MARINE PEOPLE PARTNERSHIP

THE CHALLENGES, NEEDS AND OPPORTUNITIES FOR STRATEGIC WORKFORCE DEVELOPMENT IN THE GREATER MARINE INDUSTRY

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Report prepared by the
Institute for Ocean Research Enterprise (IORE)

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Executive Summary

Since the 2011 announcements of the successful NSPS bids, there has been rapid response from regional players in academia, industry and government to conduct needs and gap analyses, and to develop certified or endorsed training for new and existing workforces to elevate capability to meet the short-and long-term labour requirements of these complex projects. Much of the activity has been locally initiated and regionally focused resulting in numerous, fragmented responses to workforce development. The focus of this report is on identifying areas of common challenge nationally, and on recommendations for single scaled collaborative solutions across regions.

A first step in developing a workforce development strategy requires understanding the scope of the industry in question. For the purposes of this report, the greater marine industry includes shipbuilding and ship repair sectors, as well as other sectors along the value chain that benefit directly or indirectly from investment and success in this core sector. With the scope defined, it is important to also understand the extent to which other regional industries employ and compete for the same or similar workforce, insofar as this can inform strategies around workforce recruitment, development, retention, and succession. A second step is to understand the perceptual or real barriers to participation in the industry. The third step requires understanding the present and future workforce needs for the industry, and validating the forecasts of supply and demand. Along with validating capacity, is the requirement for a deeper understanding of the present and future capability requirements for this workforce to understand how education, training and development must evolve to deliver against these requirements.

To meet present and future labour force demand will require a focus on ongoing skills development and knowledge transfer. And, it will also require more stability and predictability in the industry. This presents the catch-22 of workforce development – that to invest in infrastructure, innovation, and workforce development requires confidence in the sustainability of the industry – but to ignite and sustain a going-concern industry requires infrastructure, innovation, and workforce. And if the industry has one weakness it is the fragility of confidence in its sustainability.

The ultimate objective of the national marine industry is to develop and evolve into a sustainable industry that can endure the peaks and valleys that have historically

characterized its activities by establishing broader engagement in domestic and international markets to mitigate reliance on defense contracts. To fully develop a national, competitive, export-ready Marine Industry requires a robust, skilled and ready workforce at all levels. This includes the skilled trades and technicians who operate at the production and manufacturing end of the workforce continuum, through to the engineers and ocean scientists who lead the design, innovation, and research activities that stimulate and evolve the industry, through to the entrepreneurs who populate the supply chain, and the leaders who steer industry strategy. Moreover, it is the timely availability of these workers, coupled with highest quality parts, materials, and systems that underlie the success of these projects.

Paramount to building a sustainable national marine industry workforce is understanding the inter-related sectors that comprise that industry. A sustainable and prosperous Canadian marine industry isn't formed by one shipyard – or even two. It is the aggregate of technical and intellectual and manufacturing enterprises that participate in a value chain of a central and dominant sector, and the related but peripheral operations that compete for and share workforce, innovations, and research outcomes, and that collectively benefit from momentum in one or more parts of the industry. Presently, with a contract value of $37 billion[1], and with Industrial and Regional Benefits (IRBs) requiring that prime contractors invest 100 per cent of the value of the respective contracts back into the Canadian economy, shipbuilding is at the influential epicentre of this broad industry.

Where some sectors (i.e. ocean technologies) have evolved and turned their focus to exports and international markets, the IRB commitments ensure that even if the ship building value chain isn't sourced entirely within our borders that other sectors will still benefit from the contract obligations. And so NSPS has provided the financial catalyst to develop our national marine industry, but a sustainable industry must be able to endure and surpass the timelines of NSPS. NSPS may breathe new life into the industry, but the industry in turn must grow its own lungs. If we can't build a strong workforce regionally, then people will choose not to invest in this industry. And, if we build a national marine industry, only to have it collapse when the funding for shipbuilding is exhausted, then we will not have succeeded.

[1] (Public Works and Government Services Canada, 2015)

Key Findings

This report identified six priority areas that comprise common challenges to workforce development in the marine industry, nationally. These priority areas include:

- The History of Boom and Bust
    - Projects and initiatives aimed at progressing the industry from an infrastructure or workforce development perspective often find themselves dragging the dead weight of a legacy of boom and bust that produces tenuous confidence in the dreams of building a sustainable industry.

- The Socializing and Normalizing of Mobility
    - Coastal regions now have an established and embedded history of 'leaving for work', which normalizes and rationalizes this as a valid option
    - Trends in worker mobility demonstrate that our workforce ignores regional boundaries in the pursuit of employment. The conventional mindset views this as cannibalization of workforce. There is an opportunity to shift our thinking to see workforce mobility as a benefit that expands rather than shrinks the pool of talent. A national workforce strategy can help to balance regional supply and demand, and support the cultivation of domestic talent and experience

- Social and Systemic Challenges to Attracting Talent to the Skilled Trades in the Marine Industry
    - A significant hurdle to the recruitment of new young workers to trades and technology careers is the social bias against what is perceived to be a plan-B education and career path
    - Career literacy and career counseling in schools emerged as significant gap areas relating to workforce development. Career counseling tends to be biased towards traditional academic pathways

- Developing Essential Skills, Workplace Skills, and 21st Century Competencies
    - Essential skills support effective learning, enabling workers to learn new skills, possess workplace knowledge more readily, adapt to workplace change, and make better decisions
    - New entrants to the workforce or to post-secondary education are lacking the minimum level of these skills to be successful and to contribute at the expected level

- Developing Workforce Capability among Under-Represented Workers
    - Women, immigrants, Aboriginal people, visible minorities, and people with disabilities have largely been marginalized from the marine industry because of low turnover, low relative visibility of the industry, perceptions of

unwelcoming work environments and workplace cultures, low awareness of how to hire an under-represented worker, and lack of awareness of how innovations have made many roles more accessible to a broader range of workers
    - Common obstacles include the absence of relatable role models, perceptions of restricted accessibility and 'fit' challenges, and lack of continuity in Government-funded initiatives aimed at supporting under-represented workers

- Developing Management and Leadership Capability
    - The cycles of boom and bust have derailed succession strategies so that there is a significant gap in management and leadership capability (the 'little middle') across the industry
    - Modern management and leadership require a more complex combination of technical and interpersonal skills, and diminished notions of positional authority require more nuanced people management skills

In addition to the priority areas, this report also examines issues relating to workforce development in skilled trades and technology roles, in unionized environments, and of professionals. Some noteworthy issues that are examined include ongoing challenges with completions and certifications for trades and technology workers. Issues regarding professionalization of the skilled trades, career mobility, and progressive certification are also examined insofar as they relate to workforce recruitment, retention, and development. Union issues relating to workforce development are examined, including the influence of unions on learning culture, pursuit of cross-certification and career pathing, and strategic development and succession of existing employees. Finally, issues relating the development of highly educated and experienced professionals examines some challenges related to attracting new generations to professional career pathways in the marine industry.

Despite the challenges to workforce development outlined in this report, there is tremendous optimism that the greater marine industry will be rejuvenated. As with any rejuvenation, there will be continuous change and adaptation across the industry. The most significant changes are presently being felt in the shipbuilding and repair sectors, where transformational change is rippling across procurement, work processes, knowledge and skill requirements, behavioral change, organizational cultures, team integration and technology use, and changes to the physical environments in which people work every day. Most organizations tackle one area of change at a time, but the two primary yards involved in NSPS are stretching to coordinate all of these massive transformations at once, and all while under the

microscope of the media, the government, and the public, and the rest of the industry whose success is well-entangled with the success of these yards. But these transformations are already underway, and reports like this one are aimed at identifying present hurdles, and predicting future ones, to smooth the way for the evolution of the industry.

