With the new system, given its significant funding role, some interviewees worried that the system will become quasi-public. They were unsure of the potential benefits and downsides of such a shift.

Keys to Success of the Swedish Model

Samuel Enghorn, a policy analyst with the TRR, the job security council for white-collar workers, believes that the Swedish system could be replicated in other countries. He comments:

> It is easy to jump to the conclusion that the transition agreements and job security councils are the rare fruits of a very particular legal and industrial relations context, making it an example of little value for other countries. It is certainly true that Sweden has a comparatively high collective bargaining coverage and unionisation rate, but if we review the conditions necessary to conclude transition agreements, we find that these are present not just in Sweden or the other Nordic countries, but in many OECD-countries.[101]

Governments can facilitate the creation of transition agreements and job security councils. They establish the rate of unemployment benefits, and then unions and employers adjust them based on the transitions agreements they negotiate. The more generous the government unemployment insurance is, the lower the costs for the job security councils. Governments could, for example, help finance the initial set up of transition agreements and JSCs and then gradually withdraw support. Another option would be to offer lower payroll taxes to employers that conclude transition agreements with unions.

2A: TRENDS FROM CASE STUDIES

This section summarizes the leading practices and themes from the six case studies that are most applicable to the British Columbian freight transportation context. These trends informed the development of draft recommendations on how the BC sector can best prepare its workforce for increased automation and technology. In January 2022, two focus groups of industry stakeholders discussed these draft recommendations to validate their applicability in the local context.

TREND 1

Organizations established an employer-led training program featuring strong collaboration between industry, unions, educators, and economic development organizations. Partners included companies, unions, educators, and economic development organizations.

A culture of collaboration and alignment with broader economic goals were keys to success in several programs. The lead organizations developed training aligned with industry, educator and regional needs consistent with their regions' long-term economic strategy. Employers were involved in the design and execution of training programs. College and community organizations collaborated to elevate engagement in programs. Employers, industry, and educators worked with government to ensure a common understanding of how training outcomes contribute to the country/region's competitiveness and lead to measurable economic benefits.

Case studies illustrating Trend 1

CASE STUDY	ILLUSTRATION OF TREND
PSA SINGAPORE	PSA designed and executed new training programs by partnering with the Singapore Port Workers Union and a local technical college, ITT, to develop courses.
PIMA COMMUNITY COLLEGE	PCC set up a workforce development office to help match training instruction with the skills employers require. It jointly developed successful programs through employer partnerships with TuSimple, Caterpillar, Boeing, and others.
UPSKILL HOUSTON	UpSkill Houston's activities have been designed to meet the needs of employers of middle-skilled workers in the Greater Houston Region. Its college members recognized that community organizations were best placed to offer life skills training and an introduction to the workplace and collaborated closely with them.
SWEDEN	The Swedish labour model is based on negotiation between employers and unions on collective agreements rather than through government regulation. The transition agreements reached are founded on an understanding of how transition agreements align with shared views of labour dynamics and the future of work.
FOOD PROCESSING SKILLS CANADA (STAC)	Food Processing Skills Canada develops all its programming based on consultations with industry and educators.

TREND 2

Some successful programs are based on a learning framework developed through robust consultations with industry and educators.

Prior to developing specific programming, some programs developed or obtained a learning framework. The framework guided initial programming or course development or helped revise existing programs. In addition, partner companies identified skills requirements so that colleges, community, and workforce development organizations could create programs around employer goals and objectives. Obtaining a recognized and transferable certificate at the end of training is also crucial in many instances.

Case studies illustrating Trend 2

CASE STUDY	ILLUSTRATION OF TREND
FOOD PROCESSING SKILLS CANADA (STAC)	FPSC developed a Learning and Recognition Framework. With strong support from industry and educators nationally, the framework formed a solid foundation for developing food processing training courses. The national course program was then adjusted in consultation with Atlantic region companies to meet the needs of local employers. The development of a certification program is ongoing.
CALGARY ECONOMIC DEVELOPMENT (EDGE UP)	Calgary Economic Development spent more than a year assessing the workforce needs of Calgary's IT sector. It then developed a petroleum worker transition training program (EDGE UP) in conjunction with post-secondary institutions, based on these consultations. It will be reassessing these IT sector needs as the labour market changes.
PSA SINGAPORE	ITT, a local training institution, worked extensively with subject matter experts at PSA to develop a Work Study Diploma in Port Automation. After five years, it will return to PSA for assistance in a major curriculum revision to ensure the program remains current with changing technologies. Three Singapore post-secondary institutions recognize the certificate provided upon successful program completion for laddering into higher technical programs.
UPSKILL HOUSTON	Upskill Houston defined its workforce development program based on the talent supply chain model/concept of the United States Chamber of Commerce. This model is designed to help local employers build pools of qualified talent to meet their needs. Subsequent program development was driven by employer demand and labour market research and less by traditional curricula in post-secondary institutions. A joint industry-education committee developed the upskilling program for San Jacinto College's petrochemical technology instructors.

TREND 3

Organizations build-in program sustainability by articulating the resources required and return on training investment.

Long-term program sustainability depends on the ability of its managers to articulate the resources required and the long-term payoffs to partners and stakeholders. To enable responsiveness and innovation, managers of successful programs built-in flexible timelines and were willing to tolerate ambiguity. Employer leadership commitment, governance and participation are key to program success. Senior education leaders engaged with industry executives to develop certification processes and assembled faculty to ensure buy-in, alignment, and program cost optimization.

Case studies illustrating Trend 3

CASE STUDY	ILLUSTRATION OF TREND
PSA SINGAPORE	PSA has extensive internal training budgets and draws upon Singaporean government programs designed to fund retraining and upskilling citizens across sectors.
TUSIMPLE/PIMA COMMUNITY COLLEGE	Pima College's leadership believes the College must be "dedicated to the idea and practice of innovation" when building partnerships with industry. For TuSimple, the College could not use a traditional cycle of program development and outcomes. Instead, it worked with the company through an iterative process to develop training to meet its specific needs. It also sourced United States government transportation research funding for the certificate program development.
UPSKILL HOUSTON	Upskill Houston articulates program benefits by closely tracking metrics on placement success, career progression and income increases.
CALGARY ECONOMIC DEVELOPMENT (EDGE UP)	EDGE UP's Program managers closely monitor overall job placement figures for program graduates and make them available on the project website. Graduates still seeking positions are highlighted.

TREND 4

Successful programs provided strong financial supports and individual guidance for learners.

Many programs were designed for workers at different career stages and allowed for differences in learning abilities to maximize participation. Key was financial support; interviewees repeatedly noted that mid-career workers with family and financial responsibilities could generally not afford to take significant unpaid or lower-waged leave from their jobs. Providing funding for workers' training on the job or for outside training allowed more diverse participation. Self-selection for training programs contributed to the learner's commitment to training and continuous lifelong learning.

Programs adopted an agile approach to tailor programs to learner needs. Depending on circumstances, course lengths varied and often were offered on the job. Some programs provided learners with additional technology courses when needed and provided laptops to reduce barriers to program uptake. Ongoing individual counselling was available in some cases, guidance that can be advantageous for under-represented groups.

Case studies illustrating Trend 4

CASE STUDY	ILLUSTRATION OF TREND
PSA SINGAPORE	PSA offers workers on-the-job training while paying them full salary. In the case of technical maintenance training, workers can gain a credential recognized for university credit. PSA and the Singapore Port Workers Union clearly articulate the link between automation, job opportunities and immediate benefits for the trainee.
SWEDEN	In response to rising global competitive pressures, the Swedish Government is creating "a new and more proactive system for security in the labour market." Laid-off workers receive ongoing, individualized counselling on career prospects. Under the proposed new labour law, Sweden will pay currently employed workers up to 80 percent or more of their wages for up to a year while they take job-related retraining.
UPSKILL HOUSTON	San Jacinto College and local petrochemical chemicals companies developed an extensive upskilling program for college instructors offered during the summer months. Instructors can take up to six weeks of full-time, on-site training at company sites while receiving their full salaries.
CALGARY ECONOMIC DEVELOPMENT (EDGE UP)	In response to learner evaluations in the pilot program, EDGE UP 2.0 strengthened the mental health component of its program and lengthened an introduction to information technology course. Managers included post-secondary institutions in the candidate selection process to ensure they could cope with program intensity. EDGE UP obtained additional government funding for wage subsidies to increase the possibility program graduates will be hired into the IT sector.
FOOD PROCESSING SKILLS CANADA (STAC)	Skills Training Atlantic Canada provides online, short courses available 24/7 to provide learners and employers flexibility to adjust to current job demands, seasonal workforce needs and labour shortage conditions. Workers take retraining while being paid their full wages. The pilot program started with supervisors as they can serve as role models and ambassadors for other workers.

TREND 5

Programs that have a diverse group of learners intentionally focused on diversity during recruitment and retention.

In British Columbia, predicted labour shortages have led to government focus on bringing underrepresented groups into the labour force. Industry and educators can connect upskilling training to these groups, including Indigenous peoples. The case studies demonstrate that successful programs incorporate new and different approaches to training, developing and re-skilling workers, including deliberate, focused outreach to diverse and underrepresented groups as part of their core activities. While Indigenous peoples were not directly mentioned, case study interviewees highlighted several success factors that form the foundation for accessing diverse and vulnerable groups. These included partnering with community groups to reach out to diverse individuals, adapting programs for differing needs, and ensuring individuals' support.

Case studies illustrating Trend 5

CASE STUDY	ILLUSTRATION OF TREND
PSA SINGAPORE	In its on-the-job technical training program, PSA Singapore accommodated workers who had been out of school for extended periods by enabling them to take additional classes as required while paying their full salaries. The length of automated crane training varies, allowing individual learners, many of them older, to continue to train until they believe themselves ready for the assessment and evaluation.
UPSKILL HOUSTON	UpSkill Houston acknowledged that without significant intervention from local leaders, inequities facing vulnerable workers would increase after the COVID-19 pandemic. They organized a series of webinars and in-person conferences to discuss these issues in September and October 2021. On an ongoing basis, Upskill Houston's education partners collaborate closely with local community groups to gain access to diverse, underrepresented groups and integrate them into their regular programming. For example, the petrochemical technology program has a 90 percent-plus placement rate into stable, high-paying jobs.
CALGARY ECONOMIC DEVELOPMENT (EDGE UP)	From the start, EDGE UP intentionally selected diverse applicants from a variety of communities, considering cultural background, gender, age, and other factors. This emphasis continues in EDGE UP 2.0.

3. ROUNDTABLE SESSION SUMMARIES

DATES	FEBRUARY 23, 2022	FEBRUARY 24, 2022
NUMBER OF PARTICIPANTS	13	24
LOCATION	ONLINE MEETING	ONLINE MEETING
FOCUS	PRINCE RUPERT & BEYOND VANCOUVER	VANCOUVER & LOWER MAINLAND

The research team conducted two virtual roundtables to review the findings and recommendations of the case studies, along with the BC mini-report. One session focused on stakeholders outside the Lower Mainland, including Prince Rupert and the other session on those in Vancouver and the Lower Mainland. The session objectives were to discuss the BC mini-report and draft recommendations. Participants represented a wide range of freight transportation stakeholders: companies, labour unions, Indigenous communities, academic institutions, and training organizations. Both sessions were facilitated by WESTAC and Ingenia Consulting.

The sessions were designed to maximize opportunities for industry stakeholders to share their own experiences and expertise as part of the larger group and within smaller breakout groups. Participants were presented with the background of the project, a summary of case studies and draft recommendations.

Roundtable discussions highlighted the diversity of the freight transportation sector, as participants from different sectors noted their respective opportunities and challenges with technology and with preparing their workforce for the future. Further comments highlighted that BC economy is not primarily dependent on the transportation sector, as is the case for Singapore.

