

INSTITUTE FOR OCEAN RESEARCH ENTERPRISE

OCEAN TECHNOLOGY SECTOR STUDY: COMPETENCY
ASSESSMENT AND WORKFORCE STUDY

REPORT OF RESEARCH FINDINGS AND RECOMMENDATIONS
Submitted to the Nova Scotia Department of Labour and Advanced
Education and the Department of Business | June 2017
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Report of Research Findings and Recommendations

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Executive Summary

Serendipity plays a strong role in triggering the pathways of many current players in the Ocean Technology sector. Apart from some new programs specializing in this field (i.e. NSCC Advanced Diploma in Ocean Technology), there are few well-outlined corridors to these careers. As the sector evolves across other ocean industries, and growth and opportunities accelerate, there is a compelling need to understand the skill and competency profiles of the sector's critical employees and general workforce so that current and future talent pools can be well-stocked with highly skilled, engaged, and adaptable employees.

This report summarizes a study of workforce that is competency focused (rather than jobs focused) to provide a more robust picture of the skills and competencies that are unique to and across the sector, and that can be commonly developed through targeted learning programs. Data was collected from industry representatives from 9 ocean-oriented industries (Marine Defense, Marine Renewables, Ocean Research & Observation, Oil & Gas, Fishing and Aquaculture, Marine Tourism, Ship Building, Boat Building, Marine Transportation) with strong presence in the ocean tech sector. The online survey gathered data relating to the competencies of critical employees (i.e. high value and high demand roles) and the general workforce, that exist at present and that are predicted for the next 5 years.

Analysis of the sample group indicated that all 9 industries were well-represented. Responses also indicated that most organizations participating in this study have activities crossing several industries. Indeed, upon deeper analysis, it was found that more than half of participating organizations operate in 4 or more industries, and only 10% define their activities within a single industry.

Highlights and key insights from the data

The study gained insights into industry members' perceptions of market optimism (excellent – 67%), key growth drivers (i.e. funding, international demand) and obstacles (i.e. availability of skilled and motivated workers, access to capital). These results helped to validate participant responses, demonstrating that respondents occupied roles that provided current and relevant insights into the present and future opportunities of their industries, and the concomitant workforce prerequisites that are essential to seizing these opportunities.

The study revealed the top 5 critical employee roles that are common across the oceans industries surveyed. They included;

- Business development roles – including sales and marketing specialists
- Technician roles - Marine Service Technicians, marine electronics technician/operator, mechanical& electrical engineering Systems Technicians, System maintenance technicians
- Project management roles, especially those with R&D skills
- Senior Management roles – especially CTO (chief technology officer), CEO, Safety Risk Managers, and Operations Managers
- Software engineers, code developers, and programmers
- Experienced supervisors, mentors, and trainers

The most-pressing current workforce challenges were identified as; availability of relevant training for both new and experienced workers, and the availability of both funding and time to do so. The connection between current training challenges and the relevance of succession planning is highlighted in the identification of *mitigating the impact of numerous retirements* as the most-anticipated future workforce challenge. More alarming is that a follow-on question revealed that only 13% of participating organizations have a formal workforce strategy in place to begin addressing this challenge. What became evident was that organizations are well-aware of their current and future workforce challenges, but few have taken the time to formally map out strategies to address them.

Employers in Nova Scotia identified Advanced Literacy and specialized STEM knowledge to be essential competencies for Critical employees. They also identified the following 21st Century Skills & Competencies;

- Creativity/innovation
- Critical/Analytical thinking, problem solving and reasoning
- Self-direction and initiative
- Flexibility and adaptability
- and, Teamwork and collaboration

and the following Organizational skills;

- Verbal communication
- Interpersonal skills
- Customer orientation
- Strategic thinking;

to be essential to the roles of critical employees, and a requirement for hiring. Interestingly, Information and Communication (ICT) skills and competencies were not identified as essential to Critical employee roles, were only identified as gaps among experienced employees, and were unanimously identified as essential future skills.

There was significant cross-over between essential competency areas and those identified as gap areas and as predicted areas of future need for the general workforce. The most commonly identified future skill and competency areas for Oceans industry workforce were;

New employees	Experienced employees
High skilled trades skills	Social Media expertise
Verbal communication	Strategic Thinking
Coding and programming	Flexibility and Adaptability
Teamwork and collaboration	Customer Orientation
Self-direction and initiative	Big data analysis
Creativity & Innovation	Project Management
Critical/Analytical thinking, Problem solving and reasoning	Business and financial acumen
Advanced literacy competency	Influence & Persuasion
Entrepreneurial mindset	Teamwork and collaboration
Data synthesis, analysis and interpretation/Highly Specialized STEM	Developing others

This report summarizes a collaborative study between the Institute for Ocean Research Enterprise (IORE), the Nova Scotia Department of Labour and Advance Education (LAE) and Department of Business, and the Ocean Technology Council of Nova Scotia (OTCNS).

The data generated by this study will help to inform numerous programs and activities including;

- career literacy programs relating specifically to ocean technology opportunities in Nova Scotia
- Co-op and internship programs for students in Engineering and technologist/technician programs at provincial Post-Secondary Institutions (PSIs)
- Recruitment and selection processes for provincial ocean technology firms and businesses operating in Oceans industries
- Talent management strategies for local oceans firms (including upskilling and ongoing learning and development of existing employees, and learning and development strategies for new-to-role employees)
- Marketing and social messaging strategies to influence youth perceptions of career opportunities in NS
- and Curriculum links with career opportunities (and skill relevance)

What became especially apparent from this study is the ongoing commitment industry employers have made to the development of their internal teams. In the absence of formal training and development workshops, programs, and certifications, employers have managed to

patch together formal and informal development activities to cultivate a workforce with highly specialized, industry and organization-specific skills. While this approach has been effective in the past, the burden on industry members has not been light. With accelerating opportunities across the oceans industries in Nova Scotia, the vital need for support in workforce development becomes evident. Talent management is an arena where investment and support for development across the sector can yield broad benefits to the province, and secure a competitive advantage to our Oceans industries.

Introduction

The Ocean Technology and broader Oceans sector in Nova Scotia is a rapidly growing community. Presently the sector is comprised of entrepreneurs, innovators, and employees who have not typically followed traditional career paths to arrive in their current role. Indeed, serendipity defines the career paths for most, which makes it difficult for post-secondary institutions (PSIs) to replicate with programs of study. This in turn hampers efforts aimed at building career literacy for the sector among the next generation of workers.

At present, there are numerous definitions of this sector, and several OT firms operate within and across more than one sub-sector, making measurement of activity and workforce untenable. With much focus on this established but nebulous sector, there is occasion to better understand the areas of opportunity for developing workforce both within the organizations, and within the province.

There will be broad sectoral benefits from assessing the workforce demands that facilitate sector growth, and that provide insight into the breadth and scope of the players within the cluster. Additionally, a study of workforce that is competency focused (rather than jobs focused) will provide a more robust picture of the skills and competencies that are unique to and across the sector, and that can be commonly developed through targeted learning programs.

Opportunity

This report summarizes a collaborative study between the Institute for Ocean Research Enterprise (IORE), the Nova Scotia Department of Labour and Advance Education (LAE) and Department of Business, and the Ocean Technology Council of Nova Scotia (OTCNS), examining the competencies of high value and high demand roles in Ocean Technology (OT) firms across the province, that exist at present and that are predicted for the next 5 years¹. The outcomes and insights summarized in this report will support decisions at LAE and the Department of Business, and among other stakeholders regarding program development and delivery, provision of training services, and addressing other labour and workforce development gaps in the Ocean Technology sector in Nova Scotia.

¹ Responses to the Market Information and Activity questions captured data relevant to deriving more insight into the present activities and growth of the sector, provincially. This data has been submitted to OTCNS and the NS Department of Labour and Advanced Education and is not summarized in this report.

Benchmarking the Current Study

This study is a complement to a 2015 study conducted by CFN Consultants (Atlantic) Inc. and Partner International. The previous study was an in-depth analysis of the Ocean Technology sector, with some general gap analysis of skills requirements. Conversely, this current study is a detailed analysis of the broad skills and competencies that characterize roles across Nova Scotia's oceans industries, with some light analysis on sector activity and investment. The gap analysis in this study focuses not on mismatches in forecasted labour market numbers, but rather on gaps in skill and competency and workplace readiness of current and future employees.

The competency groupings assessed in this study are modeled on and consistent with those evaluated in OECD research (OECD, 2017), other research conducted in analogous industries such as Aerospace (Noor, October 2011), and general competency research in the public education domain (Ananiadou, December 2009; Claro & Ananiadou, 2009).

Study Methodology

The study was conducted using an online survey coupled with the option of one-on-one interviews. Areas of focus in the survey included general labour market information, as well as detailed competency assessments for high value and high demand roles (present and predicted for 5 years out). The survey tool was developed by the principal researcher (Dr. Sherry Scully), and questions were crafted to be accessible to participants who may have a broad range of familiarity with constructs relating to workforce recruitment, retention and development. Given the small population from which to draw participants, the survey tool was piloted with two participants to test for;

- **reliability** (i.e. are any questions ambiguous; did participants have consistent interpretations of the questions)
- **validity** (i.e. do the questions solicit the desired responses, do the questions tap into the target constructs),
- **time for completion** (what is the range for completion, what can be communicated as a reasonable expectation for completion time). This factor is important to building participation levels, which tend to be strongly negatively correlated with expected completion times

Survey Design

The survey tool was comprised of 19 questions; 6 relating to perceptions of sector activity and development (i.e. current and future sector presence; industry drivers), 8 relating to workforce management and development (i.e. skills and competencies; workforce strategy), and 5 relating to sector data (i.e. FTE counts, investment in R&D, investment in training and development).

A key construct of the survey was **Critical Employees**. This construct was operationally defined as;

the high value and high demand roles within the organization that are/will be highly competitive (from a recruitment perspective), or that involve highly valued expertise or unique competencies that are not broadly available. These are also roles that are critical to strategic succession planning to build workforce from within (the organization, and the province).

Questions regarding workforce development, competency and availability for recruitment looked specifically at this group, as well as at the broader workforce across the industry.

No questions were modified following the pilot and the two piloted surveys were included in the data summary.

Guiding Research Questions

Guiding questions for the study included;

- What are the short and medium terms workforce issues effecting the Ocean Technology sector in NS?
 - Are there labour force obstacles preventing growth?
 - Is labour force an issue?
 - If so, what are the obstacles? (eg. quantity? Quality? experience?)
- What talent management strategies are currently in place to ensure development for succession, development of new-to-role employees, and effective recruitment and retention of new and experienced workers in the sector?
- What areas of learning and development will have immediate and future impact?
- What are the high value/high demand roles within the Ocean Technology sector, and what skills and competencies characterize them; are unique to them; are common across the sector?
- How do industry members perceive the potential for growth, and what are the implications for workforce (demand, skill evolution, training of new grads/new hires) in the short and medium term?