Perhaps the greatest potential hurdle to workforce development in the greater marine industry is the need for trust at all layers. Industry needs to trust that government won't pause or renege on contracts, leaving yards and suppliers with idle workers and unutilized infrastructure, and squandering the investment that was directed into developing these assets. Government in turn needs to trust industry to expand their strategies beyond the endurance of a contract, or beyond their property lines without needing to implement conditions and requirements to compel this. Employees need to trust industry to commit to succession and development and retention of their workforce, and employers need to trust that their investments in workforce development will see a return, and not see the backsides of departing employees who prefer the short-term affluence that other industries offer over the uncertain promise of a recovering industry. Industry members in turn need to trust competitors and partners to not poach their workers, appropriate their contracts or undermine their competitiveness. Trust will fuel change and progress and investment and innovation across the industry, and will write a new prophecy of a sustainable national marine industry.

Introduction: The Marine People Partnership

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The Impetus for a Focus on Workforce

The National Shipbuilding Procurement Strategy (NSPS) presents an unmistakable opportunity for Canada as a nation to revitalize its shipbuilding industry. The direct opportunities, as well as the cascading opportunities to the broader marine industry, have triggered rapid responses from industry, government, and academia to react to the concomitant challenges and potential obstacles of this opportunity. Key among those challenges are workforce issues that may restrict participation from, and benefit to, those regional organizations positioned to contribute to the strategy, as industry players manoeuvre to find skilled, experienced, committed, and available employees to fulfill these projects.

Despite the complexity of defense procurement contracts and the sophistication of the products they delineate, the success of NSPS is ultimately dependent on two essential and basic factors;

- an effective and responsive supply chain, and
- well-trained and available workers

Much of the research, activity, and response at this time, has been locally initiated and regionally focused. However, many of the regional challenges are actually common or national challenges. For example;

1. **Capability gap.** The capability gap is not unique to either coast of Canada – it is a challenge shared across the country as an aging Canadian Marine workforce advances towards retirement, leaving gaps in experience and capacity, and succession plans with yawning interruptions between their most and least experienced talent.

2. **Career literacy gap.** Pure and broad-reaching career counseling activities have all-but vanished from our schools, as school counselors' attentions are drawn instead to more pressing and vital student needs like mental health or bullying interventions and support. Across the country there is a common gap in career literacy and informed career counseling that results in a lack of awareness of the existence, let alone the variety, of marine-oriented trades and professional careers. And where

there is awareness, it is often tainted by stigma and bias towards an industry with a history of boom and bust.

There is redundancy and inefficiency in continuing to try to confront common industry problems separately from opposite coasts. As projects ramp up there is a temptation to restrict our focus to a single region, however there are efficiencies and advantages to be gained by stretching our view. When we broaden our view from a single coast to the entire country, and when our vision includes other sectors in the greater marine industry that comprise part of that supply chain, or that compete for the same high demand workers, then we begin to see the workforce and capacity problems in their scale and complexity.

In this way, NSPS is a pretext for commitment to the development of a broader marine industry that includes sectors along the shipbuilding and ship repair value chain, and related sectors that benefit directly or indirectly from investment and success in this core sector (see *Scope* section for the full definition of Greater Marine Industry). NSPS isn't just an opportunity to build ships – it's an opportunity to build a more comprehensive Canadian marine industry. And workforce is a deciding variable in achieving this vision.

The Vision for a Collective Workforce Development Strategy

With the recognition that the shipbuilding industry does not operate in isolation, but as part of a broader marine industry, this validates the argument for a collaborative national workforce development strategy. The industry as a whole benefits from investments in R&D and education that lead to more effective, accessible and consistent training of workforce, and that lead to more advanced technologies and efficiencies from suppliers. These advances and benefits cascade to other industry members, who may not contribute directly to the shipbuilding projects, but who in turn, benefit from a more robust and skilled labour pool, and from broader application of R&D outputs. The shipbuilding project may be the catalyst for investment in the marine industry, but the benefits will reach beyond the yards. This recognizes the complex and integrated nature of the marine industry.

The Marine People Partnership (MPP)

The Marine People Partnership (MPP) was established to explore workforce development issues and advise on a national human resource development strategy. Conceived from Irving Shipbuilding's Value Proposition commitment under NSPS, the objective of the MPP is to propose objective and relevant recommendations aimed at overcoming challenges to developing a highly trained, skilled, and available workforce. The workforce in question spans the continuum from skilled trades and technology workers to professionals or knowledge workers (i.e. engineers, marine architects), entrepreneurs, and leadership roles. The overarching objective of this initiative is to provide the necessary workforce to establish an innovative, sustainable, and globally competitive marine industry.

There are numerous human capital issues that confound a straightforward strategy, including; competition for high demand roles from several industries and regions, extensive retirement and attrition of experienced workers, and recruitment and training capacity challenges for trades careers, and others that will be explored in more detail throughout this report.

Hurdles to Collaboration

Building collaboration and partnerships nationally is not an easy feat in a broad industry that has a long history of fierce competition for government and commercial contracts. Competition has also crossed over into recruitment and retention of essential employees, and has been further exacerbated by an education system that has not prioritized the public education of its skilled trades and technology workers, or of building awareness and exposure to careers in its industry. Only recently have more post-secondary institutions expanded their offerings to include a range of marine-oriented programs, with a new Naval Architecture and Marine Engineering program at UBC, an Advanced Diploma in Ocean Technology at NSCC, and marine oriented trades training offered at BCIT, to name a few.

Of course, the national workforce issues aren't limited to short-term concerns with capacity (trying to find enough workers) and capability (availability of skilled and experienced workers). A workforce development strategy must consider the skills that are required today, tomorrow and into the future. In an industry that must evolve to adopt and innovate new technology in order to operate in both national and international markets, the skills that are needed tomorrow and into the future will also evolve.

MPP Project Mandate

- To recommend strategies to better prepare, attract and retain participants in shipbuilding and the greater marine industry
- To identify other future high demand careers in the greater marine industry and determine capacity and capability for domestic schools to meet this demand
- To Identify HR capability and skills gaps, and promote initiatives and training that will engage Canadian youth and underrepresented groups (i.e. women, first nations, immigrants, visible minorities and people with disabilities) to select the marine industry as the career sector of choice
- To identify other confounding factors that may pose a challenge to developing a long-term domestic workforce
- To link the education and training of a highly qualified marine work force to research and industry, to build competency and capacity

Workforce as a Competitive Advantage

In an industry where most of the costs of production are common, fixed and unchangeable (i.e. costs of steel and major systems), one broad lever that is available for nudging margins in a favourable direction is the cost of labour. The best mechanisms for achieving this are training, cross-certification, and innovations in work processes or technology that make production more efficient, effective, safe, and streamlined. This report will examine how these training outcomes are helped and hindered by present training and development programs, by collective agreements with unions, and by investments in new and experienced workers and in professional talent.