Highlights from Roundtables on Draft Recommendations

Participants largely responded positively to the draft recommendations, as they encompassed a broad range of solutions pertinent to British Columbia. However, some participants said that the context of each case study should be considered when drawing parallels with BC. For instance, governance issues are different in organizations such as PSA Singapore than in companies in British Columbia. In addition, they argued that the government of Singapore owns PSA and the local training institution and so can heavily influence the training activities they undertake and provide significant funding for them.[102]

Participants noted the degree of diversity (or fragmentation) within the freight transportation sector. For example, the skills used in terminal operations differ from those used in long-haul truck operations or when working in a rail yard. Therefore, it may be difficult to design programs suitable for the broad spectrum of transportation occupations. Participants were also cautious about some of the recommendations. They highlighted the importance of understanding the differences in social structures across jurisdictions presented in the case studies. Some participants emphasized formulating a homegrown solution based on our specific collective agreements and industry dynamics. The participants mostly agreed that the recommendations were broad enough to inspire application to British Columbia.

The following paragraphs highlight specific feedback the participants provided on several draft recommendations.

There was significant agreement on the importance of **building diversity and inclusion**. This benefits the employers and workers as it helps with recruitment and retention. For instance, technology adoption ensures safer jobs than a few decades ago and limits the strain on one's physical abilities. Participants also noted the importance of shifting the narratives presented to the workforce by showcasing the positives of technology. For example, instead of focusing on what jobs will be lost, there needs to be a broader discussion on how technology will make some jobs more accessible, particularly for those who have long-term experience in the industry, i.e., employees might work longer before retirement. In addition, respondents noted the importance of having soft skills training on social skills and cultural appropriateness to ensure that underrepresented groups feel safe in the industry.

Some stakeholders felt that the draft recommendations did not focus enough on how governments need to be involved, particularly regarding funding and bringing people together. Many felt that government funding is essential for long-term programs or project sustainability. For example, the collaboration between Coast Mountain College and AltaGas to train students worked well, which otherwise would have been unaffordable. This example led to the further discussion of how collaboration is critical to **developing employer-led, competency-based skills programs through close collaboration with industry, unions, educators, and government and regulatory bodies.**

Building from this, many favoured pilot programs, particularly with a single sector approach as they will be nimbler. Success in one sector can inspire application to a large degree in another part of the transportation industry. Again, participants emphasized the need for government funding to ensure program sustainability. They noted that some pilot programs fail or come to a halt because of a lack of ongoing funding and well-defined metrics. Additionally, the importance of communication was highlighted with pilot programs as well. Regular communication is critical for the viability of a successful program.

A participant also mentioned that having **metrics for return on investment** sound viable but are challenging to cultivate. It is not straightforward, particularly when it comes to measuring the success of a pilot program. However, well-defined metrics can aid in the success of pilots.

Discussions validated that many companies are currently doing training in-house. However, they would need to start relying on training institutions to broaden the skills offered to their workforce. On the other side, some noted that even when hiring someone trained in a specific trade, many employers will still need to train them in the specifics of the technologies being used in their organization. The scope of training will vary for each sector and organization. Some mentioned the high cost of in-house training for individual companies and stated that it would be cost-effective to look for areas where training can be consolidated across companies.

Participants also favoured the draft recommendation to **start preparing for technological change early and communicate often**. It is important not to sugarcoat the requirements and be specific, especially when communicating with workers. Participants discussed the importance of effective change management and the need for training to combat resistance to change. By prioritizing people, adopting technology can become easier both for employers and employees. One stakeholder mentioned that we need to think about the effects of technology adoption more broadly and not just within the industry. In addition, there was a suggestion to look at connections to technology outside the transportation workspace. Lessons and strategies might be learned to benefit sectors within the broader transportation industry.

Some individuals noted that when developing retraining programs, new managers and mid-management staff need to be considered, in addition to workers in manual, labour-intensive jobs. This is especially important as we see increasing competition for talent across industries. A suggestion was to highlight all the green initiatives and technology being developed in companies to the younger workforce, as many Millennials and Gen-Z want to strongly align their values with their employer. Following this discussion, a participant noted that training should be focused on the freight transportation sector and not the general technology industry. Companies need to know how best to draw interns from the education space early and make freight transportation attractive as a career.

Regarding the draft recommendation to ensure that **retraining programs are worker-centric**, some were concerned that emphasizing worker-centric can be problematic. The amount of effort it will take to develop and implement a program might not be a viable cost. Still, another person commented that there could be a collaboration between employer-led skills programs and worker-centric approaches by reaching out to workers and listening to their needs. Essentially, all could come together to determine the best way to learn. Champions and ambassadors might also be needed to aid in the program's long-term sustainability. Additionally, union concerns need to be proactively addressed when developing training programs. Participants did recognize the need to support workers being retrained by addressing the workers' financial and social needs.

4. MINI-REPORT ON THE BRITISH COLUMBIA TRANSPORTATION SECTOR

This section explores the present day and future impacts of automation and new technologies on the trucking and port sectors in British Columbia and community colleges. Data for the assessment came from three sources. Interviews were carried out with ten individuals from marine terminals, ports, trucking firms, labour unions and post-secondary institutions. For the report on British Columbia, the interview sample was not designed to be random. Rather, the intent was to communicate with respected individuals from the freight transportation and college sectors that would have knowledge about and a perspective on key industry issues and trends. WESTAC developed a list of selected industry contacts, who were then approached for interviews. Governance Committee members also recommended individuals.

Additional data came from WESTAC's 2021 Compass Survey of transportation leaders across Canada. Lastly, 37 people from industry and education participated in two roundtables, where they were invited to review and comment on an earlier draft of this section and the draft recommendations.

Generally, industry representatives viewed technological change as an ongoing process necessary to keep the freight transportation sector competitive. The pace of technology adaptation differs by company and sector. In some cases, it will lead to job loss and increase the demand for retraining. Companies interviewed retrained their staff in-house or through outside consultants, with limited interaction with the public education system. The WESTAC Compass Survey revealed that budget constraints, uncertain return on investment and lack of internal skills and competencies could slow the introduction of new technologies.

INTERVIEWS AND ROUNDTABLES

Below are summarized comments from interviewees and roundtable attendees. They are organized by general topic area, then further divided into the sub-sectors of trucking, ports/terminals, and post-secondary institutions.

A. Automation and new technologies used in British Columbia freight transportation businesses today

The first set of questions gathered information on today's automation and new technologies used in the trucking and port sub-sectors. Key comments are summarized below.

General

- Companies can be affected by the upstream and downstream technological changes by other companies that they have no control over—they must react. Sometimes, it is suppliers or customers that drive technological change.
- Some roundtable attendees saw only a limited impact of technology in their operations or subsector.

Trucking

- Most new technology investment has been in the truck cab, information systems, and electronic control systems (breaks and axle control). Companies introduce these systems to remove cumbersome paper-based processes and for safety reasons.
- Information systems in the back office improve efficiency and productivity. For example, formerly paper-based bills of lading are now electronic. These systems help reduce human error and are generally more accurate.
- Trucks have become more sophisticated, especially in their data and equipment and parts monitoring technology, e.g., tire pressure regulated via software.
- Electronic logging devices (ELDs) replace paper logbooks for tracking driver time operating the vehicle. Since June 12, 2021, ELDs have been required in particular trucks under a federal regulation to prevent fatigue in commercial drivers. The regulation covers commercial trucks that cross provincial and territorial boundaries.
- Some companies use geofencing software to restrict trucks to operate in specified zones—this is the driver's area to which the vehicle is assigned. In addition, GPS tracking of truck movements assists with fleet management and leads to more efficient operations.

Ports/Terminals

- Generally, shipping companies use more business logic information systems to support decision-making.
- The use of blockchain technology is helping to enable better integration of supply chain flows (physical, financial and information). For example, to ensure the physical flow of goods through the port, various parties involved need to share certain information when unloading a container ship of its cargo; blockchain can facilitate this.
- The shipping industry is driving further automation in ports. Companies increasingly deploy mega container vessels, which create pressures at terminals to manage the surge in volumes. Communication links across the supply chain need to be better, larger gantry cranes deployed, and more extensive container storage facilities are required.
- All components of the strained global supply chain are innovating to improve productivity and competitiveness while improving fluidity and resilience.
- Software using AI has also been developed to help better plan container movement, maximization of yard space and crane scheduling. Such software is critical to the overall supply chain. It can manage uncertainties and variability, ultimately increasing the efficiency of goods movement.
- AI is used for road transportation planning for container drayage by showing workers the correct information at the right time. As a result, AI can reduce expenses, eliminate bottlenecks, reduce empty runs, and improve asset utilization.

B. Workforce impacts today of new technologies and automation

Interviewees and roundtable participants discussed the impact of introducing new technologies in their workforces regarding work requirements and skills needed. When designing and implementing complex new software applications, most noted that their organizations retrained existing workers. More details are provided below.

General

- Views differed on the impact of technology on job loss. Some participants argued that automation is about increasing productivity, not saving on costs by reducing the size of the workforce. Automation in their sector had led to a greater need for workers, not fewer. Others said they had not seen job losses yet but believe it is coming as technologies continue to advance. They want to be prepared and have lots of lead time to respond.
- One roundtable participant said that in his experience, collaboration between the union and employer had been a factor in working well and adapting to new technology— the initial uptake with automation was good because they sat down at the table together.
- Another person commented on the importance of shifting the narratives presented to the workforce by showcasing the positive aspects of technologies. For example, instead of talking solely about job loss, a broader discussion needs to occur on how technology will make some jobs more accessible, particularly for those who have long-term experience in the industry. As a result, employees might stay in their jobs for longer periods before retiring.
- Governments need to be more involved in helping companies address issues of technological change and its impact on the workforce. They can fund longer-term projects and bring the appropriate groups together. In addition, government funding can be needed to sustain a program or project for the long term.

Trucking

- Digitization can be frightening, especially for some older workers. When offering to retrain, one company has found it difficult and noted they had to allocate more time for their retraining. One company starts to send out literature on the proposed system changes at least six months in advance to signal their intentions and to explain the benefits of the changes. The company's human resource and executive teams make themselves available to field questions from the workers.
- Drivers, office administration and managerial positions have all been affected.
- The sector is having trouble attracting drivers, so many companies try not to let anyone go. Some prefer to train in-house, although they occasionally use experts from equipment manufacturers. One interviewee noted, "if we train in-house, the knowledge stays in the company." The other benefit of internal reskilling is that it encourages a learning culture.
- The interface on electronic logbooks is simple (most drivers can learn to use it in 30 minutes) and more reliable than paper-based methods. Time-based management for companies is now much tighter and can be more effective.
- The industry has many small firms that lack the capacity to train for either new technology or safety, which is a problem for the entire trucking industry.

Ports/Terminals

- Introducing new technology can create a lot of stress and fear of job loss. Training is key. A good practice is to provide upskilling in bite-sized chunks so that workers can master the changes a little at a time. It is also important to reassure employees that their jobs are safe. Staying competitive through the greater use of technology will prevent them from losing their job in the future. Technology can also improve working conditions if implemented well.
- Despite the fear of job loss, automation has driven job growth. The unionized workforce on BC's waterfront has grown by 46% in the last ten years (2200 new jobs), with further growth of 5-10% expected in 2022. Technology implemented to date has removed bottlenecks, increased volumes and spurred a more significant requirement for labour.
- The industry has invested over $35 million in land, equipment and facilities over the last six years in the world-class Waterfront Training Centre in Richmond to ensure longshore workers are highly trained and supported to perform their jobs safely and efficiently.
- In British Columbia, experience has shown that automating a terminal is complex and can be a slow process filled with disruption and technical problems. Resolving issues can lead to significant delays, which are exacerbated if unions are not in agreement with the proposed automation. Some said that through automation, terminals and carriers seek to boost productivity, reduce bottlenecks and increase throughput and, as a result, increase the requirement for labour. Others said that automated equipment is expensive, so companies expect to offset these costs by decreasing labour costs.
- Workers have legitimate concerns about their safety when in proximity to automated equipment. The equipment has sensors and can be trained to avoid people and smaller vehicles. Still, it takes time and rigorous demonstrations to convince workers that automated equipment is safe to work around. Risk assessments need to be made early on to ease the process of adoption.
- Back-office technology has enabled employers to be more flexible. For example, during the pandemic, companies adjusted to more staff working from home. This change has helped parents with young children and people with eldercare responsibilities to work on weekends or at times more suitable for them. It also has increased flexibility and potential opportunities for people with disabilities. These arrangements, however, can sometimes be challenging for managers, who are used to a one-size-fits-all approach to working hours. Some can find having alternate rules for different individuals a challenge.
- Sharing data with external partners creates the need to develop new agreements to manage this data and respect privacy and proprietary information.