Sample Group

This study sampled members from the Ocean Technology community across Nova Scotia. Invitations to participate in the study went out to 99 individuals or organizations representing the following sub-sectors;

- Marine Defense
- Marine Renewables
- Ocean Research & Observation
- Oil & Gas
- Fishing and Aquaculture
- Marine Tourism
- Ship Building
- Boat Building
- Marine Transportation

The survey closed after 3 weeks, after achieving a participation rate of 34%. The total sample group of 34 (responding to 99 invitations to participate) was small but representative, comprising each of the sub-sectors listed above. Participants were senior employees or owners who all had some responsibility for recruitment and workforce development in their organizations, and thus possessed current and relevant insights into the competency gaps and needs of their current and future employees.

Study Outcomes

The data generated by this study will help to inform;

- Career literacy programs relating specifically to ocean technology opportunities in Nova Scotia
- Co-op and internship programs for students in Engineering and technologist/technician programs at provincial Post-Secondary Institutions (PSIs)
- Recruitment and selection processes for provincial ocean technology firms and businesses operating in Oceans industries
- STEM curriculum in junior and secondary education
- Talent management strategies for local oceans firms (including upskilling and ongoing learning and development of existing employees, and learning and development strategies for new-to-role employees)
- Marketing and social messaging strategies to influence youth perceptions of career opportunities in NS
- Curriculum links with career opportunities (and skill relevance)

And will provide insights into;

- the perceptions local Oceans firms have of their own opportunities for workforce development and expansion
- competency and workforce gap areas for local Oceans firms
- areas for learning and development that will have immediate and future impact
- the potential for growth overall across the sector over the next 3-5 years

Data Analysis

Section Summary

The sample group reflected the population well, with representative participation by each Ocean industry

Business-specific data is provided to the Nova Scotia Government and to OTCNS in a separate addendum and is not included in this public document.

Participants reported strong optimism in the potential for growth across the Ocean industries

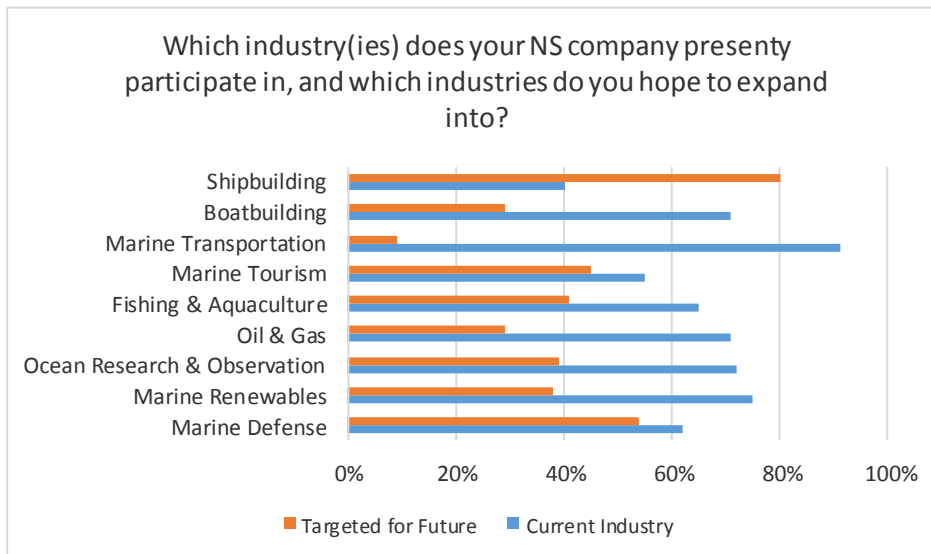
Participants anticipate significant workforce challenges in the future, but few have talent management strategies in place to begin addressing these challenges

Data Analysis

Responses were collected via Survey Monkey and the data was downloaded by the Principal Investigator to Excel. The primary statistical analysis was conducted in Excel, and was repeated using SPSS to validate the analysis. A thematic analysis (for open-text responses) was conducted in Excel. Responses were analyzed for common themes and coded per those themes. Generally, the top 5 (frequency) responses were reported, although other less-common responses were also examined if their low-response rates were noteworthy, or if the response was unique but relevant.

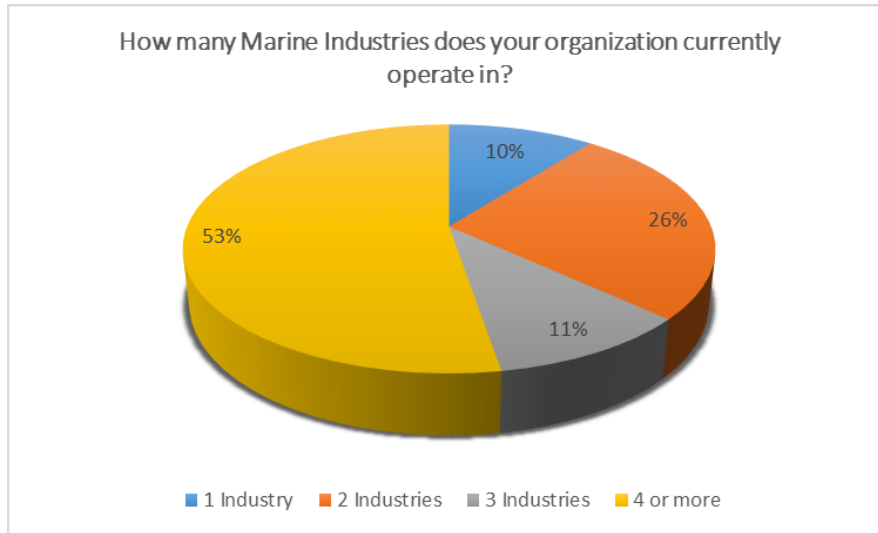
Participant Data and Industry Representation

Participants represented each of the industries of interest for this study. The chart below demonstrates that representation across industries was fairly-balanced, with more participants representing marine tourism, fewer participants representing shipbuilding based on current industry activity, and no single industry was represented by fewer than 40% of participants.

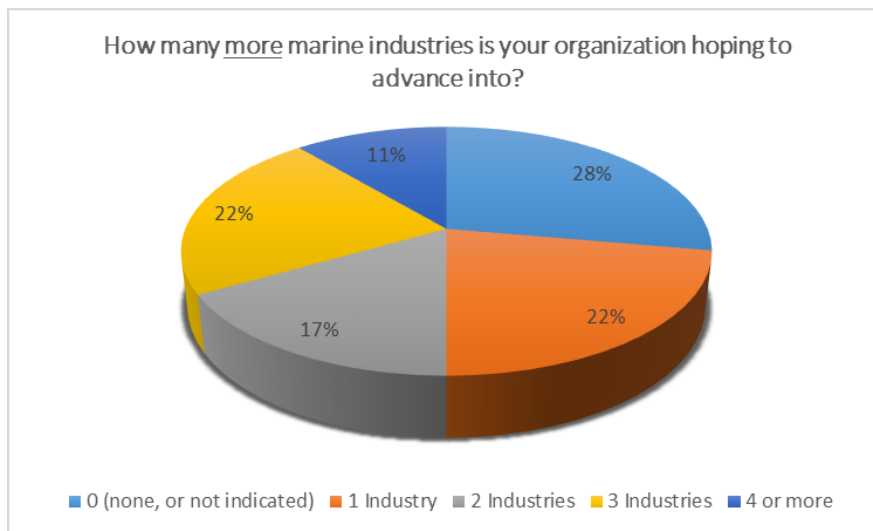


This question also asked participants to project to the future which industries they would like to expand their company's activities into. Shipbuilding was identified as the strongest industry for future interest followed by Marine Defense, which is not surprising given the burgeoning opportunities arising from NSS (National Shipbuilding Strategy) and the duration of those investments. The third most-popular industry for future expansion was Marine Tourism, an industry that has been under-exploited but which holds much promise across the province. The broad challenge to regional firms operating in other marine industries, will be for companies to translate goods and services that have traditionally had defense or research applications into public/tourist consumer use. Marine Transportation showed the lowest projections for future participation, followed by Oil & Gas and Boatbuilding.

Responses to this question also indicated that most organizations participating in this study, have activities crossing several industries. Indeed, upon deeper analysis, it was found that more than half of participating organizations operate in 4 or more industries, and only 10% define their activities within a single industry.

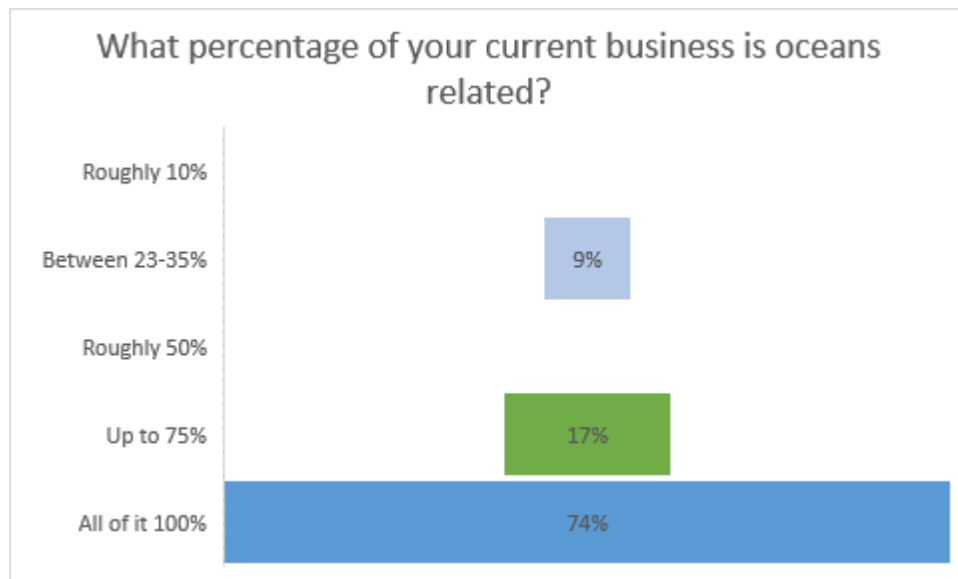


Similarly, in forecasting future industry activity, more than two thirds indicated they had plans for expansion into at least one more other marine industry and a third expressed an interest in crossing their activities into 3 or more new marine industries. This suggests strong optimism in the relevance of marine products and services across several ocean domains, and in the expansion plans of regional companies.



Sector Activity and Development

The first question in this section inquired about the extent to which the business activities of participants were oceans related. Most participants indicated that their business activities were entirely oceans related, demonstrating that the sample group was representative of the industry community (population) of interest. Only a tenth of participants indicated that their businesses focused than 35% or less of their activities on oceans.