Additionally, as the global industry evolves its procurement process to a 'bid compliance[2]' structure, the skill and experience levels of our workforce become a powerful key competency that can offset price disparities and fortify bids. This view helps us to envision the competitive advantage that is gained through having a stable, predictable, and highly skilled workforce. Investment into R&D and education & training are central to this common industry interest.

Common and Competing Interests

There are four important sources of tension at play in the pursuit of a sustainable national marine workforce.

1. **Optimized vs Steady Build Times.** One source of tension is the interest of yards to optimize learning curves in order to build quickly, efficiently and continuously to preserve margins and to keep a coveted workforce close by. This is countered with a Federal requirement to build more steadily, with more uniform build-times, to recapitalize funds more gradually and to coordinate the launch of the new with the decommissioning of the old, and to match the demand for new vessels with the availability of crew.

   There is an image of the family of elephants, joined at trunk and tail in a connected and well-spaced ring. This is the image of 'perpetual build' that lies at the heart of the sustainable defense procurement strategy. If one elephant walks more quickly and laps his mate, or if one slows his pace, the ring is broken and analogously, the cycle of builds becomes disrupted and unpredictable. Either scenario would result in workforce challenges; the first in resource challenges as demand exceeds supply, and the second in workforce attrition as gaps in production lead to gaps in employment that prompt workers to look elsewhere.

   Add to this a yard culture where the lived-experience of contract uncertainty has often led to workers tempering their work-pace to 'stretch out' contracts in the

[2] 'Bid Compliant' refers to competitive bids that meet all the requirements for the goods or services to be purchased set out in the request for tenders. Requirement often include a weighted combination of price, capability (expertise, technology, workforce skill, safety), and reinvestment in the local industry/economy. NSPS, and other defense procurement strategies, are an example of the bid compliant process.

interests of job security, and we find this paradox has a third player adding tension. At the heart of this paradox are the issues of predictability and stability. Without predictability in contract and materials requirements and in schedules, there can be little stability in supply chains or in workforce. But predictability is not so easy to achieve. Defense contracts often have long time lines that make it difficult to plan for with great accuracy.

2. **Public vs Private Responsibility for Workforce Development.** A second source of tension exists between industry and education partners regarding who is responsible for workforce training. Employers want employees to arrive with the most training and experience possible before starting their job. Conversely, the education system is governed by a more conventional mandate that directs it to provide general and broad training and skill development to students who will be deployed to a range of different employers. Industry associations, unions, and private training companies tend to fill this gap in customized curriculum, providing training in more tailored sector or company-specific skills and knowledge. But even as they do there is a simultaneous tension between industry that criticizes government for not supporting their sector by sponsoring robust training, and criticism from government towards industry for not showing more willing engagement and investment in their own work force.

3. **Costs vs Benefits of Employee Mobility.** The third source of tension concerns the push and pull of employee mobility. At the heart of this paradox is really a philosophical question that needs to be considered - *who is our workforce*? Employers have long regarded the provincial or regional labour force metrics as the lens on local supply. But what are the limits of 'local'? Mobility trends in some high demand roles have shown us that workers aren't limited to a local view of job and career options. The next job could be a 'tweet' away and also many provinces away, and employers may unwittingly find themselves at the gain or loss side of this trend.

4. **Politicized Procurement.** It is argued that one of the reasons why the US and other major European industries have been successful in smoothing out their own boom and bust cycles is that they've insulated defense procurement contracts (and industries) from election fall-out. Rarely do their governments renege on contracts once they are in motion, however the Canadian Government is notorious for this very thing.

   It is challenging to build a sense of predictability and stability in an industry when major defense projects are so vulnerable to changes in government. It would be very difficult to re-establish confidence in an industry that is presently so reliant on government procurement to catalyze its rejuvenation if it suffers an early setback. And it will be even more difficult to convince a workforce that this is an industry

worth committing to, if projects vacillate through the echoes of an election. We may convince workers once to return to the marine industry, but good talent will not be fooled twice.

These sources of tension will be explored in more detail throughout this study insofar as they influence policy, funding, participation of key members, and integration of those members into workforce recruitment and development strategies.

Project Challenge

Can we build a national human capital strategy that will influence innovation and evolution in the industry by facilitating the sharing of HR research, best practices, training, and program funding from coast to coast to coast?

Guiding Questions

This study provides an analysis of workforce development that goes beyond projecting skill, capability and capacity gaps to uncover the unique socio-cultural challenges that relate to addressing these gaps. In doing so, the following questions provided guidance for data collection and analysis insofar as they communicated the more audacious potential outcomes of the NSPS projects.

- If we look at stats across nation, how do we balance success and sharing and still promote healthy competition nationally? How do we address common issues?
- How do we ensure that the revitalization of the marine industry remains a priority of the federal government?
- How do we build a stronger workforce that will enable competition in both domestic and international markets?
- How do we create more predictability in the industry, from a procurement standpoint, to allow for more confident investment in infrastructure and human capital?
- How do we shift from our coastal views to a unified industry viewpoint?
- What is the uniqueness to the industry – how do we revitalize an entire industry that is weighted down by history and legacy issues? How do we address issues with confidence in the promise of sustainability?
- How can we view the fluidity between industries as an opportunity rather than an obstacle?
- How do we ensure that as we grow the industry, that we also revitalize it?
- How do we balance social mandates (i.e. aboriginal engagement strategy, under-represented workers' strategy), with a sector strategy that is looking for the most well-skilled and experienced workforce possible who can hit the ground running in the short-term?

Background, Current and Future State

Background

The growth of Canada's economy and community development has long revolved around ocean and fresh-water related activities, however still only approximately 1.9% of our GDP is ocean-based compared with almost 5% in the US (Pinfold, 2008). The marine industry in Canada has evolved from a focus on fisheries, transportation, and defense to one that includes emerging or expanding sectors in ocean technology, aquaculture, ocean energies (including offshore oil & gas and tidal energy), and shipbuilding and repair.

Despite a geography that boasts the longest coastlines in the world, Canada has yet to develop a sophisticated and integrated marine industry. To some extent this is due to a big-country-small-population problem. We may have lots of coastline, but no people on much of it. Or, perhaps due to the vast and complex geography that separates its east from its west coasts by roughly 7000km, the industry has by-and-large developed in three distinct regions – on either coast and in Ontario/Quebec - that operate almost independently.

The shipbuilding industry has traditionally been heavily reliant on government defense contracts, and accordingly, has suffered the booms and busts associated with alternating build and belt-tightening programs. Fragmented into a handful of big players and a collection of smaller yards and suppliers that fit into the small to medium-sized enterprise (SME) category, the related sectors lack the integration or the momentum of a sophisticated national industry.

The industry has suffered a history of starts and stops, and the negative impact of the boom/bust cycles reach far beyond the obvious direct impact to yards. Bust cycles result in:

- loss of workforce, as skilled and professional workers are drawn away to more stable industries
- loss of experienced workers as the gaps in projects restrict the natural transfer of knowledge and succession and results in a workforce that, at the time of each project,

is either new and inexperienced, or that possesses skills and knowledge that are dated or too-long idle

- lack of investment in costly but essential infrastructure and training for which a favourable ROI (return on investment) might never be possible
- lack of investment into ongoing research and technological development (R&D), which is an essential activity in any evolving industry

A stable industry requires predictability in workforce availability and in work contracts, and in turn, this predictability is an outcome of stability. But the reverse is also true. The lack of investment in these essential activities and competencies ultimately produces erosion of confidence in the industry overall, creating a self-fulfilling deceleration to the industry.