Post-Secondary Institutions

- Colleges are seeing a greater demand for data analytics courses, largely generated by international students. Many have advanced degrees and seek a two-year diploma to gain immigration status in Canada. Increasing demand exists for courses in analytical skills for diagnosing data and informatics generated by equipment, including in trucking.
- Several operators noted that they found new employees entering their business had to undergo significant training in the specific technologies used by that business.
- Some larger trucking companies view their internal training as a competitive advantage. For educators, the biggest challenge is to convince them that some training is too expensive for a college to develop solely for one firm. Still, they can deliver it cost-effectively as an industry-wide program. If workers in many different companies have similar skill sets, less poaching may occur. Overall, colleges believe that companies are better off supporting a training program open to the entire trucking sector. This conversation usually happens with the larger firms and with smaller companies coming along after the fact.
- A major challenge is finding the instructional talent to develop the curriculum and have the knowledge, skill, and ability to be a good teacher. It is also challenging to find staff who can teach online (most have little experience) and then attract enough students to take the course or program once developed.
- The COVID-19 pandemic accelerated what many colleges planned to implement by the end of the decade. They were dabbling with digital delivery but had to adopt it sooner. "Digitally enhanced teaching" was a ten-year plan that suddenly had to be implemented to meet current needs. Micro-credentialing as a concept was also sped up, and new courses were rapidly launched.
- Google, Amazon, and LinkedIn have become major competitors to post-secondary institutions in British Columbia. These companies demonstrated that they could develop courses and offer accelerated certification—they do what the colleges do, but faster. The colleges have had no choice but to adopt micro-credentialing and other rapid training options in response to this pressure. In addition, the pandemic pushed colleges to develop new offerings and be more responsive to the needs of learners and industry.
- Many companies seem to do in-house training, but eventually, they may get to the point where they will have to go outside their skill sets and rely on colleges and universities to help them improve.

C. Automation and new technologies affecting British Columbia freight transportation business in five to ten years

Interviewees made predictions on the technologies most likely in use in their sectors by 2030. They also were asked for their expectations on the pace of this change. More details are provided below.

Trucking

- Technology seems to be moving faster than ever, driven by truck driver and office worker shortages.
- Customers' expectations have changed. They are expecting an Amazon-like fast, frequent delivery service. Information on and visibility of product movement is driving innovation in technology systems for the back office. Companies are constantly seeking software that improves the customer experience.
- The ongoing, rapid pace of change in the IT sector means that the use of software in the trucking sector will shift significantly in the next five to ten years. Start-ups in technology hubs like Washington state are developing new software programs that can automate back-office functions, using the cloud and data science to solve older problems. Examples include Postmates for on-demand logistics for local couriers and Nintex for business process automation for small companies without an IT department.[103]
- In 2021, much process software was developed independently, and companies implemented different applications to solve unique problems in a piecemeal fashion. As software solutions become ubiquitous, trucking companies will develop more unified implementation strategies for automating their business processes.
- One interviewee mentioned a trucking report he found of particular interest. In February 2021, IBM Research released *Truck 2030: Digitally Reinventing for the Long Haul*, a document based on interviews with senior trucking executives in eight countries.[104] Commenting on future technologies, the report states:

> What previously was a very singular, manual, labor-intensive process of picking up and delivering a package has been replaced by truck companies implementing logistic processes called capacity-as-a-service, crowdsourced delivery, truck platooning, optimized predictive maintenance, driver/truck/road specific routing, smart cargo, automated driver assist, and the list goes on and on. Thanks to digital technologies such as cloud, AI, Internet of Things (IoT), advanced analytics, and machine learning, these and many other truck capabilities and mobility services are available today or are expected to be readily available by 2030.

- Electric trucks present an opportunity, but it will be difficult to transition a large fleet to this technology. Another issue is using electric trucks in a hub and spoke system.[105] Electric trucks do not work well in Canadian winters with the current technology and infrastructure.

- Geography, difficult mountainous roads, and weather conditions will likely discourage the use of fully automated trucks in much of Western Canada. Sensors embedded in the road cannot be seen in the snow, and the roads in the Rockies can often be too dangerous and the weather too unpredictable for automated driving. Eventually, automated trucks may travel through the Prairies and then their trailers would be attached to traditional trucks traversing the Rockies to the west coast. Full automation may never occur in Northern British Columbia, but if it does, it will likely take 10 to 15 years of further technical innovation.
- Semi-automated truck platoons are not deployed yet, and it may be some years before the technology is ready. In November 2021, Transport Canada launched a six-month pilot of truck platooning in Alberta, with safety drivers in the vehicles.[106]
- Large trucking companies have the investment capital for new technologies, whereas smaller firms do not.

Ports/Terminals

- Technologies that may be used more frequently in the future include geofencing and electronic interchanges. Geofencing uses GPS technology to create a virtual boundary. This boundary is an invisible parameter set around a specific monitored geographic area. The technology also detects violations of the boundary. Combined with software, it can track ships, trucks, and other equipment.
- Companies may make greater use of optical character recognition (OCR), using cameras instead of workers at gates and on cranes. Implementing this change could have a major impact on jobs. For example, today, for 1200 trucks entering a container terminal, 15 checkers are required per shift. One checker would be required per shift using OCR and an exemption-based system. Instead of examining every container, a checker would deal with perhaps 1 percent of all containers—targeting damaged containers or incidences where the OCR code doesn't match. Similarly, with port cranes today, one crane requires three checkers; with OCR, one operator could use a remote camera to check multiple cranes.
- If the proposed Terminal 2, a new container terminal at Roberts Bank is approved, or GCT Global Container Terminals' Deltaport facility is expanded (DP 4 project), the operation will likely have some degree of automation. Currently, there is uncertainty on this point as a terminal operator has not been selected for Roberts Bank, and GCT has not determined the potential automation of DP4.
- Climate change is another factor driving technological change. More electric equipment is coming to the market to reduce greenhouse gas emissions. For example, Seaspan in Vancouver has already been electrifying its docking tugs. When companies upgrade, they will likely purchase equipment that is also more automated.
- Automated trucks deployed dockside are probably ten or more years away.

Post-Secondary Institutions

- Colleges will likely be using more virtual reality applications for trades training.
- Online learning will continue to expand, and more sophisticated learning environments will be deployed.

D. Implications of future technologies and automation for freight transportation workforce

New technologies and automation will bring changes to workforce requirements and skills. Interviewees outlined their predictions on skill requirements and the impact of these changes on job availability in general.

Trucking

- Federal and provincial governments provide significant support in subsidies for the industry, primarily for environmental-related jobs. Adapting systems and tools for environmental purposes often means bringing in new technologies.
- Some college programs take place because of government support. For example, professional logging truck driver training is being offered because the British Columbia government has funded the program for 2021.
- If innovation is successful, adoption can occur relatively quickly throughout the industry. However, if adoption also carries a high risk for job loss or a need for retraining, some organizations hesitate because they are reticent to take on these issues.
- Lack of skilled workers and government regulations are currently the main challenges to the sector, more so than technological change.

Ports/Terminals

- Some interviewees and roundtable participants saw automation primarily as a way to increase capacity without requiring a larger physical footprint. They noted that through automation, terminals and carriers seek to increase productivity, remove bottlenecks, and increase the requirement for labour. Others believed that port automation was primarily driven by the need for companies to save money.
- New machines can increase productivity and safety and be better for the environment, with many using less fuel, new fuels, or electricity. Automation could also help address issues of seasonal labour shortages of port workers.
- Terminals in Canada are smaller and more compact, so automation will likely be slower. Many ports require building a new operating terminal or a complete restructuring of terminals to implement automation. This means that ports must secure public funding or private financing to implement automated systems. Finding investors willing to fund this type of project is challenging, particularly for smaller ports or those where long-term returns are uncertain.
- Technology will likely cause changes to the types of jobs, but if ports expand and more vessels arrive, workers will continue to be needed. Some interviewees noted that there could be opportunities on the equipment maintenance side for workers to retrain as electricians, instrumentation mechanics and programmers. Such retraining would need to be negotiated between the British Columbia Maritime Employers Association (BCMEA) and the International Longshore Workers Union (ILWU).
- Unions will moderate the pace of automation and negotiate to maintain jobs and reskill union members. Equipment may be used in a semi-automated fashion to protect jobs.
- Well-designed, user-friendly technology allows companies to attract more people with less education and shortens their learning curve.

E. Issues related to diversity, equity and inclusion and recruitment and retention

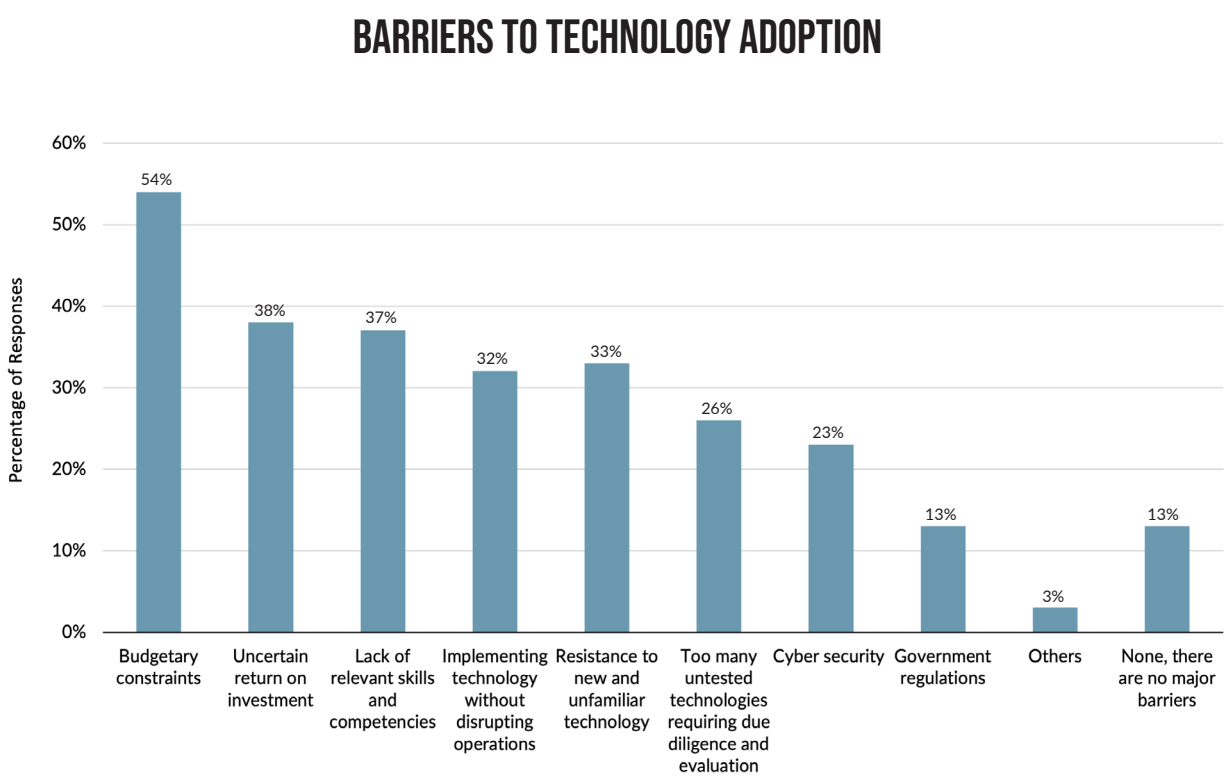
Roundtable attendees mentioned issues related to recruitment and retention of new workers and ways the freight transportation sector could increase its attractiveness to potential employees.[107] From a social and financial perspective, participants noted the importance of creating a more diverse workforce in the sector.