Following this, participants shared their top current and targeted (i.e. future) export markets. By count from highest frequency responses, the most common export markets are presently;

- USA
- Europe (Including UK)
- Asia (especially Taiwan, Singapore, China)
- South America

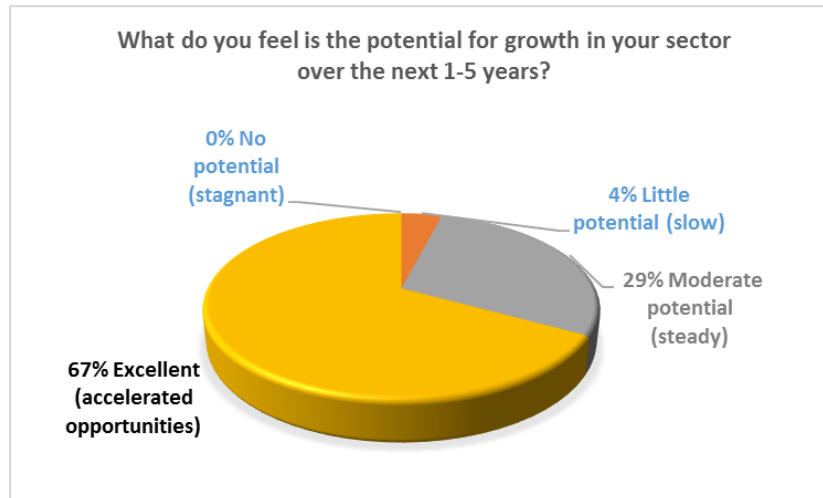
Future markets identified by participants (by frequency, from highest) included;

- South America (Especially Chile)
- MENA (Middle East North Africa; especially Israel)
- South East Asia (especially China)
- Domestic markets *

*Notably, several participants indicated that they are interested in exploring domestic markets, reflecting the reality that a considerable proportion of the oceans industry that has established itself regionally has traditionally been export focused with few to no domestic markets.

Market Optimism

Participants were asked for their perceptions of the potential for growth in their respective sectors over the next 1-5 years, and were asked to identify drivers of and obstacles to that growth.



When these results were analyzed by Industry, we found that participants predominantly reported optimism (Excellent) across all 9 Marine Industries², with no one predicting stagnant growth (no potential), and only two predictions of slow growth (for Fishing & Aquaculture and Ocean Research and Observation). The most consistent responses of optimism from participants were for Shipbuilding, Marine Renewables, and Ocean Research & Observation. Oil & Gas also received positive predictions for future growth, although it is unclear from these results if this optimism was relating to growth in regional and domestic, or international Oil & Gas activities.

² Oil & Gas; Marine Tourism; Fishing & Aquaculture; Marine Transportation; Marine Renewables; Boatbuilding; Marine Research and Observation; Marine Defense; Shipbuilding.

Drivers for growth

Participants identified numerous drivers for growth in Oceans industries. The most-commonly cited drivers (by frequency of responses) were;

- access to funding
- international demand
- regional projects/regional demand
- market development and market expansion
- product innovation and game-changer technologies

Other notable comments referred to the contagion of success, whereby successes in one Ocean sector give a boost in adjacent Ocean sectors that can benefit from the exposure, supply chain development, workforce development, and market access and market development that arise from the wake of the vanguard.

Obstacles to growth

Conversely, obstacles cited by participants related to (in order, by frequency of responses);

- Presence of skilled & motivated workers. This included challenges relating to rural employment (limited talent pools, reluctance of talent to relocate to rural locations, access to training and development in rural locations), internal capacity difficulties experienced as small businesses attempt to scale-up quickly, competition for skilled workers, the presence of experienced mentors, and finding time for new workers to train while keeping production going
- Access to capital
- Access to funding. Several respondents cited challenges in access to funding for technology improvements and research & development (R&D)
- Government Obstacles. This included the perceived pace of work from regulatory bodies, CRA disputes, slow access to Investment in Regional Development (IRD) funds, controlled access to certain international markets, and perceptions of equivocating Government decision-makers

Other comments provided from the open-text responses related to the availability of affordable build and office space, marketing challenges, regional competition, and distance to customers.

Workforce Management and Development

Common Critical Employee Roles

Participants were asked to indicate the top 3 high value/high demand roles (i.e. critical employee roles) in their organization. Critical employee roles were defined for respondents as;

the high value and high demand roles within the organization that are/will be highly competitive (from a recruitment perspective), or that involve highly valued expertise or unique competencies that are not broadly available. These are also roles that are critical to strategic succession planning to build workforce from within (the organization, and the province).

The roles that were most frequently identified by participants across the region's ocean industries were (in order of frequency of response);

- Business development roles – including sales and marketing specialists
- Technician roles - Marine Service Technicians, marine electronics technician/operator, mechanical& electrical engineering Systems Technicians, System maintenance technicians
- Project management roles, especially those with R&D skills
- Senior Management roles – especially CTO (chief technology officer), CEO, Safety Risk Managers, and Operations Managers
- Software engineers, code developers, and programmers
- Experienced supervisors, mentors, and trainers

Other roles that were mentioned related to generalist employees who possess broadly diversified skills within a highly specialized and unique industry (i.e. general boatbuilder or shipbuilder). These roles reflect a growing trend in some Ocean industries away from demand for highly specialized certification in narrow areas of practice, and towards employees with broader, integrated skills that enable production efficiencies and fuller FTE utilization.



The value of these critical employees is reflected in the recruitment challenge that most employers face in trying to fill these roles. Participants reported that it was difficult (48%) or moderately difficult (48%) to find critical employees when they are needed. This speaks to the importance of developing retention strategies to keep critical employees, as well as succession strategies to develop an internal pipeline where possible to mitigate the recruitment challenge.

Recruitment of Critical Employees

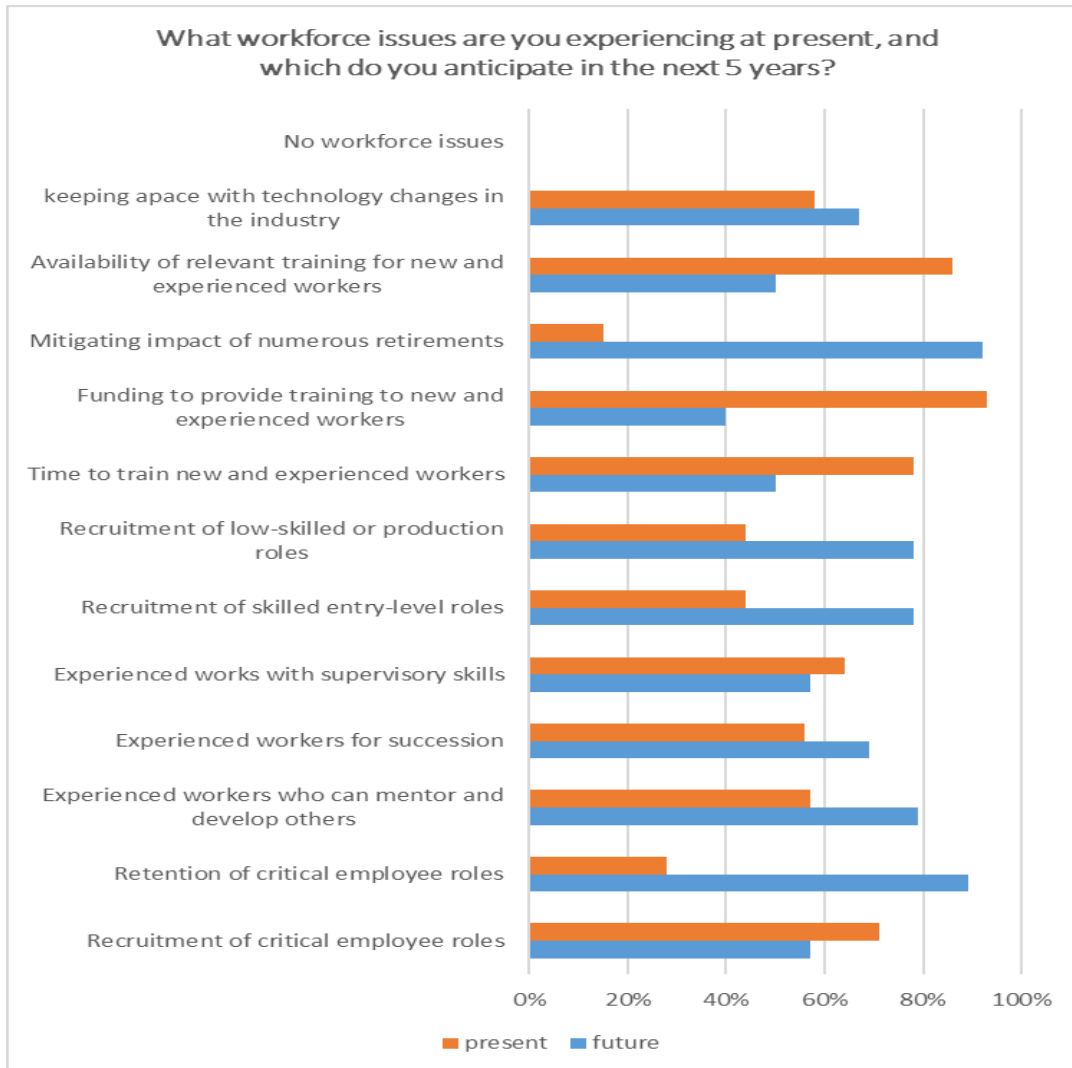
Where recruitment of critical employees is a challenge, we were interested in learning where employers typically look for new to fill vacancies. According to survey data, most employers recruit critical employees from within Nova Scotia, and then look to the broader Atlantic region. This contradicts the anecdotal evidence that many critical roles are shopped for internationally, or go to talent that has been relocated to our region under HQP (highly qualified personnel) development and retention programs – begging the question, “are locals really local?”.



A similar question regarding recruitment of general workforce showed a parallel pattern, with recruitment focusing predominantly within the province and the Atlantic region, and to a lesser extent outside of the region or international. This recruitment pattern reinforces the importance of developing good talent within the province so that employers aren’t just choosing from who’s available, but are choosing from a well-developed, informed, skilled and motivated pool of talent. This requires dedicated curricula to develop future workforce, as well as robust awareness and exposure programs earlier in the p-12 education system to catch the attention of the provinces’ brightest talent early on.

Current and Future Workforce Challenges

Participants were asked to identify from a list of options, what workforce issues they are experiencing at present, and which they anticipate in the next 5 years.



Current Workforce Challenges

The most common current challenges included;

- funding to provide training to new and experienced workers
- availability of relevant training for new and experienced workers
- time to train new and experienced workers
- and, recruitment of critical employee roles

Several respondents cited building capacity as an obstacle to growth, and vital to building internal capacity is facilitating the employee skill-build and adaptation needed to keep stride with change and growth. But this is an exigent challenge as building capacity (i.e. employee capability, production) is in a continuous race to catch up with, but not exceed, sales growth. Woven into this challenge is the added complexity of providing relevant, timely, and affordable training to groups of employees while continuing to meet the day-to-day demands of business operations.