But Canada isn't unique in enduring a marine industry that is defined by booms and busts. Europe has ridden the crests and valleys of an industry that cycles through profitable and lean periods for much longer than we have, but industry players have found ways to smooth out, if not the cycles themselves, then the repercussions of those cycles. How have they done this? Many international industries found success and stability through consolidation and specialization. They have smoothed the cycles and lessened the reliance of government defense contracts by finding small niches where they can develop expertise and adopt world-leading technologies and workforce, and by literally becoming better than the rest of the world at building a type of ship or support system. This provides the competitive advantages of reputation, talent magnetism, production efficiency and productivity, and economies of scale.

Australia has recently proposed a plan to smooth out their own boom/bust cycles and stabilize their marine industry by adopting a continuous build strategy. Analysts have calculated that the 30-40% premium currently associated with domestic production of new naval ships can be halved by a continuous build strategy insofar as it precludes the need to continuously rebuild the workforce capability that drifts with each bust. This strategy also assumes that production costs will be reigned-in with mature designs at the start, and minimal changes throughout production, and with adoption of continuous improvement practices and metrics to invert the learning curve into an efficiency curve (RAND, 2015).

It will be interesting to see if these assumptions transpire, as one of the key benefits of continuous build, cited in the Report the Australian Industry Group (Acil Allen, 2013), is the flexibility to evolve capabilities of vessels over time with 'technology inserts', so that the tenth ship reflects more modern capabilities than the first build in its class. This speaks to the expectations for spiral development in a continuous build strategy versus the assumptions of uniformity in a batch replacement model.

This report also argued the benefits of shortening vessel life from 30-35 years to 20-25 years. Not only would this coordinate replacement cycles with a continuous build strategy, but would offer a cost-effective option that replaces the rolling budgets of support and maintenance of older and less reliable ships with the comparative costs of new vessels with improved capability and dependability (Acil Allen, 2013).

Current State

Today, our modern marine industry is adjusting to shifting paradigms of work and purpose. Globalization coupled with rising fuel costs mean that marine transportation will become even more cost-effective and commonplace. As the products of our economies are transferred more and more across water, there becomes a greater need for marine policing, patrol and surveillance. Conversely, shifts towards unmanned underwater vehicles or minimal crewing strategies potentially reduces the workforce at the user-end of these products, but potentially increases the on-shore workforce who design and produce, operate and support this equipment.

Future State

It becomes difficult to forecast too far into the future what our greater marine industry workforce requirements will be, or even what that workforce will comprise. Some of these jobs are yet to be invented, as innovation occurs, often simultaneously with production, and as defense and commercial marine strategies evolve and adapt to steps and leaps in innovative technologies. If we use other industries as a point of reference, we can predict a significant shift towards automation over the next two decades. This transition has been swifter in some sectors, such as automotive, because of higher production volumes, but automation is shifting into emerging industries as well. Not only do advanced automation technologies provide efficiency and quality benefits, but they often replace human labour for tasks that are dangerous, repetitive and monotonous (Lo, 2013). In South Korea, Geoji shipyard in South Korea boasts 68% of its production processes are carried out by intelligent systems, performing tasks such as inspection, pipe-cleaning, welding, heavy lifting, and painting.

While some jobs will see more automated processes, other jobs will be created, such as technicians who maintain and program these intelligent systems. This has implications for cross-certification to ensure that trades workers' skills evolve to outpace rapid redundancy. This also has implications for collective agreements that may presently sanction human-labour over automated-labour, despite efficiency and quality levels in the latter that will quickly become the global standard in the marine industry.

Finally, as we look to the future we can predict that as roles become more complex, our workforce needs will shift towards higher minimum requirements, and broader skillsets (OECD, 2013). This has practical implications for recruitment and training, and for curriculum and program development in post-secondary institutions. It also has implications for organizational culture and the traditional boss/worker relationship, as production workers master a broader range of skills and become more educated. This can result in a shrinking power gap between subordinates and their superiors. In defense roles, traditional rank and command norms could be challenged. A recalibrated power dynamic shifts management requirements from monitoring work, to choreographing resources and affecting high performance. This requires a more sophisticated cohort of people managers, supervisors, project managers, and leaders. Add to all of this the trend towards worker mobility, and the complexities of a workforce development strategy become even more entangled.

The ocean technology sector in Canada has had minimal involvement in the front-end of shipbuilding and repair technologies. The focus instead has been on systems and equipment relating to naval defense, imaging systems and equipment, instrumentation and information systems, marine communications, navigation, surveillance, systems integration, marine acoustics, and communication (AZCICS, 2015).

It is hoped that the Ocean Technology sector will gain from the investment benefits to the greater marine industry, and that it will grow more regional demand to match its already-established export markets. These opportunities will likely signal greater demand for sector workforce with technical, engineering, innovating and entrepreneurial skills.

While the first wave of workforce development across the greater marine industry may centre on skilled trades workers to rejuvenate the industry, subsequent waves will likely orient towards a workforce with creative cognitive talents and experience, and leadership and management skills, to elevate the industry and steer its progress.

Labour Market Forecasting

Labour market forecasting for the shipbuilding sector reveals that there will be significant opportunities for labour on either coast for the foreseeable future. It also reveals the relative impact of NSPS on its primary beneficiary regions, including the east and west coasts where efforts will focus on build and repair activities, ocean science and research, and ocean technologies, and central Canada where much of the supply chain for the greater industry is already located. This is relevant to the discussion of workforce development insofar as it relates to recruitment and retention of employees to the greater industry and its relevant sectors.

Nova Scotia

In Nova Scotia, the NSPS contract outlines a significant regional investment into the shipbuilding industry over 30 years, making this a notable regional initiative on Canada's east coast. Recent labour forecasts have predicted an increase of 16,000 jobs at peak employment. In addition, at peak employment, there will be $351 million in disposable income spent on cars, trucks, homes, and in stores, as well as more than $350 million in federal, provincial, and local tax revenue in Nova Scotia alone. GDP will increase substantially, with an estimated $661 million generated by the combat vessels fabrication project (PWGCS, 2015; Halifax Partnership, 2011). These promising labour forecasts have compelled strong attention to the development of a regional workforce.

British Columbia

In BC, the NSPS contract outlines a ~$8 billion dollar investment into the regional shipbuilding industry. This represents an increase in employment in shipbuilding & repair by 47% by 2016; and by 62% by 2020 (for a net gain of 4, 237 jobs) (SSRB, 2013; Work BC, n.d.)

Yet despite the scope of the NSPS project, the BC shipbuilding industry will remain dwarfed by other industries such as construction, forestry, and mining, and oil and gas (including LNG) in terms of job growth. Employment in mining, oil, and gas extraction is predicted to increase from 26,300 in 2012 to 39,400 in 2022 with a total 10-year employment increase of 13,100 (4.1% forecasted average annual employment growth). In construction, a similar increase can be seen – from 192,900 to 231,200 in 2022 with a total 10-year employment increase of 38,300 (1.9% forecasted average annual employment growth) (WorkBC, 2015)

The Liquified Natural Gas (LNG) sector is expect to expand rapidly, with two peaks of workforce needs in 2018 and 2022. Up to 100,000 jobs would be created between 2015 and 2023. These employment opportunities would include 58,700 direct and indirect construction jobs at the height of the construction phase in 2018, including 31,700 direct construction jobs and 27,000 indirect construction jobs (Work BC, n.d.) (StatsCan, 2015).