- Employers should seek to attract a more diverse workforce and examine barriers in the workplace environment that discourage underrepresented groups from applying. Organizations can broaden their talent pool by recognizing that workers have diverse abilities and taking steps to address the barriers individuals may face. Workplace policies and structures may need to be reviewed and revised considering cultural and social factors.
- Younger workers increasingly seek to work for organizations that match their values. Total compensation and other benefits are still important, but a company must be seen acting in a way that demonstrates concern for environmental, social and governance issues. Environmental issues can be especially important to millennials.[108]
- Sectors are increasingly promoting their commitment to diversity, equity and inclusion. For example, the BCMEA's website notes that "we seek to maximize the potential of our diverse workforce not only as a social imperative, but as a competitive advantage."[109] As an example activity, in January 2022, the Association released a video produced in conjunction with the ILWU and Ending Violence BC called "More than a Bystander." The video aims to end harassment and bullying on the waterfront and create a culture that encourages and values the participation of women and other underrepresented groups in waterfront jobs.[110]
- Diverse workers often leave organizations because of issues within the workplace culture. Employers and other workers may need training in cultural awareness and in creating a workplace environment that is welcoming and inclusive for individuals from a multitude of backgrounds. Companies also need to examine policies, procedures and work practices with an eye to systemic issues and work to eliminate or adapt these policies to a workforce with various social and cultural needs.

WESTAC SURVEY RESULTS

Below is a summary of responses to questions on technology and skills training that were part of WESTAC's 2021 Compass Leader Survey. WESTAC sent the survey to a broad set of freight transportation leaders in Canada, with the majority being WESTAC members. Data was gathered between September 8-26, 2021. Figures have been rounded up or down to the nearest digit.

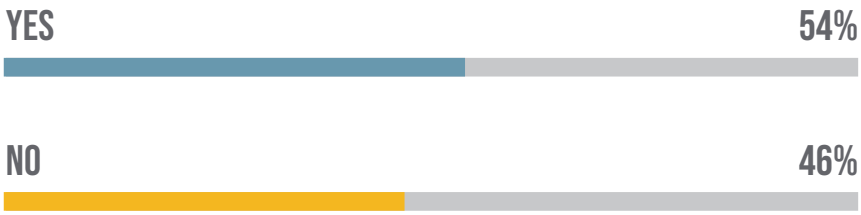
What are the major barriers to adopting new technologies at your organization?



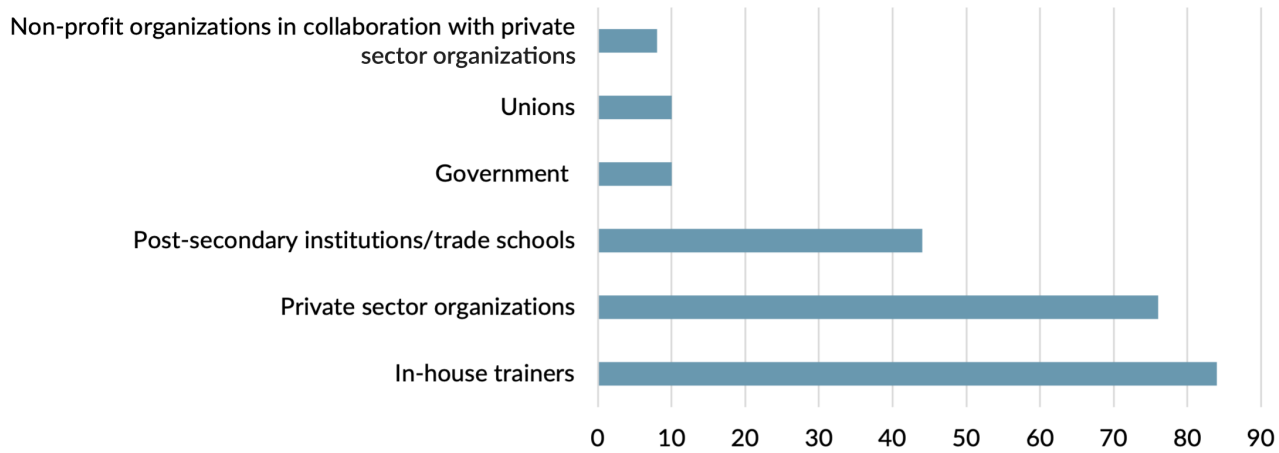
Other barriers respondents identified included:

- Customer and stakeholder collaboration on data sharing
- Automation will ruin the Canadian economy by taking jobs away from workers

Within the next five years, do you anticipate a need to retrain a significant number of your workforce as a result of introducing new technology?



Who do you anticipate will provide the training as a result of introducing new technology?



5. RECOMMENDATIONS

This section presents recommendations based on the leading practices and themes from the six case studies that are most applicable to the British Columbian freight transportation context. These recommendations outline ways the BC sector can best prepare its workforce for increased automation and technology. In addition, industry and educators commented on actions that the government could take to assist with these preparations.

As a general observation, industry participants in roundtables had contrasting views on the applicability of case study programs and practices to British Columbia. Some stakeholders emphasized the need to formulate a homegrown solution based on the specific collective agreements within their sector and local industry dynamics; in their view, practices and programs from other jurisdictions needed to be treated with caution. Others argued that new approaches and programs that succeeded elsewhere could provide valuable lessons and should be considered and adjusted to the BC context.

Participants were also divided on the implications of technology for jobs. In some instances, technology can intensify and degrade conditions for workers through surveillance, task speed-up and digital outsourcing (think of algorithm-dictated work in a high-tech distribution warehouse). On the other hand, technology can enable more creative, safe, and secure jobs and provide significant environmental benefits such as reduced emissions, quieter machinery, and fuel efficiency. It can also provide opportunities for workers to stay on the job longer or open new possibilities for underrepresented groups by reducing demands for physical strength and improving the work environment (e.g., working inside a warm, dry, and accessible crane control room versus climbing up a ladder to a manual crane in the rain.)

A standard argument favouring automation and technology is that automation creates new jobs in the long run, even as workers are displaced from existing jobs. For example, in 2020, the World Economic Forum estimated that by 2025 technology would create at least 12 million more jobs than it destroys.[111] In contrast, other economists argue that by replacing workers with machines in production tasks, automation reduces labour's share of value-added (and national) income, contributes to inequality, and may reduce employment and wages.[112]

MIT's Taskforce on the Work of the Future concluded that the likelihood of robots, automation, and AI soon wiping out vast sectors of the workforce is exaggerated—but reason for concern exists about the impact of new technology on the labour market. In recent decades in the United States, technology has contributed to the polarization of employment, disproportionately helping high-skilled professionals while reducing opportunities for many other workers, and new technologies could exacerbate this trend. The MIT report highlights the need to provide individuals with the skills required to meet these technology and workforce challenges, especially workers without a four-year college degree who have disproportionately borne the brunt of automation.[113]

McKinsey Global Institute maintains that automation will create more jobs and notes that some types of activities have a greater propensity to be automated, such as physical activities in predictable environments. It states, "There is a big question about whether those (displaced) workers, given their existing skill sets, will be qualified to get the jobs that will be there."[114] Echoing this concern, Martin Ford in *Rule of the Robots* reviews American data showing stagnating wages, rising income inequality, and declining labour force participation in the United States since the 1970s. He writes that these issues are in part due to increasing automation in multiple sectors.

> Imagine the transition from farm worker in 1900, to a factory assembly line worker in 1950, to a cashier scanning barcodes at Walmart today. These are all very different jobs in entirely different sectors, but they are all defined by largely routine and predictable tasks. This time around, there aren't going to be large numbers of routine jobs in some new sector to accommodate displaced workers. Instead, workers will be faced with making an entirely different transition into work that is fundamentally non-routine and may often require qualities such as the ability to effectively build relationships with others or perform non-routine analytical or creative work. Assuming that a sufficient number of such new jobs are available, some workers will successfully make this transition, but many others will likely struggle.[115]

Stephen Poloz, former Governor of the Bank of Canada, takes an intermediary position on the impact of technology on jobs. Taking the case of driverless trucks, Poloz argues that the replacement of truck drivers will take many years, and driverless vehicles will also need to be built, managed, monitored, and maintained, that is, supervised by people. He also notes that automation can raise overall income levels, so the creators, manufacturers, programmers, and monitors of driverless trucks will have more money to spend. They could conceivably buy more houses, which would create other jobs in the broader economy. As Poloz notes,

> Jobs are created across the entire spectrum of the economy, not only in the new technology sector, providing a wide range of opportunities for the displaced truck driver. The upskilling required for a truck driver to become a furnace technician, an electrician, a drywaller or some other construction tradesperson does not appear to be insurmountable. Unfortunately, this crucial job-creating growth effect is never credited to the original technological advance—people just see it as normal economic growth.[116]

Many freight transportation jobs are routine in nature, on the front line and in the back office, and so are at risk of being reduced in number, altered in nature, or eliminated entirely as technology progresses. As such, industry, educators, and government in British Columbia would do well to begin planning ways to address these foreseeable changes and ensure reskilling programs for workers are available as companies adopt new technologies. As a starting point, below are some recommendations based on the experiences from other jurisdictions in addressing workforce transitions.

1. **Start preparing for technological change early, communicate often and build in long timelines.** Preparing for new technologies or introducing automation takes considerable time—whether it be for identifying skills requirements, developing training courses, and for implementation. Many workers are anxious about the potential impact of technologies on their job. Employers and unions should work collaboratively and communicate about how jobs will change and how new occupations will emerge. Training providers need to be brought into the conversations early to develop appropriate reskilling programs. In addition, companies and educators must assess current staff's skills level and readiness to understand their reskilling or upskilling requirements.

   Examples from Case Studies:

   - Assessing skills needs, creating a learning framework or standards, validating them with industry, then recruiting employers and piloting the courses with workers can take years, much more time than most organizations anticipate. PSA Singapore, TuSimple and Food Processing Skills Canada (FPSC) started developing reskilling programs years in advance of major changes in technology and managed these long lead times. In Singapore, retraining for automation started in the early 1990s. TuSimple approached Pima College while pilot testing their autonomous trucks, at least six years before they expected their vehicles to be fully deployed. FPSC believed that an early start on developing any training program was crucial since years of development and industry validation time was necessary; they launched a program in 2021 based on work that began in 2017.
   - The Swedish government started pressing employers and unions for changes to the country's worker transition system in 2015 and again in 2018. Stakeholder consultations on proposed changes to the labour laws took over a year. If all goes well, the new system that government, employers and unions agreed upon will be fully deployed in October 2022.

2. **Develop employer-led, competency-based skills programs through close collaboration with unions, educators, and government.**
A group of key stakeholders should be part of the design, implementation, and delivery of reskilling efforts. Roundtable participants emphasized the need for communication and collaboration throughout this development process and including local governments and Indigenous communities in the BC context, as well as regulatory bodies which may need to define or update their certification requirements. In several case studies, employers strongly influenced the training content so that graduates were job-ready and able to take the lessons learned and immediately apply them in the workplace. While less suited to developing a broad, general skill set, this approach could be beneficial for local businesses. Involving stakeholders could lead to improved integration between the classroom and on-the-job time. It is also important to consider train-the-trainer programs to ensure that instructors within public educational institutions and within companies and unions have current knowledge on content and on classroom and virtual teaching methodologies. Government should consider continuing to encourage partnerships between local technology firms and the transportation industry. For example, the Quantum Algorithms Institute's outreach to the transportation industry and efforts to identify pilot projects for quantum computing could be a model.