Future Workforce Challenges

The most-common anticipated future challenges are;

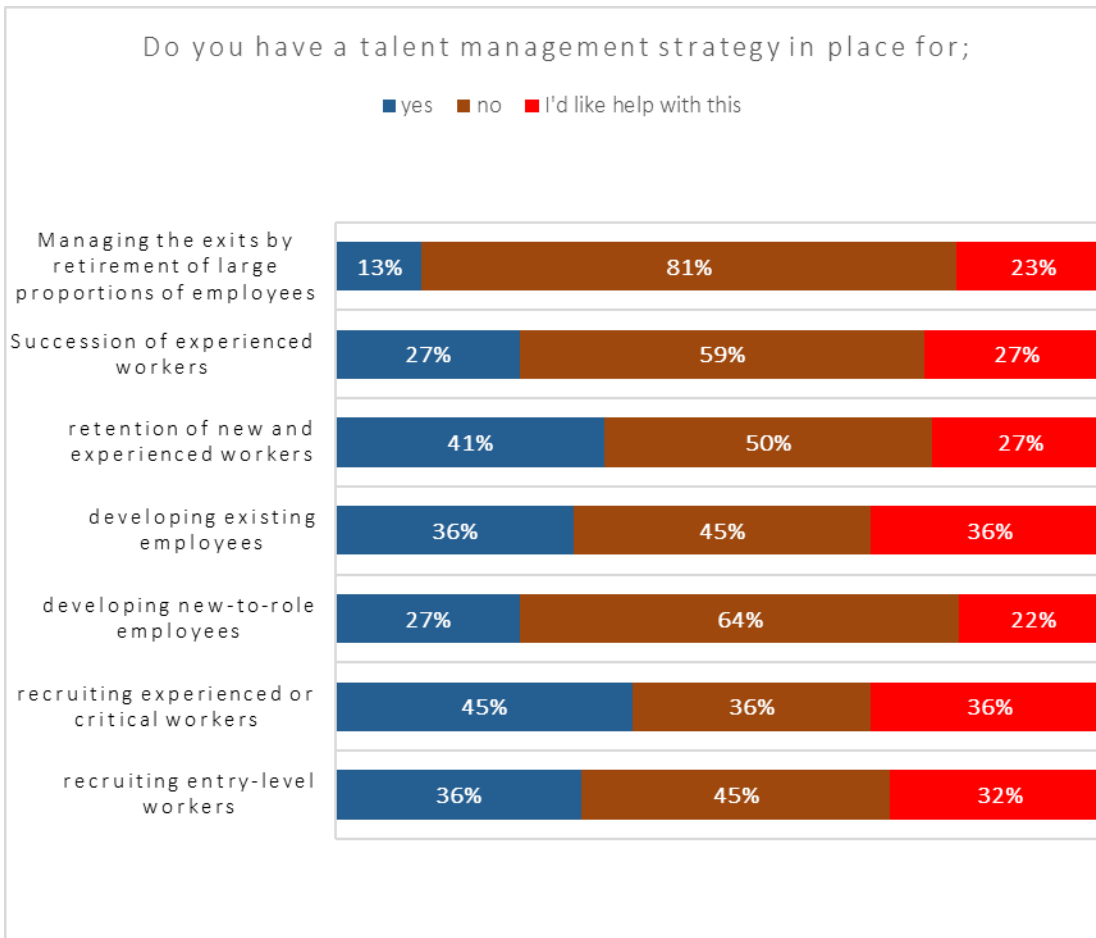
- Mitigating the impact of numerous retirements
- Retention of critical employee roles
- Experienced workers who can mentor and develop others
- Recruitment of low-skilled or production roles
- Recruitment of entry-level roles

A well-known challenge in our region is the looming workforce gap that will occur as the aging Canadian Marine workforce advances towards retirement. Not only will this leave gaps in experience and capacity, but will highlight breaks in succession plans and create a significant tilt in workforce bulk towards the least experienced. This in turn will produce a mentoring challenge as companies will find themselves with unwieldy ratios of junior employees to mentors, and potentially with experienced employees sliding into management or supervisory roles without having developed management competencies.

An additional workforce issue (from open-text responses) highlighted the challenges of navigating a distributed workforce; one that is geographically spread out and distal from the organization's leadership. The productivity and access to talent advantages of cultivating a dispersed workforce can be offset by challenges of mobility, effects on teamwork (especially effective communication and collaboration), and security (of information, IP, etc).

Assessing Readiness: Presence of Talent Management Strategies

These weighty and central workforce challenges highlight the critical guiding force that talent management strategies can provide. The next question evaluated the extent to which responding organizations currently have strategies in place to mitigate the impact of common workforce challenges. The chart below illustrates participants' responses indicating if they have talent management strategies in place for a number of key challenges, and if they would like support to do so.



If we cross-reference this list with the preceding list of the most-common future workforce challenges the gap in readiness becomes apparent. The most-pressing future challenge predicted by participants related to mitigating the impact of numerous retirements, yet this chart highlights that only 13% of participants have a strategy in place to begin managing this challenge.

Managing succession pipelines requires several years of strategic talent development to ensure that in-house talent is prepared to replace retiring employees when they decide to vacate their roles, or that external recruitment has begun well in advance. Likewise, effective talent management strategies consider entry and middle-level roles as well to ensure there is continuous replacement of talent as employees develop and move up. This is vital to ensuring that un-anticipated vacancies or mass attrition from retirements don't create workforce disruptions that put undo burden on remaining employees – especially critical employees – whose retention is most critical – and whose employment options are most plentiful.

It is noteworthy that the 'I'd like help with this' responses ranged from 22%-36% indicating that there is some awareness across the Oceans industries of the importance of the talent management function, and of the willingness to invest time in this function with support.

Skills and Competencies of Critical employees

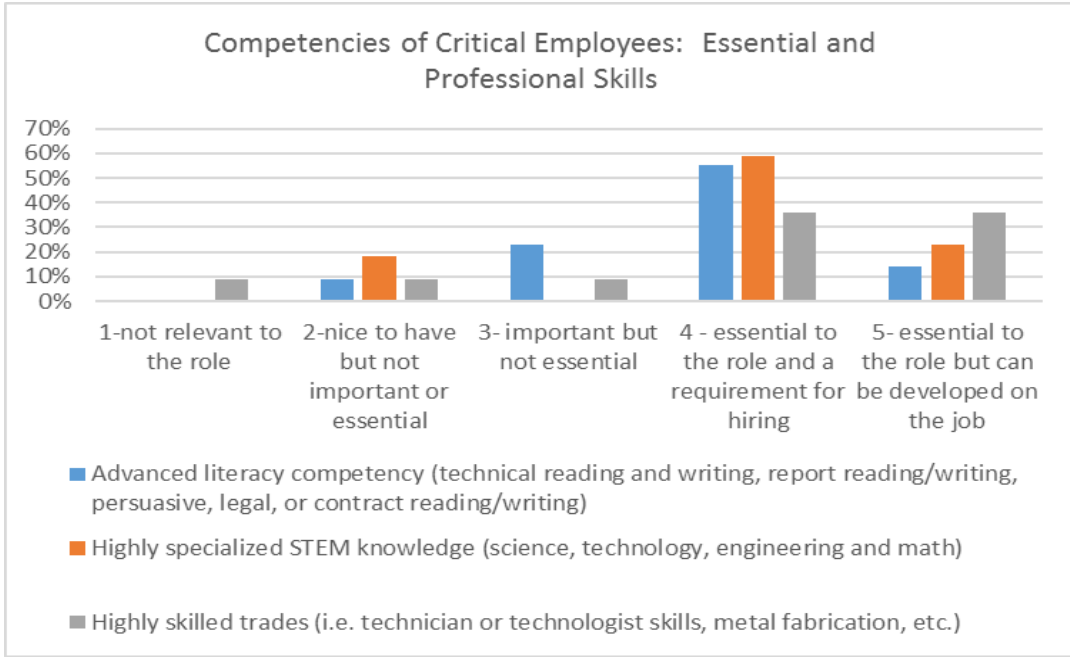
Keeping the top 3 **Critical employee roles** in mind, **complete sections A and B** of the competency grid below, indicating the **importance of the competencies** listed for those roles.

Essential and Professional Skills

Essential skills provide a foundation for working and learning, and are relevant to all jobs in varying degrees. Essential skills go beyond basic numeracy and literacy to include skills for everyday living (i.e. thinking skills, computer use, continuous learning).

For the purposes of this study we have grouped several related essential skills under two groupings; **Advanced literacy competency**, which includes technical and report reading and writing, and persuasive, legal or contract reading and writing; and, **Highly Specialized STEM knowledge**, which combines numeracy essential skills with the science, technology or engineering skills and knowledge that are needed for successful marine-oriented professional careers. The third dimension, **highly skilled trades** refers to the technical skills and knowledge that are essential to success as a professional trades worker or technician.

Employers in Nova Scotia agreed (50% or more) that advance literacy competency and highly specialized STEM knowledge are essential competencies for critical employees, and are requirements for hiring. Similarly, they also found that trades skills are essential, but were divided on the requirement for hiring versus believing they can be developed on the job.