While the opportunity presented by NSPS is proportionately more significant in NS than in BC, the workforce squeeze is being equally felt in the two regions, as BC yards compete with other regional industries, and with their neighbouring province, and while NS manoeuvres to repatriate workforce from the west or recruit and build a new workforce locally. A variety of research has purported the demand for labour arising from NSPS to increase over the next 10 years (Malatest R. &., 2012; SSRB, 2013; Partnership, 2011; BC, British Columbia: 2022 Labour Market Outlook).

Ocean Tech Sector

Quantifying the size of the sector in Canada is challenging, as the sector has not been assigned unique North American Industry Classification System (NAICS) codes. Without these codes it is difficult to determine the contribution of the sector to GDP or to calculate current and projected employment numbers.

A 2006 study (ACOA, 2006) provides estimates of the size and activity level of the sector in Atlantic Canada. According to this study, Atlantic Canada has a strong ocean technologies industry with approximately 140 companies generating an estimated $330 million in sales annually and responsible for approximately 5,300 person-years of employment. This sector is predicted to experience rapid growth in the near future fuelled by the strong growth of the offshore oil and gas[3] and the defence/marine security industries (Atlantic Canada Opportunities Agency, 2006).

Sector growth on the west coast is similarly optimistic. The sector evolved alongside activities in offshore energy, defence and security, marine transportation and environmental monitoring, and marine clusters have been established in Victoria and Vancouver. Activities from these clusters, which include industry, academia, and private and government research centres, are estimated to contribute $785 million annually, and produce 5,230 fulltime equivalent employees (Ministry of International Trade, March 2014).

[3] Assuming the timely recovery of the oil & gas industry.

In-service Support Contracts

Regional forecasting of labour requirements has not yet included predictions for workforce for the in service support contracts (ISS) for NSPS. While predictions of workforce numbers are not available, the requisite skill and experience level can be surmised from similarly scaled projects internationally. These contracts outline tasks and responsibilities relating to the ongoing support, maintenance, repair and upgrades of ships produced through the NSPS program. Regardless of the procurement outcomes of these contracts[4], implementation will require highly specialized teams of workers with broad skillsets to perform the routine maintenance and repairs, as well as significant spontaneous capability to respond to the non-routine needs.

Some ISS models have demonstrated the effectiveness of a SME model that leverages local skill and availability (building regional supply chain capability) rather than committing to a dedicated team of employees (interview notes). Alternative models practiced by other ISS competitors endorse employment of a small core team of experts and seasoned trades who present a dedicated workforce whose singular role centres around ISS commitments (interview notes). There is some doubt among industry players that the contracts would provide sufficient work to justify assembling a dedicated NSPS ISS team. But there is also skepticism that local SMEs whose primary business centres on commercial work (at commercial-level standards), would possess the deep expertise to handle the range of repairs and upgrades (at warship-level standards) that could occur on these new state-of-the-art and comparatively bespoke ships.

In-service support follows schedules of planned maintenance, and ad hoc operational maintenance for repairs or upgrades. While shipbuilding generally follows a scheduled sequence of tasks and activities, in-service support can require just-in-time repair and problem solving, to minimize downtime and return vessels to their scheduled deployments. And so, workflows can be more sporadic and unpredictable. According to a report on the Australian shipbuilding strategy from RAND (Birkler, 2015), workforce requirements for ISS for warships can range from a few hundred to a few thousand depending on the tasks, and these peak labour periods can be brief, requiring the ability to quickly scale workforce up and down in response to service needs. This provides some rationale for conjoining the awards of build and ISS contracts, so that employers can move workforce between the two to build and

[4] At the time this report was written, the ISS contracts had not been assigned.

leverage experience and to have access to workforce numbers as requirements demand a rapid but temporary capacity shift.

Conversely, interviewees involved in international ISS activities contend that the skillsets of workers involved in in-service support often differ from those of counterpart roles in shipbuilding insofar as the latter generally involves interpreting clear and consistent specs repeatedly for each build, while the former may involve problem diagnosis, solution finding, solution testing, and the drafting of new specifications for a repair. There is considerable overlap in skill requirements, however ISS generally requires more competency in problem solving and creative and collaborative solution finding, competencies that take years of experience to cultivate.

While much of the work done for ISS involves skilled trades and technologists, the proportion of professionals involved in these activities far exceeds that in shipbuilding. The term of these contracts parallel the full life-cycle of the vessels, and will likely involve some combination of full-time equivalent roles and contractors. Work activities are time-sensitive, and maintenance teams often need to work in situ, getting in and out quickly to fulfill the primary objective of getting or keeping the vessel available.

In addition to experience gaps in ISS workforce, there will also be a gap in Management capability. The dynamic, swift and responsive environment of ISS work will require a project management orientation that calls for technical competence as well as problem solving, scheduling and coordination skills. Managers will need to be able to direct a team of equally skilled people to solve a unique problem or evaluate how ship equipment performs at sea.

A domestic provider of ISS will need to resolve this experience gap by finding ways to fast-track competency development through a combination of technical skill assessment and screening, formal training, on the job training and mentoring, and formalized knowledge transfer processes to continue building succession for these crucial roles. Formal training would include fundamentals of project management for ship support and logistical practices. Mentoring would focus on knowledge and experience transfer from a seasoned manager who can help to build an understanding of the support requirements of the whole ship, including reliability and maintainability, and modeling of the diagnostics processes that enable a manager to understand the nature of a problem, and the activities for correction. Presently there is no formal designation for ship support project managers, as qualifications are insinuated by experience. Formal certification would connote a reproducible

development pathway, but in the short term would exclude more experienced managers than it includes for this unique role.

The longevity, esteem and relative stability of these ISS positions will likely produce significant recruitment interest, but the challenge will be in finding talent with enough experience (and diversity of experience) and technical expertise. Already a rare combination, these experts will also be the focus of recruitment efforts elsewhere along the value chain and across the marine industry.

Project Details

Scope

The primary focus of this study will be on workforce development in the shipbuilding and ship repair sectors, but will extend to several sectors of the marine industry supply and value chains, and will be described as the Greater Marine Industry. This scope is defined by the common workforce needs, transferability of skillsets and competencies, and by the inter-reliance of sectors for success in meeting objectives and project commitments for NSPS.

In-scope

- Shipbuilding and ship repair (DND and Commercial contracts)
    - In-service support
    - General Manufacturing/Fabrication
- Suppliers for shipbuilding and ship repair
- Marine technology sector
- Marine-related R&D
- Marine Defense
    - Fleet Maintenance Facilities

Out of scope

- Aqua-culture
- Fisheries
- Recreational boat building
- Logistics and transportation related to in-scope projects
- Marine transportation industry (i.e. operations of marine transportation)
- Defense Industry generally
- Oil & Gas

Focus

For Canada to fully develop a competitive, export-ready Marine Industry requires a robust, skilled and ready workforce at all levels, including skilled trades and technology roles through to professional (primarily University-educated) roles. A sustainable industry needs to be relevant internationally as well as domestically, and this requires that we organically grow capability in skilled roles and in competitive design, management and leadership. Thus, the scope of this project will focus on education and/or training providers in the;

- k-12 system
- Community Colleges
- Universities
- Private training organizations (including industry and trade associations and union training providers)

Methodology

This qualitative study examined existing industry and government studies in relevant sectors, extant literature relating to key themes or constructs that emerged throughout the course of the study, and qualitative data drawn from stakeholder interviews. More than 120 interviews were conducted over a 9-month period with stakeholders from industry, academia, and government.