Examples from Case Studies:

- A culture of collaboration with unions and government and alignment helps PSA Singapore achieve the nation's broader economic goals of global competitiveness and a skilled labour force.
- The Swedish government, in collaboration with employers and unions, is working to create opportunities for citizens, who have some say in determining the best ways to meet their needs for retraining.
- Union leaders, from Singapore and Sweden respectively, helped develop retraining programs and created success stories to help workers overcome fears and concerns about job loss due to automation.
- For UpSkill Houston, community organizations with strong roots in local communities were best placed to attract diverse participants into workplace skills programs and leverage funding from employers for required post-secondary education. This approach is particularly important at a time when financial resources are tight at educational institutions, as occurred with the Centre for Petrochemical Engineering at San Jacinto College. Companies also provide free externships each summer (between 1 to 5 weeks in length) to San Jacinto College instructors to familiarize them with the latest technologies within plants and the types of instructional methods used within the industry for training new workers.
- TuSimple/Pima College jointly developed a new autonomous vehicle operator program. With UpSkill Houston, workforce planning and education were primarily driven by employer demand.

Electric Vehicle (EV) Maintenance Training Pilot Program: A Potential Model for Retraining Programs

Roundtable participants cited the British Columbia EV training program as a potential model for developing and implementing province-wide retraining initiatives. The EV program provides Red Seal automotive technicians with the skills needed to work on EVs and prepares workers for well-paid jobs in the burgeoning clean-energy economy. The British Columbia Institute of Technology (BCIT) developed and piloted the EV program in 2019.[117] In March 2021, other community colleges then piloted the EV program on their campuses (using a train-the-trainer model), including Okanagan College's Kelowna campus, College of New Caledonia's Prince George campus and Camosun College's Interurban campus in Victoria.[118]

3. **Establish a strategy and then develop a framework for upskilling that meets long-term economic development needs and has demonstrable outcomes.**
As a first step, interested parties (such as a group of employers or other stakeholders) could conduct more research into skills mapping and strategy development for the freight transportation sector in BC. For example, prior to the COVID-19 pandemic, the Canadian Chamber of Commerce was exploring opportunities to pilot the Talent Supply Chain model in Canada, the same model used by UpSkill Houston. UpSkill Houston works with multiple sectors in a region, targeting specific, shared occupations rather than taking a siloed, industry by industry approach to studying and addressing labour market needs. An option to explore would be to take steps to replicate the initial regional labour market study that launched UpSkill Houston. Partner groups could include the Canadian Chamber of Commerce and a Chamber of Commerce in the Greater Vancouver area and interested industry associations. As a start, interested employers could conduct a labour market study to identify the most pressing retraining needs and skills shortages in selected sectors within a region. They could then request educators/industry trainers to respond with ideas for appropriate retraining programs.

   With a strategy in hand, learning frameworks could be developed and tailored to individual freight transportation subsectors, or as was done for food processing in Canada, for an entire sector, highlighting cross sector skills. Consider alignment with British Columbia's industry clusters and its economic development strategies, including the Strong BC/Future Ready: Skills for the Jobs of Tomorrow initiative. In addition, in the BC context, it is important to ensure that the needs of a representative group of companies are considered, including small and medium-sized enterprises. Develop an actionable roadmap. The road map should include a prominent role for the regional trade colleges/Red-Seal programs, Industry Training Authority, and other relevant trades bodies. Roundtable participants emphasized the need for creating more micro-credentials and other short, skills-based courses. A flexible framework is also important since technology is continuously changing, and companies will need an agile and adaptive workforce.

In February 2022, the provincial government released *StrongerBC: A Plan for Today, a Vision for Tomorrow*, a long-term economic plan that will steer the province through the post-pandemic era. Dr. Marianna Mazzucato head of the U.K.-based Institute for Innovation and Public Purpose (IIPP) and her team of experts advised the Province on the Plan's development. Key actions under the StrongerBC Economic Plan include developing a plan to train British Columbians to succeed in the jobs of tomorrow (Future Ready: Skills for the Jobs of Tomorrow) and building a new trades and technology centre at BCIT. The centre will consolidate several trades, diploma, degree and masters programs into one location with space for inter-trades and technology collaboration.[119]

Examples from Case Studies:

- Employers, industry, and educators collaborated with government to ensure a common understanding of how upskilling contributes to national or regional competitiveness and leads to measurable economic benefits. This was demonstrated by EDGE UP, UpSkill Houston, PSA Singapore and Sweden.
- Food Processing Skills Canada (FPSC) developed a Learning and Recognition Framework with support from industry and educators nationally. This framework formed a foundation for the development of nationwide and regional training courses.
- UpSkill Houston develops workforce development programs using the United States Chamber of Commerce Foundation's Talent Pipeline Management Initiative. This supply chain model provides a process to build local pools of qualified talent to meet employer needs.
- Flexibility is needed to respond to short-term labour market conditions while keeping long-term goals in mind. FPSC's pilot program in Atlantic Canada adjusted program delivery to meet the needs of small businesses that were short on resources and labour, particularly during the peak harvest season.
- Embrace ambiguity and imperfect information. TuSimple and Pima College began their collaboration without a predetermined result. They developed a program through an iterative process, repurposing old content and developing new. Pima College adjusted its traditional program development process to meet TuSimple's needs as it had for Caterpillar for an industry training academy.

Demographics of BC's Transportation Workforce

In BC, the transportation industry has more older workers and fewer younger workers than the provincial average. As noted in the case studies, it often takes additional time for older workers to become more comfortable working with new technology.

	55 YEARS AND OVER	15 TO 24 YEARS
TRANSPORTATION & WAREHOUSING	27%	8%
ALL INDUSTRIES	22%	13%

Source: Statics Canada. Table 14-10-0023-01. Labour force characteristics by industry.

4. **Estimate the resources that are realistically required for program success and establish performance measures.**

The case studies demonstrated that reskilling programs require significant financial investments. Despite many having large corporate sponsors and industry backing, government funding was key in four of the six case study programs. Roundtable participants highlighted the need for government funding for program sustainability and emphasized that governments can play a key role in bringing parties together in the first place. They also noted that successful training programs require expertise for development and skilled instructors for delivery. These human resources are not always readily available in rural and remote locations. Capital expenditures for equipment may also be required. In addition, it takes a substantial amount of time for reskilling programs to gain traction, even with industry-led program design and significant collaboration between educators, government, and other stakeholders. However, doing nothing also has a social and economic cost if there is large-scale unemployment or under-employment.

In several case studies, local leaders were looking to the future, developing programs in advance of job losses or the need for retraining as technology changed. Program designers should be able to articulate program outcomes and develop clear measures of success, including the return on investment. This planning will ensure the long-term sustainability of programs. While ROI metrics can be challenging to develop, governments and educational institutions have experience with them. Well-defined metrics can aid in demonstrating the success of pilots.

Examples from Case Studies:

- Many of the companies in the case studies contributed significant internal human and financial resources to retraining programs. PSA Singapore has a training university and covers full salaries for workers taking short and longer-term training. Working with a local college, petrochemical companies that are members of UpSkill Houston plan, organize and provide four to six weeks of on-the-job upskilling for college instructors at their plants at no cost to the college. Small employers in Atlantic Canada organize training participants and cover their salaries as part of FPSC programs. TuSimple made three staff members available over nine months to help design the autonomous vehicle certificate program at Pima College.
- UpSkill Houston articulated benefits by developing metrics on placement success, career progression and income increases. They also clearly identified training partners and funding sources and provided opportunities for these groups to network and collaborate through workshops and conferences.
- Employer leadership, commitment, governance, and participation are key to program success. Senior leaders from TuSimple and Pima College were engaged from the beginning in the certificate program development process. College executives helped assemble the appropriate faculty, resolved interdepartmental tensions, and secured necessary program funding. They also led efforts to repurpose existing courses for the new program. Pima College set up a workforce development office to partner with employers and match their skills requirements with training instruction.
- EDGE UP closely monitors graduate success in obtaining jobs in the IT sector and makes this information publicly available.
- Sweden is making major changes to labour market legislation, recognizing that automation and climate change have led to an increased need for retraining and upskilling workers. Instead of solely relying on a company payroll tax to support retraining, the government is now committing major funding to these programs annually.

5. **Ensure retraining programs also address workers' financial, learning, and social needs.**
All stakeholders should be prepared to support reskilling workers by creating customized programs and providing significant financial and social support. Educators should offer guidance and flexibility in requirements to support learners, including Indigenous people and those in underrepresented and disadvantaged groups. Provisions should be made for delivering programs in the ways workers prefer. This includes offering a wide array of customized learning where financial, time and social constraints are considered. Examples include on-the-job practical training (as opposed to requiring workers to attend an institution's campus), individual coaching or tutoring, micro-learning, distance education options and recognizing credentials from elsewhere. Roundtable participants from outside the Lower Mainland called for increased local training and greater involvement of Indigenous communities in program development and delivery. Educators and trainers need the funding to quickly implement program changes to meet shifting industry and learner requirements as technology changes rapidly.

   Examples from Case Studies:

   - Sweden and PSA Singapore recognized that mid-career workers require significant financial support while retraining. PSA Singapore offers on-the-job training with participants receiving their full salary. Under the proposed new Swedish law, employed workers will receive 80 to 90 percent of their salary for up to a year while studying.
   - EDGE UP includes post-secondary institutions in its candidate selection process to ensure that selected individuals can cope with the program intensity. It also introduced a wage subsidy program, with the expectation that it would encourage companies to take on program graduates.
   - FPSC and PSA Singapore provided programming for individuals at different stages of their careers and allowed for differences in learning abilities to maximize program uptake. PSA and the Singapore Port Workers Union developed a one-day course called "Digitization for the Workplace" to address concerns related to technology and worker displacement.
   - The link between automation, job opportunities and immediate benefits for trainees was made clear. The TuSimple/Pima College workforce team faced internal and external resistance when developing an Autonomous Vehicle Certificate program. In response, the College highlighted ways the program could help upskill and retrain truckers to fill new jobs.
   - TuSimple/Pima College, FPSC and EDGE UP tailored their programs to learner needs. They conducted ongoing evaluations and adjusted programs as they discovered more about learning and employer needs.
   - Individual career and occupational counselling were provided to workers in Sweden and Singapore.

6. **Build in equity, diversity and inclusion into retraining program development and delivery.**

The current BC freight transportation workforce predominantly consists of older men so retraining existing workers affected by automation may not directly lead to greater diversity within the sector. However, as the case studies show, funders and developers can ensure that limited spaces in retraining programs are equitably distributed, with an eye to ensuring diversity and inclusion. Establish greater linkages and proactive agreements between employers, Indigenous training organizations and communities, women's organizations, and unions where applicable, to prepare women, Indigenous peoples, people with disabilities, newcomers to Canada, and LGBTQIA2S+ people to take advantage of new jobs created as automation gains further traction in the workplace. Retraining program designers should directly consult diverse learners for their ideas on how program design and implementation can support equity, diversity, and inclusion principles. In this way, designers can learn how to address barriers better and deepen the pool of talent available to the freight transportation sector. As part of reskilling current workers the programs could integrate EDI strategies and provide tools for participants to help develop inclusive and equitable workplaces industry wide. During the roundtables for this project, some participants highlighted their organizations' success in partnering with Indigenous communities and training organizations to design and deliver workforce training. Sometimes individuals need to learn how to learn again, a common theme in many cases. They may need to improve on reading and math skills prior to taking full advantage of retraining courses. These steps may support attracting and retaining underrepresented workers in the freight transportation labour force.

Equity, Diversity and Inclusion

Equity is defined as the removal of systemic barriers and biases, enabling all individuals to have equal opportunity to access and benefit from the program.

Diversity is defined as differences in race, colour, place of origin, religion, immigrant and newcomer status, ethnic origin, ability, sex, sexual orientation, gender identity, gender expression and age.