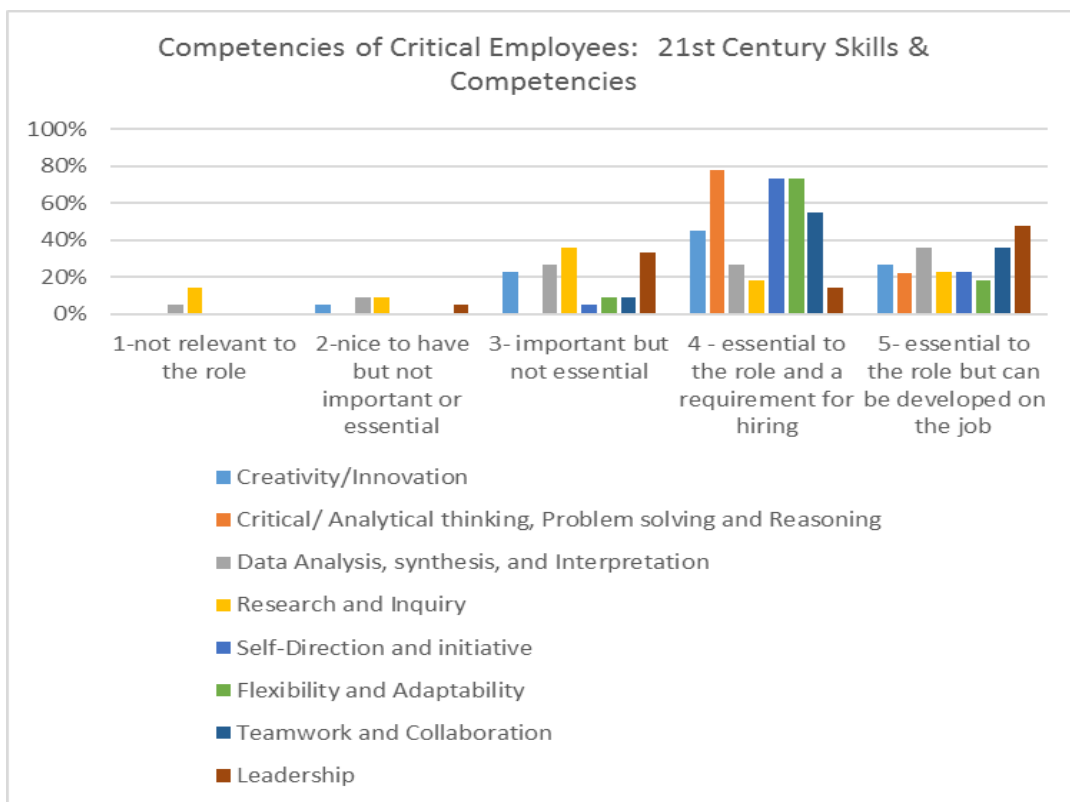


Essential skill development has been found to have a profound correlation with several important metrics of workplace success and achievement. Essential skills support effective learning, enabling workers to learn new skills and to possess workplace knowledge more readily. Additionally, essential skills have been shown to support employee decision making and adaptation to workplace change (ESDC, 2015). Employees who possess strong essential and professional skills are better able to apply technical skills and knowledge to the more demanding and non-routine parts of a job, and are better able to articulate task-level challenges and problem solving.

21st Century Skills & Competencies

21st century skills and competencies refer to the collection of thinking and reasoning skills, and workplace skills & attitudes relating to working with others and self-direction that are essential for success in a present and future workplace, including lifelong learning, self-direction, entrepreneurial spirit, and personal management (Ananiadou, December 2009). The chart below shows that employers (40% or more) in Nova Scotia found the following 21st Century Skills & Competencies to be essential to the roles of critical employees, and a requirement for hiring;

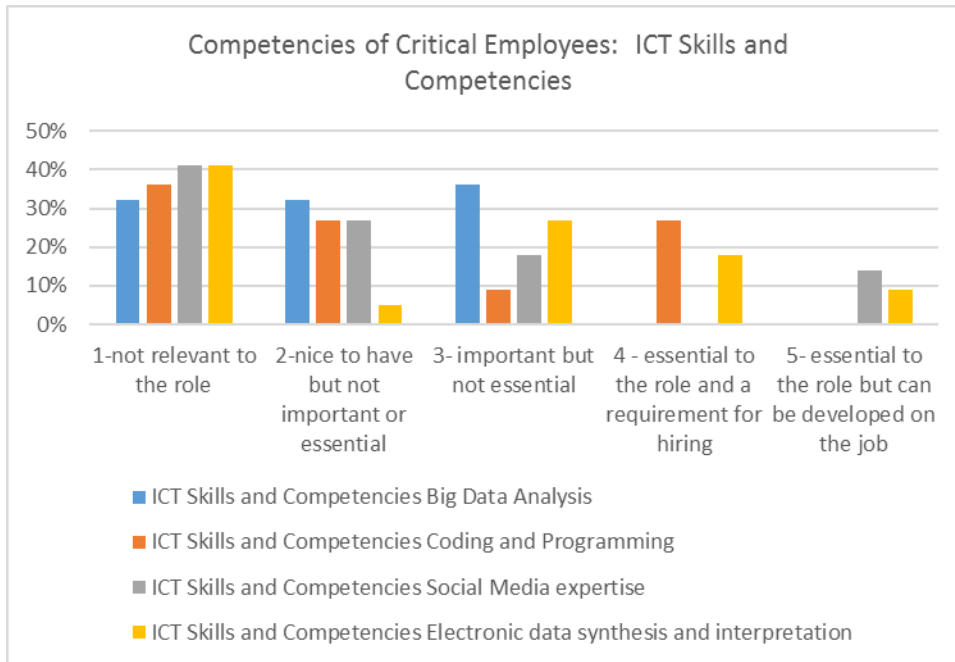
- Creativity/innovation
- Critical/Analytical thinking, problem solving and reasoning
- Self-direction and initiative
- Flexibility and adaptability
- and, Teamwork and collaboration



Leadership was also found to be an essential competency, but one that could be developed on the job.

ICT Skills and competencies

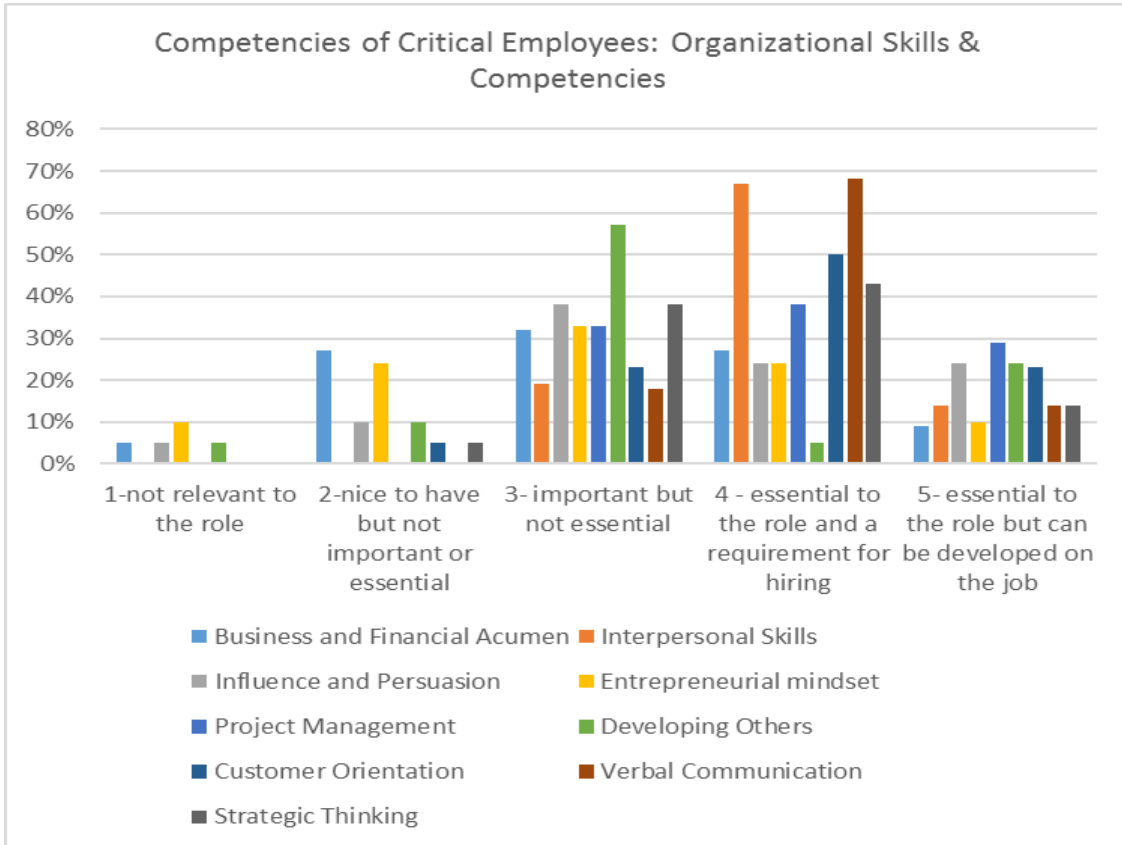
Information and Communication Technology (ICT) Skills and competencies are those relating to accessing, evaluating and organizing digital information, and to transforming that information to communicate knowledge or trigger new ideas (Claro & Ananiadou, 2009).



Interestingly, despite the strong reliance on digital technologies, employers in Nova Scotia identified most of the dimensions presented to them as not relevant to the role, or nice to have but not important or essential, and some (i.e. Big Data Analysis) as important but not essential competencies for Critical Employees. This suggests that the bulk of critical employee roles (but not necessarily all employee roles) are oriented around skills and competencies outside of the ICT domain. It may also be that these skills tend to be so prevalent at a foundational level (with the exception of coding and programming), that they represent common competencies rather than distinguishing or unique competencies.

Organizational Skills & Competencies

Organizational skills and competencies include those workplace skills relating to how individuals interact and engage with team members (i.e. interpersonal, communication, influence and persuasion), peers and subordinates (developing others), and customers (customer orientation), and how they engage with the business itself (i.e. business acumen, strategic thinking).



The organizational skills and competencies of critical employees that were identified as essential (by 40% or greater) and a requirement for hiring included;

- Verbal communication
- Interpersonal skills
- Customer orientation
- Strategic thinking

Business and financial acumen received divided responses, between nice to have, important but not essential, to essential to the role. Entrepreneurial mindset saw similar division of responses.

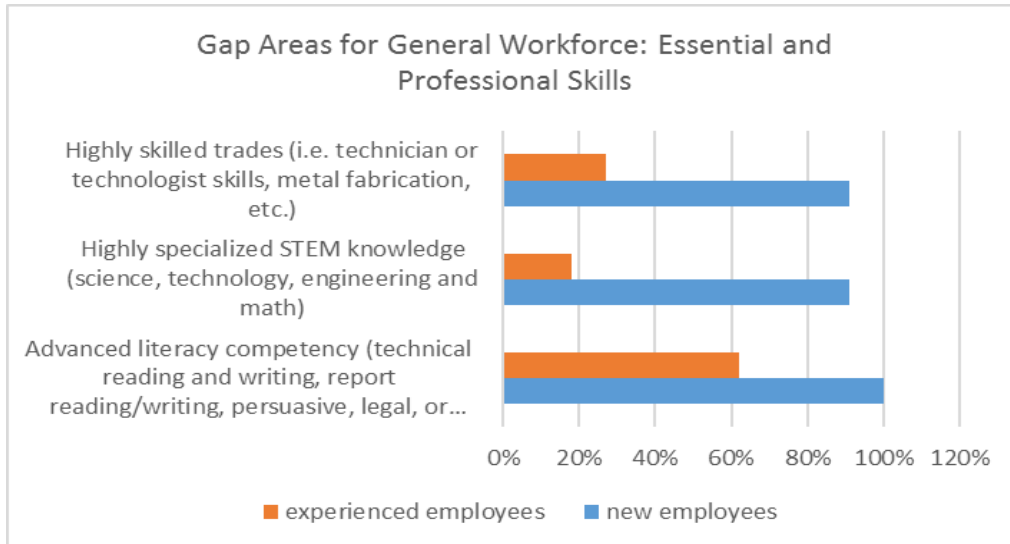
Developing others was identified by a majority of respondents as important but not essential. This is a notable result given that several of the identified most-common workplace challenges, as well as a key obstacle to growth, focused on mentoring and training challenges. This may reflect a belief that development of workers is an activity that occurs outside of the workplace through formal training and education rather than through work-integrated training or structured mentorship. With the exceptions of the boatbuilding and shipbuilding industries, the results from participants seem to suggest that the people development function rests outside of the organization, or involves bringing that function in with a dedicated development consultant/service.