While the MPP project is national in scope, most of the interviews that informed this study were conducted with stakeholders from Canada's east and west coast regions, and from Quebec and Ontario. The primary reason for the focus on these regions is that they represented the most activity in the greater marine industry, as it is defined for this study. The second reason is that stakeholder networks seemed to be largely condensed within these regions, and thus interviewees were selected based on both purposive and chain referral sampling.

Outline of this Report

This study will first outline several of the issues or obstacles that may influence a workforce development strategy. Among the key challenges and opportunities that will be explored in more detail in the report include;

- Section A: Priority Issues in Workforce Development
    1. The History of Boom & Bust
    2. The socializing and normalizing of workforce mobility
    3. Social and systemic challenges to attracting talent to the skilled trades
    4. Workforce development issues in a unionized environment
    5. Developing Workforce Capability among Under-Represented Workers
    6. Developing Management and Leadership Capability
- Section B: Developing workers in skilled trades and technology roles
- Section C: Workforce development issues in a unionized environment
- Section D: Developing workers in professional and leadership roles

Also considered in this study are the workforce issues and opportunities that are relevant to a short term strategy (i.e. those that will be more reactive to immediate labour needs and demands and the upskilling of existing workers), and a long term strategy (i.e. those that will look more broadly at attraction, retention, education, and succession of workforce) for the greater marine industry.

The analysis in this report aims to help policymakers and educational program developers by outlining recommendations relating to;

- National workforce skills and resources
- Present (and predicted, future) capability gaps and areas for improvement
- Best practices in workforce development in similar or related industries
- Strategies related to attraction, retention and succession of workforce in the marine industry
- Aboriginal education and training strategy
- Recruitment, retention, and development of under-represented workers

Section A: Priority Issues in Workforce Development

Section Summary

- The history of boom and bust has created a confidence problem that has implications for industry commitment to workforce development, and in turn, implications for recruitment of seasoned workers who remain cautious of the promises of industry sustainability
- Interprovincial mobility is a growing trend that can be viewed as an opportunity to access larger talent pools, and shed and absorb available talent in response to project needs
- There is a growing bias towards academic pathways that makes it difficult to endorse non-professional career options. Much of this may be due to gaps in career literacy and in career coaching
- Employers are reporting declining skill levels in numeracy, literacy, document use and problem solving that present academic or workplace hurdles to young people leaving post-secondary education
- Management capability is becoming more complex as workplace skill requirements and positional power norms change. Skilled management and leadership capability is an immediate and significant gap in all sectors of the marine industry

Priority Issues in Workforce Development

The announcements of NSPS contracts in 2011 spawned intensive workforce development activities on Canada's east and west coasts. Industry and Government labour forecasts were drafted and refined, Community Colleges examined their skilled trades program capacity and surveyed industry to ensure that programs matched anticipated capability demands, including demands for marinized trades programs. Universities in turn reflected on engineering and marine science programs and evaluated the capability match between new grads and industry expectations. Private training providers were also upfront, offering customized programs tailored to company-specific needs. What united all of these activities was the common focus on;

- recruitment to the industry,
- development of relevant skills and knowledge,
- and, regional retention of the new and existing workforce

While revitalization of the marine industry was the common connection, these efforts remained bound by geography with little bi-coastal collaboration. And while some workforce issues are regionally specific, requiring provincially focused solutions, many are Pan-Canadian. The analysis of this report is aimed at identifying the ubiquitous workforce development issues that command collective resolution. The following outlines the priority issues that are common to many regions across Canada and that directly influence workforce development in the marine industry.

1. History of Boom & Bust

The history of boom and bust cycles in the shipbuilding industry has transcended time to sit in the memories of suppliers and skilled workers who remember it with both promise and disappointment. Many have argued that this history has prevented the establishment of a strong classical value chain nationally, and prevented the cultivation of expertise and intellectual property along high value parts of that value chain – namely in warship design, and combat systems design and integration. Many of those supply chain players who have survived the troughs have done so by focusing on other global marine markets or on domestic markets not related directly to shipbuilding or to defense contracts. For many of these already-prospering companies, the prize of NSPS is viewed as a ho-hum occurrence that won't change their operations or outlook dramatically, if at all.

The cycles of fat and lean have also broadened shipyard strategies away from specializing in targeted areas of shipbuilding, to become the 'jack of all' shipbuilding in order to take advantage of the scarce and unpredictable contracts. As a result, according to veteran participants in the industry, yards have not historically had an opportunity to enjoy the efficiencies and advances that occur as a result of focusing on developing expertise in niche build categories. This has also resulted in three separate and practically autonomous regional marine industries; one in Ontario/Quebec, and one on either coast. And in the absence of compelling incentives or opportunities for collaboration, these three have remained insular and regionally focused. The results of these industry silos, some argue, are;

- That the benefits and economies of scale that a national industry can deliver have gone unexploited
- Our competitive focus in shipbuilding has remained internal (contending for scarce contracts), rather than external, (becoming globally competitive).

A parallel challenge is that of confidence in the promise of a sustainable marine industry. Our history of boom and bust have hobbled the industry not just from a tangible resource perspective, but also from the perspective of faith in the future. Without confidence in the endurance of the industry nationally, we are faced with an endless chore of enticing workers, investors, suppliers and customers to regard us as a legitimate player. From a human resource management perspective, the impact of lack of confidence in the sustainability of the industry can be crippling. Similar workforce challenges have been felt in Australia where the consequences of bust-

related workforce loss are linked not only to loss of skills and experience, but also to an increase in errors and accidents and a decline in manufacturing productivity among those employees who do stay, all of which threaten to hamper the industry's ability to take on big projects or compete globally (AMWU, November 2013; Acil Allen, 2013).

Where industry players are looking for more workers with marine specialities, many learners are reticent to commit to deep 'marinized' training and concentration that could provide specialization in a field without promise, and that could limit opportunities for cross over into other industries in boom.

There is a widely held assumption that investment in workforce and infrastructure signal commitment to the sustainability of an industry. However, we have a history of abandoning sizeable infrastructure investments, and allowing an industry to bust. The Saint John Dry Dock, which became mothballed in early 2000 after completing the Canadian Patrol Frigate project, is a case in point. Industry will need more significant gestures of Government commitment to build confidence in the future of the marine industry, and to correct the image casualties of a history of boom and bust.

At the same time, this may be a call to action for marine industry players to resist the lure of reliance solely on flush Canadian Federal government contracts. If the future imagines an industry that is insulated from the cycles of boom and bust, then there is a need for an explicit push across the value chain to find other domestic and export markets beyond the Canadian Navy and Coast Guard.