Inclusion is defined as the practice of ensuring that all individuals are valued and respected for their contributions and are equally supported.[125]

Examples from Case Studies:

- FPSC developed training courses to meet the needs of newcomers to Canada, as well as individuals who had not completed high school. After training the first cohort of pilot participants, FPSC enhanced the capabilities of its technical help desk to help those individuals unfamiliar with computers and online courses.
- UpSkill Houston acknowledged that without significant intervention from local leaders, vulnerable workers would face increasing inequities after the COVID-19 pandemic. It organized a series of webinars and in-person conferences to discuss these issues and develop solutions. On an ongoing basis, Upskill Houston's education partners collaborate closely with local community groups to gain access to diverse, underrepresented groups and integrate them into their regular programming— programs like petrochemical technology, which have a 90 percent-plus placement rate into stable, high-paying jobs.
- From the start, the EDGE UP retraining program intentionally selected diverse applicants from various communities, considering cultural background, gender, age, and other factors. This emphasis continues in EDGE UP 2.0.
- In PSA Singapore's example, educators realized early on that some maintenance workers had been out of formal education for many years. As a result, some had difficulties with aspects of the training for maintaining automated equipment. Instructors began providing individual coaching and catch-up classes for these workers and secured permission from PSA to allow the workers additional release hours from their regular duties to enhance their skills and keep up with the technical training courses.

7. **Consider pilot programs.**
The detailed case studies provide numerous examples of programs that the freight transportation sector in British Columbia could adapt for local conditions and implement by sub-sector, or in a multi-sectoral fashion. A success in one sector might then be applied to a large degree in another part of the freight transportation industry. Government funding is generally needed to ensure a sustainable program, as are well-defined metrics. Regular communication between interested parties (which could include educational institutions, companies, unions, community groups and others) is also critical for the viability of a successful pilot program. Below are some possible pilot projects.

- *Multi-sector approach: Educational series "Automation and the Freight Transportation Sector – The Implications for Workforce Needs"* – Following the example of UpSkill Houston's monthly forums, an interested industry association (or associations) could offer a series of monthly educational and networking events. Representatives from the port, shipping, rail, trucking, and logistics sectors would be provided with the opportunity to explore the impact of new technologies and automation and how they will be affected as a group linked through supply chains. Speakers could come from around the world, highlighting leading-edge technologies and the impact increased automation will have on their workforce needs and how they have addressed these.

- *Multi-sector approach: Developing a maintenance training pilot program for automated heavy-duty equipment* – The British Columbia EV maintenance training program (see box on p. 71) could be used as a model to develop a program to provide heavy-duty mechanics and technicians with the skills needed to work on a variety of automated equipment. Such a program could be created by training providers working collaboratively with the Industry Training Authority of BC. As automation becomes more prevalent, it will be necessary to ensure skilled tradespeople have the knowledge to maintain the equipment.

- *Single-sector approach: Developing a career path for truckers* – Food Processing Skills Canada developed a learning framework designed to support the development of skills training courses for entry-level workers and supervisors. Secondary research for this project highlighted the work of the European Union in developing a career path for truckers. The aim of its "Steer to Career" project was to develop curricula and professional learning programs to help companies prepare their professional drivers for different roles in the same company. The focus was on jobs that will become more important as automation increases, including general management principles, emergency response, customer service and safety management.[120] The British Columbia trucking sector could work with Trucking HR Canada and its newly formed "Transformative Change Group," spearheading the development of a national learning framework for truckers that considers areas like those of the Steer to Career program.[121]

- *Single-sector approach: Optimized scheduling for long haul truckers* – Launch a pilot project to use analytics to help with the difficult shifts that long-haul truck drivers face. The airline industry has developed sophisticated, networked solutions to optimize scheduling. The system generates "crew pairing" alternatives that allow the company to meet the network schedule respect all safety and union rules while providing options for working shifts for the crew to choose from. This is a well-proven, if complex, iterative analytical approach to finding the best balance between network schedule, safety, compliance, and individual preferences. A pilot project with interested carriers could explore how such analytical tools could help companies retain existing drivers and attract new ones.

RECOMMENDATIONS FOR GOVERNMENTS TO CONSIDER

Below are ideas from industry and education for the provincial and federal governments to consider. By acting on these recommendations, governments could better assist workers in transition as the result of technological change.

First, the provincial government could develop a robust overarching **strategy** that includes a roadmap for **upskilling and training across sectors**, as is done in Singapore and Sweden. Other provinces may also be a source of policy ideas, such as the SkillsAdvance Ontario Pilot.[122] A BC strategy would need to be continuously updated to respond to new trends and disruptions to the labour market, including the trend for workers to move to areas with lower costs of living, accelerated by the COVID-19 pandemic. Opportunities may exist to leverage the *StrongerBC: A Plan for Today, a Vision for Tomorrow* report (see recommendation 3) and align common goals on training and economic development strategies. An innovative approach may be required in Western Canada since it has legacy resource-based industries plus a wide diversity of small-to-medium-sized enterprises that are rapidly developing. In some of the case studies, the industry sectors were dominated by a few large companies. In contrast, British Columbia (98.3%) and Saskatchewan (98.3%) have the highest percentage of workers employed by small businesses.[123] Understanding global market changes and the latest technologies will be key to an effective retraining strategy.

A sectoral lens is particularly important, especially for industries like freight transportation. Exports of resource materials drive British Columbia's trade, and the health of the transportation industries are key drivers of economic activity. With BC serving as the Asia-Pacific's port of entry and distribution hub for Canada, focusing on transportation technologies that create efficient and resilient integration of logistics for air, road, rail, and sea is critical.

Consider an operational and governance model that integrates and coordinates programming and assigns one agency to overall accountability for setting targets, tracking progress, and adjusting across sectors.

Coordination and scalability. In BC, many upskilling programs are already in place at the industry, educator, community levels, and all three government levels. Opportunities may exist to coordinate resources and programs to generate synergies and more targeted, efficient, and robust results. For example, open sharing of courseware modules might simultaneously accelerate the rollout across several sectors. The concept of recognized and transferable micro-credentials will be an important element in the strategy. It can be difficult for companies to find qualified people outside the Lower Mainland, especially for managerial and administrative roles. Colleges need appropriate resources so that training can take place closer to home and people can remain in their communities while gaining skills that the industries need: this is where government funding is needed.

Timing of government support. Government investment in retraining could yield significant results if it is targeted and preemptive (e.g., retraining workers while employed versus retraining them after they are laid off). The Swedish Job Council and PSA Singapore case studies are examples of this strategy in action.

Consider exploring **partnerships with larger regions** such as Washington state. BC is an integral part of the western North American transportation corridor; its economy is small relative to its immediate competitors to the south and lacks economies of scale and resources for retraining. Seattle and the State of Washington are competitors and partners in the BC economy, particularly in technology. The province could explore synergies that could be leveraged. Are there lessons learned from similar regional programs such as the Cascadia Innovation Corridor, which includes a focus on transportation?[124] Could training be added to its agenda? Actions may include targeting senior transportation leaders/experts to form an advisory board on retraining and upskilling issues in the freight transportation sector. One activity could be examining training and conducting feasibility studies related to applying truck platooning technologies on key transportation corridors like the I-5 between Vancouver and Seattle.

Program development is critical. Examples of guiding principles from the case studies' leading practices and lessons learned include:

- *Accessibility*: Program delivery is aligned with learner preferences, including the types of delivery channels employed and the ways learners can find and navigate instruction.
- *Maximize value for money* by providing programs that generate the best return to the province. Develop criteria to ensure that each program exhibits a favourable cost-benefit return.
- *Coordinated and Scalable*: Harmonize programs across employers, industry partners, educators, and government. Wherever possible, re-purpose curricula and share among programs/partners. Many topics for training address core skills that are needed by many sectors and companies.
- *Outcomes-focused* programs will advance BC's transportation industry competitiveness and attract a pipeline of talent. We need to be among the world leaders in areas of transportation technology that are important to Western Canada and our role as the Asia-Pacific gateway to Canada.
- *Sector-agnostic* and durable skills enhance the relevance of retraining programs across industries and encourage program uptake.
- *Applying regional and sectoral lenses* can lead to enhanced results and more targeted outcomes.

ENDNOTES

1 The Research Methodology and Tools report (June 15, 2021) for this project set out the rationale for the number of interviews per case study. Based on leading research design practices, it was determined that a minimum of 3 to 5 interviews would be completed for each case. The aim was to interview people with different perspectives (employers, unions, educators, etc.).

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102 In response to WESTAC's query about its governance structure, a PSA spokesperson commented: "PSA is 100% owned by Temasek, the Singapore sovereign wealth fund. Temasek has very diversified participations in many sectors and around the world. PSA is run as an independent, private sector entity, with its own Board of Directors and decision-making process. We are free of any influence by any government or Temasek (other than paying annual dividends). All investment decisions (which container terminals to invest in or which technology to adapt or where to buy it from) is decided 100% by ourselves. Technology and training of our people is at the heart of what we do because we face labour and skill shortages in many of our operations. It is not a government obligation or driven by government agendas. We have had the PSA University Singapore Campus for over 20 years. In 2020 PSA opened a second campus in Antwerp / Belgium, our 2nd flagship operation."

103 Dol, Quinten. 14 Tech Companies in Bellevue You Should Know. *Built In Seattle*. 10 Aug. 2018. Accessed 7 Mar. 2022. https://www.tinyurl.com/2tue38pw

104 Knoedler, Daniel et al. Truck 2030: Digitally Reinventing for the Long Haul. *IBM*. 22 Feb. 2021. Accessed 7 Mar. 2022. https://tinyurl.com/2p9xecdz

105 Using this model, trucks collect cargo from its point of origin (the tips of the spokes) and transport it back to

a central processing facility (the hub). The shipment is then either warehoused or distributed directly from the heart of the network. Larger-scale trucking companies operate several hub-and-spoke systems.

106 Fleming, Kevin. “Alberta Highways Used in National Study to Test Automated Truck Convoys.” CTV News Calgary. 29 Sept. 2021. Accessed 7 Mar. 2022. https://tinyurl.com/4bz75fab

107 While these issues of recruitment and retention are outside of the scope of this study, they are ongoing concerns within the freight transportation sector particularly as subsectors grapple with labour shortages.

108 The Millennial cohort is a large and increasingly important generation in the Canadian demography, people born between 1981 and 1995.

109 *Diversity and Inclusion*. BC Maritime Employers Association. Accessed 24 Mar. 2022. https://tinyurl.com/7b2axfvn

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111 Browne, Ryan. WEF Says Machines Will Create More Jobs than They Destroy but Warns of Pandemic 'Double-Disruption'. CNBC. 21 Oct. 2020. Accessed 7 Mar. 2022. https://tinyurl.com/2p9662d9

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114 How Will Automation Affect Jobs, Skills, and Wages? McKinsey & Company, 11 May 2019. Accessed 7 March, 2022. https://tinyurl.com/2p8p3nbp

115 Ford, Martin. Rule of the Robots: How Artificial Intelligence Will Transform Everything, BASIC Books. Pg. 166. Print. London. 2021.