Open-text responses from participants also cited risk management as a key competency.

Skills and Competencies of the General Workforce: Gap Areas

Participants were asked to identify from the same groups of skills and competencies as identified for critical employees, the biggest **gap areas** they are seeing in their **general workforce**. Perceptions of gaps for both new and experienced employees are illustrated in the charts below.

Essential and Professional Skills

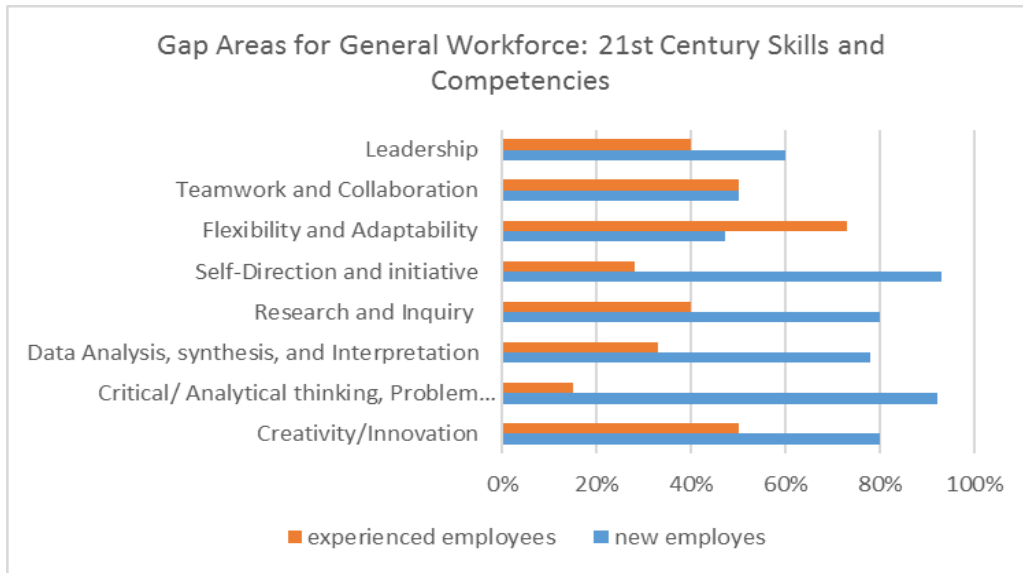


Participants identified all Essential and Professional Skill domains as gap areas, with all responses exceeding 80%, and advanced literacy competency identified by 100% of participants for new employees. For experienced employees, only advanced literacy competency was identified as a significant gap.

These results exceed those reported in a recent study by the Conference Board of Canada (CBoC, The state of skills and PSE in Canada November 2014), where 42% reported challenges with basic literacy skills (i.e. meeting the minimum complexity level for performing basic tasks at work) among their workforce. Numeracy fared slightly better in the CBoC study with 22% of employers seeing deficits in the skills of their workforce versus more than 80% of employers identifying gaps across the STEM domain in this study.

The significant difference between these results may reflect some hyperbole on the part of frustrated employers, may indicate a mismatch in the expectations of employers for new employee capabilities, or may be an accurate reflection of the competency gap of newcomers to the workforce in our province. It is most likely the result of a combination of these three explanations.

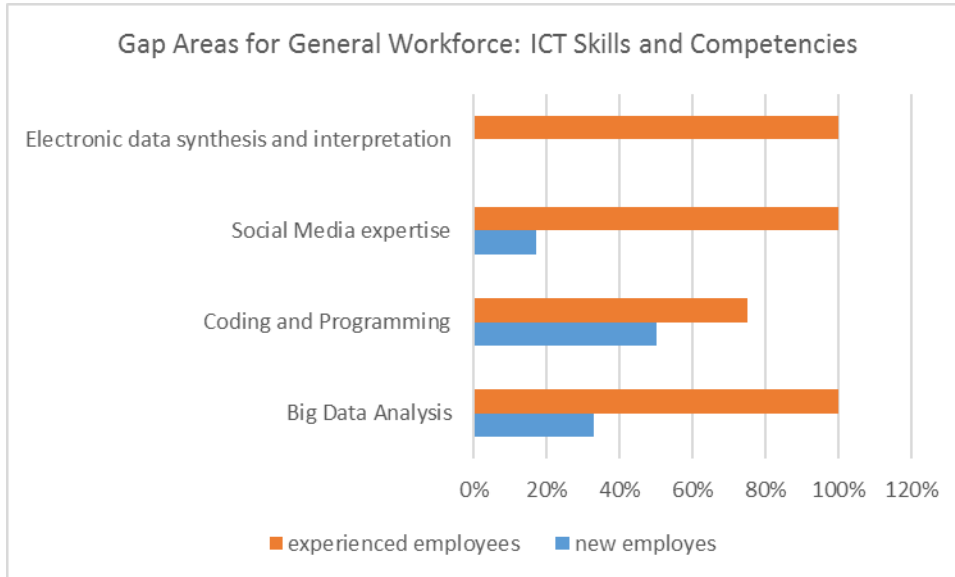
21st Century Skills & Competencies



Employers identified significant gaps (i.e. exceeding 30%) in all 21st Century skills and competencies for new employees, with *self-direction and initiative* and *critical/analytical thinking, problem solving and reasoning* highlighted as significant gaps. The results are consistent (but from some dimensions exceed) results from the CBoC study (The state of skills and PSE in Canada, November 2014), where over 70% of employers who were surveyed reported gaps in the critical thinking and problem-solving skills of candidates and recent hires, compared with more than 90% in this study.

For experienced employees, most competencies exceeded a 30% response rate, with highest gaps indicated for flexibility and adaptability, teamwork and collaboration, and creativity/innovation, and the lowest for critical/analytical thinking, problem solving and reasoning. This may reflect the development of thinking and reasoning skills that occurs on the job, and that would be difficult to mimic through training for new employees who simply lack the work experience needed to cultivate these competencies. And conversely, competencies relating to teamwork, collaboration and adaptability reflect the modern workplace that parallels the social learning environments of younger people, but that may reflect a significant shift in work-style and culture for some experienced workers.

ICT Skills and competencies



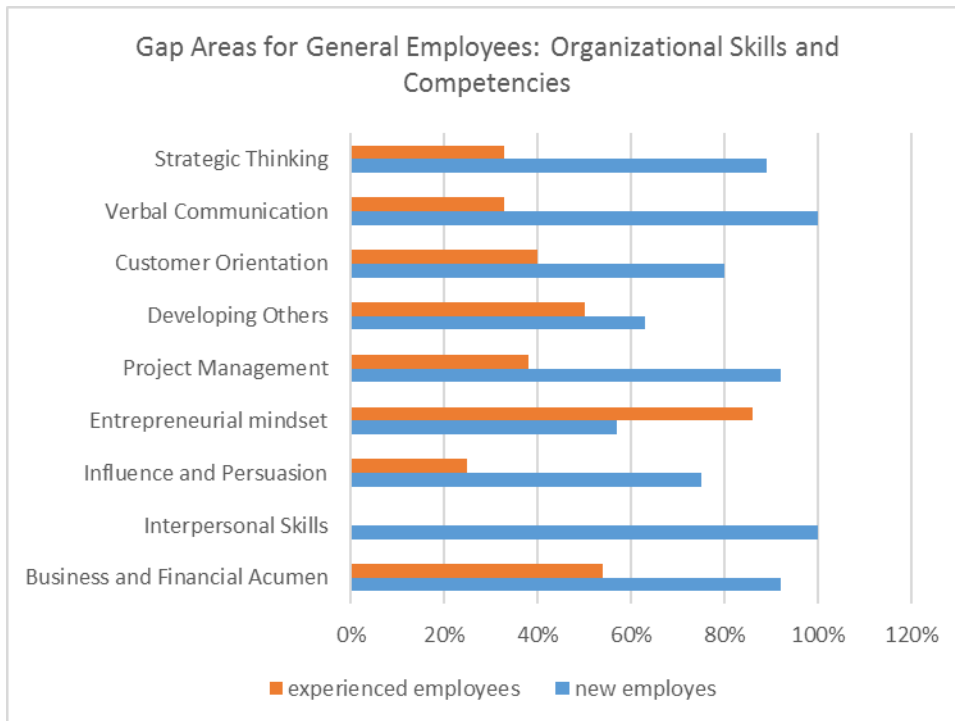
This chart illustrates the flip in competency gaps relative to the preceding dimensions, whereby fewer employers report gaps in new employees, while responses of gaps for experienced employees are at 100% for three competencies, and over 70% for the fourth.

This is not a surprising outcome given the exposure younger generations have had to information and communication technologies, and their relative proficiency with and proclivity for technology even before entering the workforce.

This outcome is also supported by research surrounding the Flynn effect (Flynn J, 1984; Flynn J, 2007) which theorizes in part, that among the effects of modernity (including the prevalence of activities with greater intellectual demand, coupled with the ubiquitous use of technology) that people today practice more of the abstract thinking and comfort with technology that is needed for competency development in this domain.

Organizational Skills & Competencies

In the last domain of Organizational Skills and Competencies, employers overwhelmingly identified gaps for new employees in all competency areas, and for experienced employees, in competencies relating to entrepreneurial mindset, business and financial acumen, and developing others.



These results indicate that most new employees are entering new jobs without sufficient workplace experience to connect and apply academic learning to workplace functions, attitudes and behaviours. It also suggests that for experienced workers, there continues to be a lag between the ability to perform technically in a role, and the ability to understand, connect with and engage in a holistic way with the strategy and vision of the business. This places considerable pressure on the original entrepreneur(s) and senior management to reinforce the relevance of individual roles and tasks to the persistence and evolution of a going-concern.

The results for interpersonal skills and verbal communication of new employees were exceptionally high with 100% response rates from employers. The results for verbal communication in this study exceed those reported in a recent study by the Conference Board of Canada (CBoC, The state of skills and PSE in Canada November 2014), where 46% of employers had cited challenges with insufficient oral communication.

Results from these two competencies likely also reflect the lack of relevant previous workplace experience (i.e. work-integrated learning, co-ops and internships, part-time positions) for many new employees which would have provided more opportunity to cultivate appropriate work-relevant communication and interpersonal skills before entering full-time employment.