Organizational Identity

A primary effect of a boom/bust industry and the subsequent loss of confidence in its future promise is a recruitment challenge that results in a workforce with deep gaps in succession and skill development. When considering recruitment and retention, the social impact of these challenges are manifest in the lack of commitment to, and engagement with, the identity of the industry or specific roles within that industry. A powerful motivator and driver of performance, engagement, loyalty, and work ethic, is the pride that arises from the passionate association with one's role and workplace identity (Tyler, 1999; Haslam, Powell, & Turner, 2000). Strong identity can be the glue that bonds employees to their professions or their companies – and without it, workers can more easily detach themselves, leading to attrition trends. This has multiple impacts, key among them being the hit to HR budgets as companies deploy new and continuous incentives to bait retention or recruitment. Strong identity is also intensely connected with pride in work, and represents a powerful lever for triggering the type of behavioural and attitudinal change required for transformational change. And indeed the change facing the greater marine industry will be transformational, as sectors face changes in innovation, work processes, organizational culture and human resource structures – all will the aim of evolving the industry to become a global paragon of modern production and innovation.

According to industry interviewees, employees in the shipbuilding sector of the marine industry in Canada possess weak attachments and loose identities with their sector. During interviews with employees, most defined themselves by their trade (i.e. '*I'm a pipe fitter'*) or profession (i.e. '*I'm a marine engineer'*), and some communicated their identity in terms of work they've recently done in other, more high profile industries (i.e. '*I've been working in oil & gas for the past 12 years*'). None included a reference to shipbuilding (i.e. *'I'm a shipbuilder'*). Even more alarming, when asked if they felt a sense of connection to the marine industry, most responses communicated weak associations (i.e. *'not really, what I do, I can do in any industry'*) to pessimism (i.e. '*what marine industry?! – this is just a contract – not an industry')*.

These attitudes reflect a low sense of confidence in the presence and durability of the marine industry. These attitudes may also be due to the relative absence of visible artefacts of workers' labour. Over the past few years there have been few tangible and highly visible products that workers can attach an 'I built that' identity with. But there are well-established yards internationally that have developed – and benefitted from – strong worker attachments. And we don't need to look any further than Bath,

Maine, to an iconic yard like Bath Iron Works, for evidence of the precursors for, and outcomes of, strong identity.

- **Legacy employment**. While BIW has the advantage of being essentially the 'only show in town' in terms of high-end, secure employment, this builds a deep initial sense of belonging, as new employees are brought 'into the fold' of a work team characterized by multi-generations of proud employees. This legacy of employment intertwines team inclusion with team performance and becomes a tangible reflection of the durability of the industry in that region, and of the livelihoods that rely on that durability. But legacy employment requires sustainability, and a commitment to retention throughout lean times.

- **Stewardship of the yard**. Strong identity is often anchored in a sense of stewardship that focuses on preserving and championing the industry to honor ones' forefathers and the generations to come. Stewardship acknowledges the boom and bust realities, and derives pride from the collective sense of responsibility for shepherding it through the tough times as well as the good

- **Impact and legacy of work products**. A powerful source of pride is the impact and legacy of the outcomes of work. It is important for leadership to connect employees' work to something on a bigger scale to build pride and identity. Workers in shipyards don't make disposable products. The outcomes of their hard work will endure for a quarter or a third of a century, and will become part of history. What they produce will be involved in national and international events and initiatives around the world, relating to peacekeeping, and peace-bringing, research, and disaster response. High quality work isn't just management mantra, it is what ensures that a ship will hold together in storms, and under fire from an enemy, and what helps us to bring our people safely home. These are powerful connection points between people and their work.

- **The art and science of the build**. Pride and identity in work are also derived from a sense of contribution to the work product. It is important that some work (i.e. design and engineering) isn't celebrated over others (i.e. trades roles). Emphasizing the art and science of the build unites management and professional staff with unionized employees around a common objective in authentic and tangible ways. This approach communicates that the burden is on the 'white collar' workers to make it easier and safer for trades to do their jobs, and in turn, the burden on the 'blue collar' workers is to lift the math and science from the page and metamorphose it into the art of the build. This symbiosis helps to minimize the sense of prestige of one function over another, and offers multiple defining identities with different but corresponding status. This can help to mitigate the sense of polarization of groups in the yard and build a feeling of a community assembling from several points to build together. This in turn can ultimately herald a collective '*We built that*'.

2. The Socializing and Normalizing of Mobility

Perhaps the most talked-about challenge is the normalization of worker mobility creating 'brain drain' and 'skills drain' from key regions. Canada's east coast has been enduring the diminishing effects of a retreating workforce of the most-skilled and most-educated to more employment-stable regions nationally (Ivany, February 2014). Even the west coast, with its numerous viable resource industries has suffered workforce cannibalization from the temptingly lucrative opportunities in Alberta and Saskatchewan. In Vancouver and Victoria in particular, the mobility trend is largely compelled by high costs of living relative to wages rather than to employment stability pursuits.

Whether it's cost-of-living or unemployment and instability that incent the departures from our coasts, the reality is that there is greater mobility of workers across sectors and regions (Ministers, 2013). These regions now have an established and embedded history of 'leaving for work', which normalizes and rationalizes this as a valid option. Indeed, during interviews with several young people entering the workforce from either coast, the notion of finding work locally had not even crossed their minds. For many maritime Canadians, this transient lifestyle is part of their lived experience, and they have been socialized to consider this as not just a reasonable option, but a primary one. This presents an enormous social and psychological hurdle that needs further study, and that needs to be considered in industry's attraction and retention strategies, and in our education system's career coaching programs.

Industry employers report significant benefits to nurturing a local workforce, including;

- mitigating the high cost of recruitment and relocation
- supporting deeper succession plans
- building an organization's culture from within
- cultivating expertise and capability in-house
- greater cohesion and collaboration potential among workers who share history and experience
- stronger commitment and engagement from workers
- a deeper sense of purpose and focus on a common goal

The challenge in unionized shipyards is that ship construction goes through distinct phases with some skills needed during one phase of a build and others at later stages. Without very flexible mobility or cross-training, there will invariably be lay-offs as

needs shift during a project. The question then is, can we view the fluidity between industries as an opportunity? Mobility of our workers can;

- Provide a way to scale up or absorb workforce as special projects commence or wind-down
- Provide unique opportunities to broaden work experience
- Expose workers to different 'ways of doing things' and to higher standards of excellence
- Build diversity in our workforce
- Provide access to established experts
- Promote a more sophisticated workforce as employees develop themselves to compete for a broader range of high profile engagements
- Cultivate deeper skill and knowledge with exposure to different regional or international projects

Industries often evolve and progress because of the human resources who lead them, work in them, and innovate for them. As we build a workforce with more sophisticated skills and deeper expertise, this talent could become the competitive trophy over which employers will fight. These realities simultaneously justify a need to collaborate nationally on workforce issues, and the need to develop separate regional workforce strategies to secure a regional 'employee advantage'.

Of course, the greatest challenge with workforce mobility is that the best talent can readily shift to follow the most compelling projects, leaving some regions struggling for talent. And, as recent events have shown us, key segments of our workforce (i.e. trades, technologists, and engineering roles) will go wherever the jobs are – and depart wherever they aren't. This may begin to feel like a national workforce development strategy is pointless and ultimately self-defeating at a regional level. But it actually speaks to the importance of integrating workforce strategies with other regional projects so that we aren't blindly competing for talent. The tension here is; do we try to restrict worker mobility to protect our regional workforce and the investments we've made in it, or do we facilitate that fluidity, but in a strategic way so that the industry overall can benefit?

Research has shown us that employees who are brought in early and whose talents and skills are cultivated in-house, and whose employers invest in their development, tend to stay with those companies or regions (CAF, Return on apprenticeship training investment, 2015). In simple terms, commitment and loyalty can be 'bought' to some

extent, with in-house development and perceived security. But this is only true for industries that are thriving and for roles that remain challenging and interesting. This is more likely to happen in regions where industries have sufficient integration and momentum and bench strength that they become magnets for talent, investment, research & development funds, and innovation activity.