116 Poloz, S. The Next Age of Uncertainty. Pg. 187. Print. 2022

117 Chen, Amy, et al. BCIT EV Maintenance Training Program to Launch in Early 2020. *BCIT News*, 13 Apr. 2021. Accessed 24 Mar. 2022. https://tinyurl.com/2p863uet

118 Ministry of Energy, Mines and Low Carbon Innovation. *EV Skills Training Now Available at Three Additional Colleges*, 29 Mar. 2021. Accessed 24 Mar. 2022. https://tinyurl.com/rebb9y98

119 More details on the Plan are available at https://tinyurl.com/y3r8kna5

120 The project finished in August 2021. More information is available at https://tinyurl.com/2ch4th6e

121 Under the leadership of Trucking HR Canada's Board of Directors, the group established an advisory group of forward-thinking individuals keen to contribute new perspectives and ideas that will inform rapid systemic change within key industry action areas. More information at https://tinyurl.com/ydv8xpy8

122 For more information on this workforce skills training pilot, see https://tinyurl.com/mr3f5uk6

123 Small Business Tourism and Marketplace Services. “Key Small Business Statistics - 2020.” SME Research and Statistics, Innovation, Science and Economic Development Canada, 10 Dec. 2020. Accessed 24 Mar. 2022. https://tinyurl.com/2p95dt5r

124 For more information, see https://tinyurl.com/2p8826mu

125 *Best Practices in Equity, Diversity and Inclusion in Research*. Social Sciences and Humanities Research Council, 22 June 2021. Accessed 24 Mar. 2022. https://tinyurl.com/2p8c3hwt

6. APPENDICES

A: TABLE OF OCCUPATIONAL CODES

B: SELECTION CRITERIA FOR CASE STUDIES

C: CASE STUDY INTERVIEW GUIDE

D: BRITISH COLUMBIA MINI REPORT INTERVIEW GUIDE

E: SELECTED REFERENCES

APPENDIX A: TABLE OF OCCUPATIONAL CODES

Using an industry definition, the British Columbia freight transportation sector encompasses firms and workers involved in moving and handling cargo. The primary transport modes are air, marine, rail and truck.

The British Columbia freight transportation sector can also be defined using the North American Industry Classification System (NAICS) Canada 2017 Version 3.0. The freight transportation sector includes the NAICS codes in the table below. Note that components of any code specific to passenger transportation, tourism and transit, are excluded.

Code	Title
481110	Scheduled air transportation
481214	Non-scheduled chartered air transportation
482112	Short-haul freight rail transportation
482113	Mainline freight rail transportation
483115	Deep sea, coastal and Great Lakes water transportation (except by ferries)
483213	Inland water transportation (except by ferries)
484121	General freight trucking, long distance, truck-load
484122	General freight trucking, long distance, less than a truck load
484221	Bulk liquids trucking, local
484222	Dry bulk materials trucking, local
484223	Forest products trucking, local
484231	Bulk liquids trucking, long distance
484232	Dry bulk materials trucking, long distance
484233	Forest products trucking, long distance
484239	Other specialized freight (except used goods) trucking, long distance
486110	Pipeline transportation of crude oil
486210	Pipeline transportation of natural gas
486910	Pipeline transportation of refined petroleum products
488190	Other support activities for air transportation
488210	Support activities for rail transportation
488310	Port and harbour operations
488320	Marine cargo handling
488332	Ship piloting services
488339	Other navigational services to shipping
488390	Other support activities for water transportation
488511	Marine shipping agencies
488519	Other freight transportation arrangement
493110	General warehousing and storage
493120	Refrigerated warehousing and storage
493130	Farm product warehousing and storage
493190	Other warehousing and storage

"North American Industry Classification System (NAICS) Canada 2017 Version 3.0." Government of Canada. Statistics Canada, 18 Mar. 2021. Accessed 16 Apr. 2021. https://tinyurl.com/y77k7tza

APPENDIX B: SELECTION CRITERIA FOR CASE STUDIES

Below are the criteria for selecting potential case studies, ranked by relevance for the goals of this project. As can be seen below, the emphasis is to maximize the usefulness of the research for companies, unions, Indigenous organizations and education and training providers.

CRITERIA	REASONING	POSSIBLE DRAWBACKS/ CHALLENGES
Applicability to freight transportation sectors under consideration for this project	Greater likelihood that recommendations from case study could be applied in the sector.	Possible shortage of studies meeting other selection criteria
Relevance to BC/Canadian policy environment and traditional labour market/educational practices	If case study recommendations are too different from practices here, greater chance they will be rejected as inapplicable to circumstances in BC.	In the face of job loss/restructuring, innovative policies and practices may be needed beyond traditional approaches used in British Columbia.
Relevance to BC business environment/company size	Mega-cap companies like Google, Amazon and Walmart have large, well-publicized training initiatives. Large companies may have practices that could be of interest, potentially at a smaller scale.	Mega-caps generally have greater funding to spend on training than a typical Canadian company.
Initiative focused on retraining/ assisting mid-career workers	Automation can result in job losses or reskilling needs for existing workers at companies. Mid-career workers may also seek to leave lower-paying jobs for higher wage opportunities.	Governance Committee may prefer to include case studies featuring industry/education partnerships to train post-secondary students in required industry skills or encourage high school students to enter the transportation sector.
Diversity of sectors	Different sectors face a variety of problems and may have developed a range of possible solutions, affecting several occupations.	Need to ensure findings/ recommendations are relevant to freight transportation sector.
Diversity of jurisdictions (e.g., not every case study from one country)	Funding sources, roles of companies, unions, educational institutions can vary by jurisdiction.	Some jurisdictions have long-standing policies, programs and workforce cultures/practices that would be difficult to implement in BC.
Availability of secondary research on case study (i.e., reports, articles, evaluations available)	More information helps provide depth to the case study. Secondary research can also help identify potential interviewees.	Initiatives currently underway may have limited secondary research available, but still provide useful insights and potential models.

CRITERIA	REASONING	POSSIBLE DRAWBACKS/ CHALLENGES
Possibility of securing interviews with project partners	As part of the research methodology, interviewing three to five people per case study is required.	Based on experience, locating contact information, and securing interviews can be challenging. Interesting potential case studies may have to be dropped as a result. As well, if an initiative was completed before 2016 or 2017, high likelihood that many potential interviewees have moved to other organizations or retired. They may also have forgotten project details.
Status of case study (ongoing or completed)	Easier to obtain interviews from initiatives in progress. Completed initiatives may have a formal evaluation available and outcomes can be tracked.	Ongoing case studies may lack results, making hard to judge the efficacy of programs or interventions. Completed case studies that are too old may be seen as lacking relevance to today's circumstances, especially after the COVID-19 pandemic.
Union involvement	Many freight transportation companies have unionized workforces.	Finding relevant case studies.
Indigenous involvement	Indigenous workers face unique challenges from the impact of automation.	Finding relevant case studies.
Public education institution involvement	Can provide useful examples for BC institutions to consider.	Finding relevant case studies, though initial research shows frequent involvement.
Private training /non-profit organization involvement	From initial research, these partners are often involved, in some countries and could provide useful examples for BC companies to consider. From initial research, private training organizations are often involved in reskilling initiatives targeting technical skills.	Finding relevant case studies, though initial research shows frequent involvement.
Diversity of occupations targeted and whether they are white collar, blue collar or both.	Automation and AI are affecting blue- and white-collar occupations.	Research shows that more initiatives target the retraining of blue-collar workers.
Internal retraining for job within company, training for job in another sector or both.	Addresses several potential scenarios that companies may face.	Finding relevant case studies.

CRITERIA	REASONING	POSSIBLE DRAWBACKS/ CHALLENGES
Length of intervention (e.g., short program or months of training)	Provides useful examples for addressing a variety of circumstances.	Traditionally, fewer examples of longer-term interventions in workforce retraining.
Costs (and who pays what)	Can provide useful funding models for consideration.	From experience, discussions about costs can be sensitive to some project partners and sometimes not disclosed. Alternately, costs may be presented as an aggregate figure only.
Type of technology change that created the need for reskilling/ job loss	Pace/timing of technology implementation may differ, with varying impacts on workforce.	Some technologies may not be widely used in Canada, due to regulations, climate considerations (e.g., icy roads for self-driving trucks) or other factors.
Targeted to one group of workers (e.g., company layoffs) versus open to workers from multiple companies	Addresses a variety of potential circumstances in the labour market.	Finding relevant case studies.

APPENDIX C: CASE STUDY INTERVIEW GUIDE

This section provides the interview guides that the interviewers will use while conducting primary research. The first guide is for preparing case studies of outside jurisdictions. The second guide will be used for preparing the mini report on British Columbia.

Outside Jurisdiction Interview Guide

The guide below would be used when interviewing participants in case studies in jurisdictions outside of British Columbia. Note that the questions are slightly different by group, that is, company, training institution or union representatives. If some interviewees fall outside these categories, the researchers will adapt the questions as required before the interview.

Based on the researchers' 2020 experience conducting interviews globally, most participants are willing to be interviewed for between 30-45 minutes, maximum.

The guide has been written to conform with the Tri-Council Policy Statement 2: Ethical Conduct for Research Involving Humans to guide ethical research and considers the following principles:

- Free, prior and informed consent for all research participants.
- Participation is entirely voluntary, and participants can decline to answer any question they choose.
- All participants will be told how their answers will be used.

This Interview Guide identifies the major lines of questioning that Ingenia will pursue in interviews. The Guide is intended to direct the discussion and act as a checklist of key points to cover.

Date of Interview	
Name of Interviewee	
Current Title/Organization	
Title/Organization during Case Study	
Email Address	
Phone Number	
Geographical Location	
Time Started (PST)	
Time Ended (PST)	

General Introduction

Prior to conducting the interview, review the secondary research Ingenia has already obtained on the case. Also, check the LinkedIn profile of the person you are interviewing. Also, search their name, in case they have been mentioned in the press, received an award, etc.

- Identify yourself as part of the Ingenia project team interviewing on behalf of WESTAC. An explanatory email with background information and obtaining consent to be interviewed will have gone out to the person when the interview was first requested. Confirm that the interviewee has received this email. If not, send it to them before starting and ask them to reply to the email, consenting to the interview.
- Provide an overview of the purpose of the project. If need be, read the explanatory email to them and ask if they have any questions about the project.
- Remind them that they are free to decline to answer any question and stop the interview at any time. Remind them that their participation is entirely voluntary.
- Remind them that individual responses will be kept confidential-we will only comment on aggregate information.
- The information they provide will be used to provide additional details and background on the case study Ingenia is preparing for WESTAC. If they would like, they will receive a copy of the final report, including the case studies. This report will be available by summer 2022.
- Solicit agreement to participate for 30-45 minutes. If less time is available, adjust your questions to the most pertinent.
- Address any other questions they may have.

WESTAC contact for additional questions or concerns:
Lisa Baratta
Vice President, WESTAC
+1-604.687.8691 ext. 320
lbaratta@westac.com

Take notes that highlight the significant points of the interview responses—if any good quotes, note them as well.

If the interviewee has limited time, move quickly from section to section—to make sure we can cover them all off. We may not have time to cover every question per section.

Topic 1 – Review of Case Study Information

These first questions are "warm-up" questions, more straightforward questions that your participants can answer without too much trouble, which helps them feel more relaxed and confident.

- Could you outline for me your current role with the organization? How long have you been with the organization/industry?
- We've conducted some background research on the retraining program you were involved with. I would like to confirm with you the details that we have:
  - *Review the main points that we already have-for example, when the program started and finished (if it has finished), organizations involved, main components of the program, number of workers retrained, types of occupations*
  - *Note any discrepancies – we will verify proposed changes with other interviewees.*
  - *Confirm the interviewee's role in the case. (e.g., HR manager overseeing the program, dean at college that conducted the retraining, front line supervisor etc.)*

Topic 2a- Training/Retraining Options-For companies

- What was/is the driver behind the need for the retraining program you were involved in? (e.g., automating plant, changing regulations, new product or service line) What new skills were required? How was the current job changing because of technology?
- What were the reasons the company decided to retrain existing workers rather than hire new workers with the needed skills? What is the current demographic profile of the workforce?
- What were the reasons you selected the (name organization) to provide the retraining? (Alternately, depending on the case) What were the reasons for doing the retraining internally?
- On what basis did you select the workers that received retraining? How structured was the process? What happened to workers who did not receive retraining? Were there any accessibility issues (e.g., language, technology, childcare) in retraining the current workforce? For what reason?
- After completing the retraining program, what accreditation did workers receive, if any?
- How have automation and advanced technology impacted diversity in your workforce? How are they affecting the recruitment and retention of Indigenous people?
- If a unionized workplace:
  - How supportive were union leaders of the new technology and the retraining?
  - Was it necessary to address technological changes in the collective agreement?
  - Were any obstacles encountered in implementing the retraining due to union concerns? How were these obstacles overcome?
  - Were there any concessions made in the event of displaced workers?
  - How did workers react to the retraining process?
  - After implementation what was the overall attitude and comfort level among workers to the change?
  - Did the workers see the technological change as a positive step?