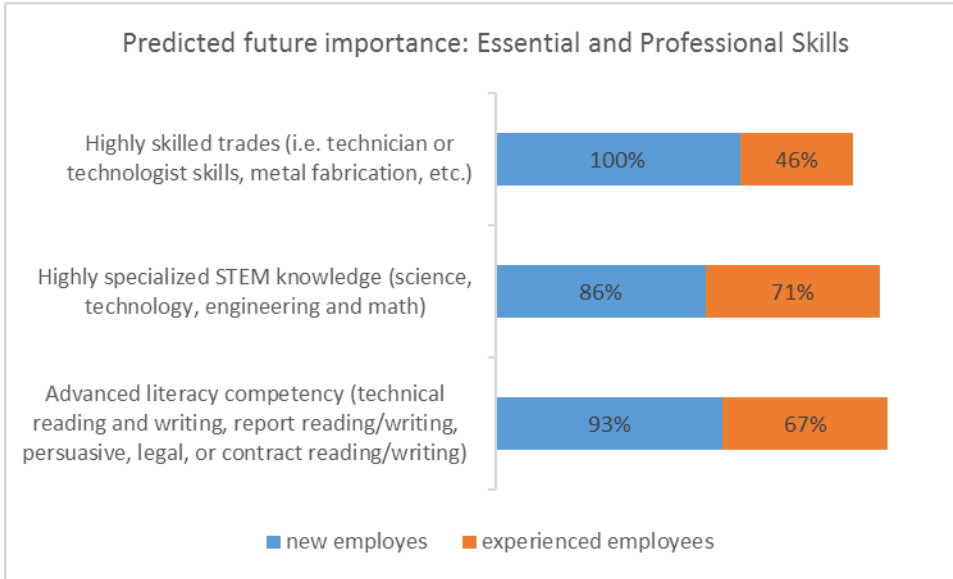
Given that these competencies were also identified as essential and requirements for hiring for critical employees, there is good reason for employees looking to advance (and employers looking to develop talent in-house) to cultivate these skills.

Participants also identified, through open-text responses, poor work ethic with millennials as a significant gap area.

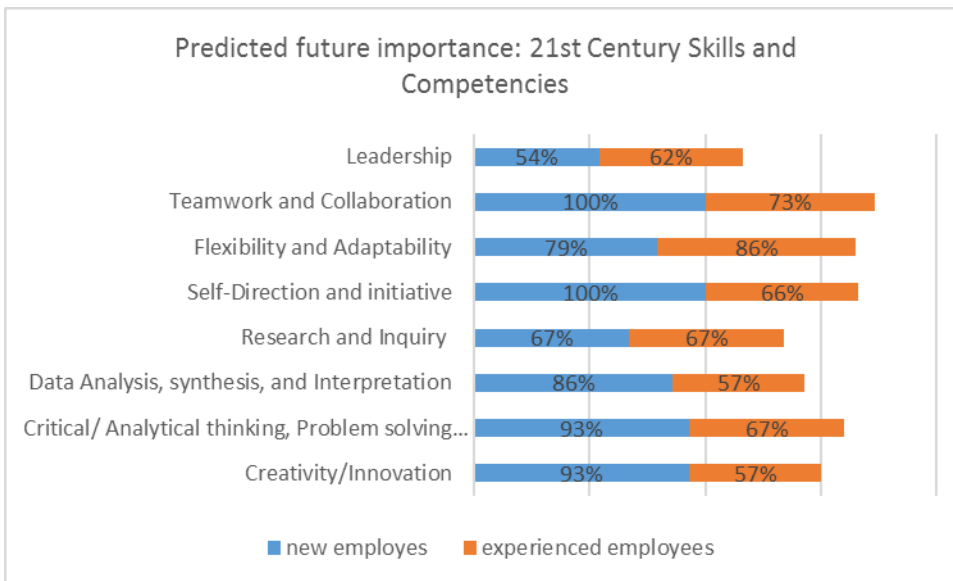
Predicted Future Skill and Competency Requirements

The third series of questions relating to skill and competency evaluations asked employers to project their workforce needs into the future. They were asked; *As your business evolves and grows and technology advances, what skills and competencies do you predict **will become more important** among your workers?*

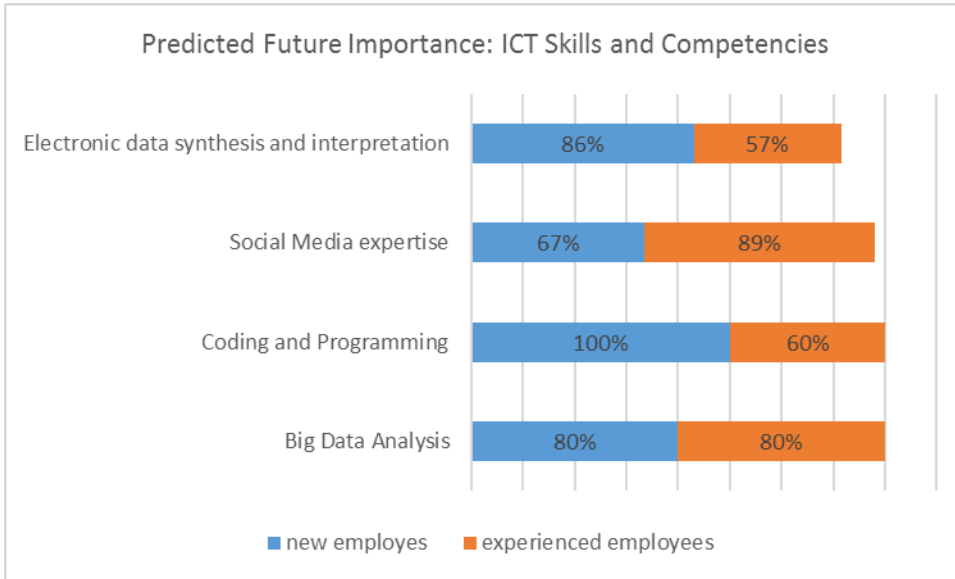
Essential and Professional Skills



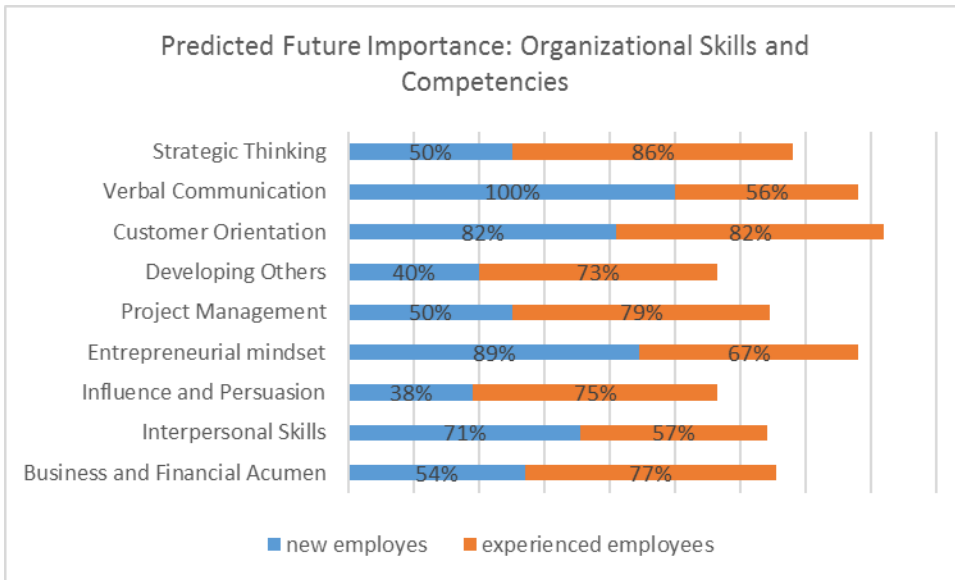
21st Century Skills & Competencies



ICT Skills and competencies



Organizational Skills & Competencies



Not surprisingly, the areas predicted for the future overlap significantly with gap areas identified by participants. *ICT skills* is the exception to this, where new employees were not identified to have gaps, but were projected to need these competencies in the future, highlighting the fact that the importance of this competency is predicted to continue and likely increase. This speaks

to vital importance of continually evolving skill and competency in this domain in stride with innovation and progress, and well in advance of entry to the workforce.

Notably, *developing others* was identified as a future competency for experienced employees by 73% of respondents, reflecting a shift in awareness of the criticality of this function to meeting future workforce demands within an organization.

Top 10 Predicted Future Skill and Competency Requirements

The following is a summary of the ten most important future skills and competencies in Oceans industries, as identified by study participants;

New employees	Experienced employees
High skilled trades skills	Social Media expertise
Verbal communication	Strategic Thinking
Coding and programming	Flexibility and Adaptability
Teamwork and collaboration	Customer Orientation
Self-direction and initiative	Big data analysis
Creativity & Innovation	Project Management
Critical/Analytical thinking, Problem solving and reasoning	Business and financial acumen
Advanced literacy competency	Influence & Persuasion
Entrepreneurial mindset	Teamwork and collaboration
Data synthesis, analysis and interpretation/Highly Specialized STEM	Developing others

A final notable competency identified from open-text responses highlighted the importance of diversifying the management function across the various oceans industries. Managers across the industry will need broad management skill – not just people management or project management or operations or risk management – but a management function that integrates all those skills and competencies into a single role.

Insights and Recommendations

Section Summary

Key workforce issues that represent priority areas of focus include;

- Competency gaps of critical employee roles
- Cultivating high demand critical employees
- Preparing for impending retirements
- Positioning youth for regional recruitment
- Developing essential, professional, and 21st century skills and competencies

Insights & Recommendations

In summarizing the data from this study, several key workforce issues became noteworthy due to their prevalence across the Province's Ocean Tech and Oceans industries, and also due to the disconnect between the importance to the industry, and the readiness of the industry to respond. This section examines 5 workforce issues proposed as priority issues, reflecting on the data results, and providing commentary to guide actions and responses to these issues.

Priority Workforce Issue 1: Competency Gaps of Critical employees

Data from this study has shown that *advanced literacy* and *highly specialized STEM* skills are essential to critical employee roles, but represent a significant gap in new employee groups. The same is true for the 21st Century skills that include *critical/analytical thinking, problem solving* and *reasoning skills*. This suggests that these skills are not being adequately developed in current programs, putting the onus on regional businesses to make use of formal or informal learning channels to provide those development opportunities to cultivate in-house talent. Where these skills are common across the Oceans industries survey, there are numerous opportunities to address these gaps with solutions that can scale across businesses. These are largely skills that can be developed through formal learning channels, including flexible online learning programs, with generic content tailored to a marine audience.

Other competencies presenting as gaps, but also essential to critical employee roles relate to *verbal communication, interpersonal skills, and self-direction and initiative*. These tend to be competencies that are best- fostered through hands-on experience. Work-integrated learning, co-op and internship opportunities - prior to new-entry into employment - provide the environment for exploring interpersonal dynamics and building appropriate verbal skills within a professional context. Similarly, self-direction and initiative will only come about from opportunities to take relevant risks and lead one-self. Early pre-employment workplace experience or project-based learning can provide those opportunities to work independently, take accountability for oneself and one's decisions, and do so within a risk environment that can be well-defined and managed.

Priority Workforce Issue 2: Cultivating high-demand Critical employees³

The identified high-demand critical employee roles are consistent with anecdotal reports reported in a recent study of the national marine industry (Scully, October 2015). Many of the small to medium sized businesses operating within the Oceans industries surveyed in this study had quintessentially humble beginnings in basements and garages, progressing from brilliant idea to enterprise without a formal business development strategy or a dedicated resource for sales or marketing. It is not surprising that these are now critical roles in businesses looking to stabilize, or to expand and exploit the new opportunities emerging across the Oceans industries.

Similarly, Project Management, senior management, and supervisory/mentorship talent who possess the skills and knowledge unique to a marine environment are in high demand. The underlying principles and practices of these respective management roles that are presently taught in PSIs and from private training providers can be customized to a marine audience by translating the knowledge and experience of subject matter experts into a series of customized marine management modules. These modules can be developed for various learning channels, including on-line learning modules, web-based learning using utilizing simulation technologies, or by providing structured mentoring or shadowing opportunities to observe and apply skills. Supervisory and mentoring roles are best learned through structured on-the-job opportunities to observe role models and apply skills with immediate application and feedback.

And while focusing on development of management capabilities, it is imperative to acknowledge the shift towards managers with a broader management complement. Like the employees they oversee, these critical employees will need diversified sets of competencies that integrate supervisory and training competencies with skills for management of local and distributed teams, budgets, operations, risk and safety, and technology.

Finally, more attention needs to be given to the recruitment of students into key marine-oriented technician roles. These programs are often under-subscribed with interested students often opting for University engineering programs due to lack of awareness of technician roles, or due to the prestige of a professional pathway. Additionally, there seems to be some consensus (anecdotally) that post-secondary programs are deploying skilled technician graduates, but employers contend that the organization or industry-specific skills are so complex and detailed, that these periods of post-recruitment development are simply par for the course.

Addressing the common current and future challenges identified in this study starts with recognition by employers of the importance of workforce development, the creation of talent

³ [Workplace Innovation and Productivity Skills Incentive \(WIPSI\) \(An initiative of the Canada - Nova Scotia Job Fund\)](#): Funding is available to support companies to invest in developing the knowledge and skills of their workforce. (See Appendix A: Workplace Initiatives for more information)

management strategies, and a commitment to investment in both, sooner than later. Finding time and resources to train new and experienced workers is a universal challenge that can only be lightened by making use of alternative learning channels (i.e. online, self-directed study, simulation, on-the-job learning and mentoring)⁴ that permit employees to access learning⁵ outside of traditional work hours, or during work hours but with fewer work disruptions, and pursue training that is most accessible to their learning style. Time and funds invested early can seem a heavy burden but the long-term productivity, engagement, and retention benefits of shouldering that burden are worth it.

It is noteworthy that for the question asking if participant firms had talent management strategies in place, that the 'I'd like help with this' responses ranged from 22%-36%. This indicates that there is some (and hopefully growing) awareness across the Oceans industries of the importance of the talent management function, and of the willingness to invest time in this function, with support from local Government and sector councils.

Priority Workforce Issue 3: Preparing for Impending Retirements

The impending retirements across the region could have significant impact on workforce development and management across the surveyed Oceans industries, if workforce is replaced or grows at the pace that some predict. This was the top issue identified by participants as a future workforce challenge, however only 13% reported having a talent management strategy in place for this eventuality.

This issue magnifies several of the other key workforce issues insofar as mass retirements could stretch the burden on mid-career employees and add urgency to the onboarding and upskilling of new-to-role and early-stage career employees. A shrunken cohort of experienced workers will stretch management resources who will be mentoring new and experienced employees, and cultivating experienced and critical employees, all while also developing and adapting their own skills to evolutions in technology, product innovation, customer demands, and production processes. This also underscores the existing holes in succession that can lead to hasty attempts to build layers of experience and expertise quickly before, or in response to, the departure of critical and seasoned employees.

⁴ [Workplace Education \(An initiative of the Canada - Nova Scotia Job Fund\)](#): Funding and supports are available to help you develop and implement training programs tailored specifically to meet the needs of your organization and your employees.

[HR Toolkit](#): Free and easy to access information, downloadable templates, practical guides, links to relevant resources and more to help you find, keep and develop your valued employees.

⁵ See Appendix A: Workplace Initiatives for more information on existing programs from the Province of Nova Scotia

Priority Workforce Issue 4: Positioning Youth for Regional Recruitment⁶

The purported tendency of local Oceans Industry employers to recruit critical and general employees from the provinces suggests either a strong level of confidence in the local talent pool, or a willingness to reconcile talent targets to a standard that allows for local recruitment. The responses from this study, which identified broad and pervasive gaps in skills and competencies that are essential and requirements for hiring, suggest the latter may currently be true⁷.

Where most employers reported recruitment strategies that prioritize our province as the primary locale for sourcing critical and general workforce, there is an opportunity to build awareness, knowledge, skill, and interest much earlier in the long pathway to employment. This will permit educators and employers alike to identify young talent, provide robust career coaching about regional pathways of opportunity, and cultivate an even stronger pool of skilled and engaged workers to draw from. There is also an opportunity to weave tighter connections to Ocean STEM outcomes into our regions' p-12 curriculum.

Priority Workforce Issue 5: Developing Essential, Professional, & 21st Century Skills & Competencies

What became evident from this survey is the importance of non-traditional skills and competencies for new, experienced and critical employees alike. Traditional skills highlight technical and professional knowledge and skills, however, as the marine industry progresses towards increasingly high tech and digital processing, there is a shift in the balance of skill from the hands to the head. The need for cognitive skills and behavioural competencies that facilitate learning, thinking, reasoning, analyzing, influencing, and shaping & sharing information is the new driver of recruitment models.

Where information is readily available, and where 'knowledge' is readily accessible, advantages are now found in a workforce where essential and professional skills have woven a strong foundation, and where workers are trained to learn and apply and readily adapt to the ever-changing work environment. The need for continuous learning and development of a workforce across the experience and tenure continuum becomes unquestionable. So too does recruitment

⁶**START:** Financial incentives are available to encourage employers to hire Nova Scotians requiring work experience and to register and employ apprentices. (See Appendix A: Workplace Initiatives for more information)

⁷ This study did not evaluate the perception of gaps of employees hired from outside of the region, and as a result can not draw comparisons between competency levels of local and 'away' recruits. It may be that these gaps exist for critical and general employees hired from both within and outside of the province.

of a workforce with the necessary foundation in essential, professional and 21st century skills and competencies that will enable skill progression throughout a career.

Responsibility for the development of skills and competencies of our youth and young workers don't only reside with our provincial educators. 21st Century and Organizational skills and competencies were identified as essential areas, as gap areas, and as predicted areas of future need. Generally, these also represent skills and competencies that can also be well-cultivated outside of formal education settings. Young people develop many of these skills through extra-curricular activities, sports teams, volunteer and community work, and part-time jobs. This gives further support to the notion of the 'well-rounded student', and extends the responsibility for developing our youth more broadly to communities, parents, and the youth themselves.

Appendix A: Workplace Initiatives from the Province of Nova Scotia

The Workplace Initiatives Division <http://workplaceinitiatives.novascotia.ca/> is dedicated to building a vibrant and adaptable workforce by partnering with employers and industry to ensure Nova Scotia has the skills we need to succeed in the workplace.

We have created a suite of HR Solutions programs to make sure you are prepared for the challenges of human resources management including how to find, manage and retain the right employees. The HR Solutions featured on this site have been developed to support businesses such as yours to compete more effectively in today's economy.

Some of the programs listed below are initiatives of the Canada Nova Scotia Job Fund including the Workplace Education Initiative, One Journey Work and Learn and the Workplace Innovation and Productivity Skills Incentive. [See link for more information.](#)

Workplace Education (An initiative of the Canada - Nova Scotia Job Fund): Funding and supports are available to help you develop and implement training programs tailored specifically to meet the needs of your organization and your employees.

HR Toolkit: Free and easy to access information, downloadable templates, practical guides, links to relevant resources and more to help you find, keep and develop your valued employees.

START: Financial incentives are available to encourage employers to hire Nova Scotians requiring work experience and to register and employ apprentices.

SkillsonlineNS: Access, at NO COST, to hundreds of online courses ranging from software applications to customer service to HR fundamentals to accounting essentials. Private learning plans can be set up and courses assigned.

Welcoming Workplaces: Information, tools and resources to support employers as they tap into the unique and beneficial blend of skills, abilities, and perspectives that diverse employees bring to the workplace.

Workplace Innovation and Productivity Skills Incentive (WIPSI) (An initiative of the Canada - Nova Scotia Job Fund): Funding is available to support companies to invest in developing the knowledge and skills of their workforce.

Sector Council Program: Nova Scotia's industry-led approach to attracting, developing and retaining skilled and productive workers.

The Job Bank: Canada's one-stop online jobsite where employers can post job openings and connect with job seekers free of any service charges.

One Journey Work and Learn (An initiative of the Canada - Nova Scotia Job Fund): A partnership between government, industry and community that supports skill development and employment opportunities for unemployed or underemployed Nova Scotians in industries where a shortage of labour has been identified.

References

- Ananiadou, K. (December 2009). *21st Century Skills and Competencies in OECD Countries: Innovation Strategy: Education and Skills*. Paris: OECD.
- CBoC, T. C. (November 2014). *The state of skills and PSE in Canada*. Ottawa: Centre for Skills and Post-Secondary Education.
- Claro, M., & Ananiadou, K. (2009). *21st century skills and competencies for new millenium learners in OECD Countries*. Paris: OECD.
- ESDC. (2015, August 2015). *Literacy and Essential Skills: Skills Definitions and Levels of Complexity*. Retrieved from Employment and Social Development Canada: <http://www.esdc.gc.ca/eng/jobs/les/definitions/index.shtml>
- Flynn, J. (1984). The mean IQ of Americans: Massive gains 1932-1978. *Psychological Bulletin*, *95*(1), 29-51.
- Flynn, J. (2007). *What is intelligence?* Cambridge: Cambridge University Press.
- Manitoba, W. E. (2015, June 5). *The 9 Essential Skills*. Retrieved from Workplace Education: http://www.wem.mb.ca/the_9_essential_skills.aspx
- Noor, A. K. (October 2011). Intelligent adaptive cyber-physical ecosystem for Aerospace engineering education, training, and accelerated workforce development. *Journal of Aerospace engineering*, 403-408.
- OECD. (2017, March 20). *Competency Framework*. Retrieved from OECD: https://www.oecd.org/careers/competency_framework_en.pdf
- Scully, S. (October 2015). *Marine People Partnership: The challenges, needs and opportunities for strategic workfroce development in the greater marine industry*. Halifax, NS: Institute for Ocean Research Enterprise.