- If a non-unionized workplace:
  - What was the rationale for retraining existing workers rather than hiring new ones?
  - Were any obstacles encountered in implementing the retraining? How were these obstacles overcome?
  - Were any accommodations made for early retirement for older workers?
  - How did workers react to the retraining process?
  - How long did it take for workers to become comfortable with the new technologies introduced?
- Did the workers see the technological change as a positive step?
- How much outside funding or support did your company receive, if any? How impactful was this support on the retraining project?
- What was the overall cost of the retraining? *(Note: This can be a sensitive question in some organizations.)*

Topic 2c- Training/Retraining Options-For unions

- In what ways did the union work with the company on the retraining program?
- Was the need for the new technology well communicated and did the union assist in the selection of the technology?
- How similar were management and union views on the need for the new technology?
- From the union perspective, was the project plan to implement the technology properly structured, communicated, and managed?
- Was the reskilling option part of the contract negotiated for the members? What were the parameters for reskilling? Which occupations were targeted?
  needed, encourage participation in the program, etc.)
- How did the union work with members before and during the retraining program? (e.g., help identify skills needed, encourage participation in the program, etc.)
- How did you personally become involved in the program?
- What did/could organized labour do to help companies considering training/retraining over hiring a new workforce?

Topic 3 – Outcomes

- On a scale of 1 to 10, with 1 being a terrible result, 5 being a satisfactory result, and 10 being a terrific result, more than you believed would be possible, how would you rate the retraining program you were involved with?
- What are the reasons you gave the program that score? (Probe on strengths and weaknesses of content and training design, methods used, people involved, time available, costs, etc.)
- In your view, what were the most effective elements of the program? The least effective?
- Have you offered the program a second time or more? If yes, what changes did you implement, if any?
- If you had three pieces of advice for another organization starting a retraining program, what would that advice be?
- Is there anyone else you think we should speak to about the retraining program? Do you have their contact information? May we use your name?
- Do you know of any reports or articles about the program that we should review?
- Can you suggest best practices companies or those taking an innovative approach to retraining?
- Is there anything else we should have talked about but didn't?

Interview close for Best Practices Case Studies

We are finished with our questions – thank you for taking the time to provide your insight and add to the discussion.

- Are you interested in staying connected with the project?

If the interviewee has responded "Yes" to the above question:

- The final report is to be provided to the British Columbia Ministry of Advanced Education and Skills Training for approval in April 2022. Once approved, WESTAC can email you a copy of the final report.

APPENDIX D: BRITISH COLUMBIA MINI REPORT INTERVIEW GUIDE

Below is the interview guide the researchers would use when interviewing participants for the case study on the preparedness of workers for automation in the freight transportation industry in British Columbia. Note that the questions are slightly different by group: company, sector organization, training institution, or union representatives. If some interviewees fall outside these categories, the researchers will adapt the questions as required prior to the interview.

Based on the researchers' 2020 experience conducting interviews globally, most participants are willing to be interviewed for between 30-45 minutes, maximum.

The guide has been written to conform with the Tri-Council Policy Statement 2: Ethical Conduct for Research Involving Humans to guide ethical research and considers the following principles:

- Free, prior and informed consent for all research participants.
- Participation is entirely voluntary, and participants can decline to answer any question they choose.
- All participants will be told how their answers will be used.

This Interview Guide identifies the major lines of questioning that Ingenia will pursue in interviews. The Guide is intended to direct the discussion and act as a checklist of key points to cover.

Date of Interview	
Name of Interviewee	
Current Title/Organization	
Title/Organization during Case Study	
Email Address	
Phone Number	
Geographical Location	
Time Started (PST)	
Time Ended (PST)	

General Introduction

Prior to conducting the interview, review the Secondary Research report that Ingenia prepared for WESTAC on the automation situation in British Columbia. Check the LinkedIn profile of the person you are interviewing. Also, search their name, in case they have been mentioned in the press, received an award, etc.

- Identify yourself as part of the Ingenia project team interviewing on behalf of WESTAC. An explanatory email with background information and obtaining consent to be interviewed will have gone out to the person when the interview was first requested. Confirm that the interviewee has received this email. If not, send it to them before starting and ask them to reply to the email, consenting to the interview.
- Provide an overview of the purpose of the project. If need be, read the explanatory email to them and ask if they have any questions about the project.
- Remind them that they are free to decline to answer any question and stop the interview at any time. Remind them that their participation is entirely voluntary.
- Remind them that individual responses will be kept confidential-we will only comment on aggregate information.
- The information they provide will be used to provide additional details and background on the case study Ingenia is preparing for WESTAC. If they would like, they will receive a copy of the final report, including the case studies. This report will be available by summer 2022.
- Solicit agreement to participate for 30-45 minutes. If less time is available, adjust your questions to the most pertinent.
- Address any other questions they may have.

WESTAC contact for additional questions or concerns:
Lisa Baratta
Vice President, WESTAC
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lbaratta@westac.com

Take notes that highlight the significant points of the interview responses—if any good quotes, note them as well.

If the interviewee has limited time, move quickly from section to section—to make sure we can cover them all off. We may not have time to cover every question per section.

Topic 1 – Introductory Questions for All Groups

These first questions are "warm-up" questions, more straightforward questions that participants can answer without too much trouble, which helps them feel more confident and relaxed.

- Could you provide me with some background on your role in the organization?
- Have your working arrangements changed in the past year because of COVID? (e.g., working from home, physical distancing on the job, etc.)

Topic 2 – Current use of new technology or automation – Companies/Sector organizations

- Since 2018, has your company introduced any new technologies or automation into the workplace? What were they? (Example-robotic process automation in the back office, greater use of drones, more Internet of things.) What was the driving force behind the changes/introduction?
- If the company introduced new technology/automation, what impact did it have on worker skill requirements, if any? Can you estimate the percentage of the workforce that was impacted? Particular occupations?
- What impact did the new technology have on the diversity of the workforce? What impact did it have on the recruitment and retention of Indigenous workers?
- What steps did the company take to address any new skill requirements? (E.g., retrained existing workers, hired consultants, hired new workers with required skills)
- If the company retrained workers, who designed the training and who delivered it?
- Were there any accessibility issues (e.g., language, technology, childcare) in retraining the current workforce? For what reason?
- If a unionized workplace:
  - How supportive were union leaders of the new technology and the retraining?
  - Was it necessary to address technological changes in the collective agreement?
  - Were any obstacles encountered in implementing the retraining due to union concerns? How were these obstacles overcome?
  - Were there any concessions made in the event of displaced workers?
  - How did workers react to the retraining process?
  - After implementation what was the overall attitude and comfort level among workers to the change?
  - Did the workers see the technological change as a positive step?
- If a non-unionized workplace:
  - What was the rationale for retraining existing workers rather than hiring new ones?
  - Were any obstacles encountered in implementing the retraining? How were these obstacles overcome?
  - Were any accommodations made for early retirement for older workers?
  - How did workers react to the retraining process?
  - How long did it take for workers to become comfortable with the new technologies introduced?
  - Did the workers see the technological change as a positive step?
- How much outside funding or support did your company receive, if any, for addressing reskilling needs? From whom? How impactful was this support?

Topic 3 – Future Activities and Their Impacts – Companies/Sector organizations

- How do you see technology and automation rolling out in your specific sector (e.g., trucking, rail, etc.) in the next five to 10 years? What technologies are you watching? (E.g., drones, automated trucks or cranes on docks, etc.) What are their upsides and downsides?
- What are the main business drivers of technological change in your sector?
- What factors might change the pace of implementing technology and automation? (E.g., lack of capital to implement, lack of skilled workers, worker resistance, regulations, union contracts, regulations to address the impact of climate change and global warming, etc.) Has COVID-19 accelerated automation trends?
- How could training institutions help your company as it implements new technologies and automation? Is your company active with any training providers at present? If yes, in what way?
- How could organized labour help your company as it implements new technologies and automation?

Topic 2 – Current use of new technologies or automation - For training providers

- What demand, if any, is your organization receiving from freight transportation companies for help with retraining workers? Is there a typical profile for companies making these requests? (e.g., large, multinational, smaller local etc.) Do specific sub-sectors dominate the requests?
- Does your program have an industry/program advisory committee? If yes, how helpful are they in advising you on the skills needed for new technologies/automation?
- What kinds of courses or workshops seem most in-demand regarding new technologies and automation in freight transportation? Is there a preferred length or style? (e.g., micro-credentials, one-week online, 2-day in-person workshop, etc.) How are entrance requirements determined, if there are any?
- How easy or hard is it for your organization to meet this demand? (e.g., getting instructors, curriculum, technology requirements, etc.) What are some considerations?
- How are technologies like augmented reality (AR) and virtual reality (VR) affecting the type of training you offer? Do you see their role increasing? Why or why not?

Topic 3 – Future Activities and Their Impacts – For training providers

- What technologies are you watching that could affect the BC freight transportation sector's skills profile/ training needs? (E.g., drones, automated cranes on docks, increased use of big data in aircraft maintenance etc.) What are their upsides and downsides?
- From a broad perspective, how well-prepared are BC training providers for meeting increased training/ retraining demands from new technologies and automation? How could they better prepare? What needs to be improved?
- What is the role of the Industry Training Authority in preparing BC training providers and new apprentices for automation and new technologies? What are/should they be doing?
- What lessons learned, if any, came from delivering training during the COVID-19 pandemic? For example, has there been an accelerated uptake of VR/AR for training purposes? Has there been a revision of how training is provided to respond to greater needs for tech skills in the industry?
- How have programs to rapidly reskill workers after COVID-19 been doing? Are they offering any lessons that could help with future reskilling programs?
- What can the BC freight transportation industry do to better help training providers? Do you have any recommendations?

Topic 2 – Current use of new technology or automation - Unions

- Since 2018, have companies in the sector introduced any new technologies or automation into the workplace? What were they? (Example-robotic process automation in the back office, greater use of drones, more Internet of things.) What was the driving force behind the changes/introduction?
- What role did the union play in addressing the impact of these changes on the workforce? Was there language in the contract related to technological change? How did this language impact what happened?
- What steps are companies taking to address any new skill requirements? (E.g., retrained existing workers, hired consultants, hired new workers with required skills). What would your union prefer to happen?

Topic 3 – Future Activities and Their Impacts - Unions

- How do you see technology and automation rolling out in your specific sector (e.g., trucking, rail, etc.) in the next five to 10 years? What technologies are you watching? (E.g., drones, automated trucks, or cranes on docks, etc.) What are their upsides and downsides?
- What are the main business drivers of technological change in your sector?
- What factors might change the pace of implementing technology and automation? (E.g., lack of capital to implement, lack of skilled workers, regulations, union contracts, etc.) What impact has COVID-19 had on automation trends?
- How could organized labour help companies as they implement new technologies and automation? What should its role be?
- What should retraining look like for workers to move onto the new jobs that technology creates?

Wrap Up Questions for All Groups

- Is there anyone else you think we should speak to about new technologies and automation in BC's freight transportation sector?
- Do you know of any reports or articles that we should review?
- Is there anything else we should have talked about but didn't?

Interview Close

We are finished with our questions – thank you for taking the time to provide your insight and add to the discussion.

- Are you interested in staying connected with the project?
- If yes, would you like to participate in the validation of the findings?

If interviewee has responded "Yes" to the above questions:

- WESTAC will be conducing validation focus groups in January 2022. One will be virtual and the other face to face in Vancouver.
- If you or someone from your organization would like to participate in a focus group, we can pass on your name to WESTAC for follow up in December 2021. WESTAC will send you more information on dates, times and so forth.
- The final report is to be provided to the British Columbia Ministry of Advanced Education and Skills Training for approval in April 2022. Once approved, WESTAC can email you a copy of the final report.

APPENDIX E: SELECTED REFERENCES

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