Conversely, there is anecdotal evidence that mobility of many high demand roles is not driven only by opportunity and financial incentive. Many young workers report mobility as the draw itself. This is important to know in considering recruitment strategies that focus on repatriation of talent, as we may be building these strategies around a tasteless carrot.

3. Social and systemic challenges to attracting talent to the skilled trades in the Marine industry

A significant hurdle to the recruitment of new young workers to trades and technology careers is the social bias against what is perceived to be a plan-B education and career path. The tendency to elevate University education and white collar career paths to primacy in our options reflects a systemic cultural bias that is socialized in our homes, schools, and media networks. As Freeman (October 2014) noted, '*teachers and guidance counsellors have a bias toward University as the anticipated outcome of high school*', which in turn attaches a stigma to other options that young people might want to pursue. A more successful trades and technology recruitment strategy will need to be anchored in a new narrative around education choices that is aimed at countering the '*trades are for kids who have no other academic options*' stigma, and validating a broader range of choices and pathways.

This is a significant challenge to the marine industry in Canada insofar as it impacts recruitment to the skilled trades. Where labour market predictions foreshadow high demand across several industry sectors due to retirements and new job creation, many expect to see fierce competition for qualified and experienced trades. The first challenge will be getting our young people to consider skilled trades and technology careers as a possible and probable pathway.

Research has shown that parents have a significant influence over the career choices of their children (Department of Education, 2010) through how they assign social value to choices, provide encouragement (Leung, Wright, & Foster, 1987), or how they reinforce feelings of efficacy for a proposed choice (Bandura, Barbaranelli, Caprara, & Pastorelli, 2001). The messaging of valid or 'good' options are communicated to children implicitly and explicitly throughout their lives. This is an opportunity for Canadians to confront our own biases about achievement and education and begin to normalize and validate different options for our young people entering a constantly transforming workplace and labour market.

Some of this comes down to how we informally communicate the distinction between University and College education. The traditional view that Universities teach students how to 'think', and Colleges teach students how to 'do' needs to be challenged, as it polarizes academic achievement with skilled practice, assigning

greater value to one competency than the other, rather than connecting them as complimentary outcomes of a robust education system.

The traditional view also needs to be challenged because it is simply not accurate. There are no trades that don't require problem solving, reasoning and critical thinking skills, and no knowledge-based work that doesn't require some technical skill and applied ability. Furthermore, there is current research and anecdotal evidence that these supposed distinguishing areas of focus are emerging as worrisome competency gaps in our young people.

A telling figure is the roughly 40-50% of students attending community college in Nova Scotia and British Columbia who already have a University degree 'in their back pocket' (interview notes with administrative staff from several community colleges). Interviews with some of these students revealed the burden of this stigma – that many students pursue a University path by default ('*it was never really an option that I wouldn't go to University. I didn't know what I wanted to do, but I knew for sure that I was going to University*'), consuming several years of time and tuition before finding a pathway leading to employment. Students who did eventually switch to the college pathway often communicated that they were interested in education that related to a specific field and career – something they could apply straight away.

Ironically, the core of the stigma around trades and technology jobs is the belief that these choices will be career limiting rather than career launching. Where a degree in business connotes a whole career pathway, we tend to view trades and technology certifications as terminal; that the career options begin with apprenticeships and end with the certificate of qualification. In reality these roles open an array of possibilities with branching career pathways into teaching, administration, business ownership, management, supervisory and industry leadership roles to name a few. This highlights a significant gap in the communication of career paths for skilled trades and technology designations.

Some[5] skilled trades and technology workers eventually move on to become entrepreneurs and small business owners, however, there continues to be a gap in the development of entrepreneurial and business skills in existing training curricula.

[5] No data is available to quantify this as regional apprenticeship agencies presently are unable to track career progression of alumni beyond certifications and 5-year renewals.

Indeed, many declare that this gap reaches back to the early cultivation of an entrepreneurial mindset for trades apprentices. For many apprentices, the assumption is that they will get their 'ticket' and then go work for someone else; an assumption that may be further evidence of the stigma associated with trades roles. Many report that the notion of starting their own business never occurred to them, or had never been articulated to them. And for those who did eventually happen upon this pathway, most report developing business skills in an ad hoc and unstructured way that exposed their fledgling businesses as they learnt key business concepts 'the hard way'.

Planting the seed for entrepreneurism, and providing training around basic business acumen could facilitate earlier and more successful ventures into small business ownership, and elevate the appeal of a trades or technology career for young people. This highlights a related challenge with how young people develop career literacy; defined for this report as *the awareness of the myriad career options available to them, and of the education and training requirements that precede those options.*

Gaps in Career Literacy and Counseling

Career literacy and career counseling in schools emerged as significant gap areas relating to workforce development. Interviews with education departments in four key regions revealed that the official career counseling function in our public schools has been largely displaced by demand for more immediate and critical counseling and support (i.e. mental health, student persistence and retention issues, learning support). Where career counseling does occur, it is reported that guidance counsellors are not equipped with current training or with labour market and PSE data to provide relevant and informed guidance (Ministers Panel on Education, October 2014). As a result, advice tends to be limited to traditional academic programs and options that may be more a reflection of the counsellors' preferences than the students'

The result of this gap in formal career counseling is that it gives more weight to the influence of parents and peers, whose advice may be even less balanced and comprehensive. There is anecdotal evidence suggesting a link between the presence of a proximal role model (i.e. parent, relative, family friend) and career choice. And

although this link should be investigated with more formal study, it does suggest a preference for careers that are somewhat familiar and whose value can be validated through vicarious experience. It also speaks to a variable that could potentially define the scope of career options that are considered. To state that *white collar kids tend to pursue white collar careers, and blue collar kids tend to pursue blue collar careers* might be oversimplifying the socio-cultural influence of proximal role models, but it might also speak to the importance of providing alternative surrogate role models to young people through awareness and exposure building programs in the k-12 system, in order to fully leverage this influence. This also points to the importance of consistent and accessible career counselling for all students, and an earlier focus on career literacy in order to present a broader range of options and pathways to our youth.

Where parents yield a powerful influence over the educational and career pathways of their children, career literacy and counseling programs also need to be directed at them so that they can offer more informed guidance, and so they can feel 'okay' with endorsing an alternative pathway for their children. Additionally, classroom teachers may not have the capacity or the training to provide career counseling, however they can support a career literacy initiative by making more direct links between curriculum content and the careers that use the related skills and knowledge. This aligns well with objectives from BC's Skills for Jobs Blueprint and with Nova Scotia's Action Plan for Education, both of which aim to embed stronger links between curriculum and economic growth sectors.

Exposure and Awareness Building Programs in K-12

Exposure and awareness building programs are aimed at providing opportunities for young people to learn about trades and technology through hands-on interaction with the tools, resources and skilled workers who volunteer their time. These programs provide a brief glimpse into the tangible parts of the job, and many now also provide information on training and education requirements, as well as career pathways that proceed or bridge from this starting point. These programs are ultimately aimed at cultivating awareness, and more informed understanding, of trades and technology careers in the hopes of boosting recruitment and retention. The additional advantages of these programs is that they can introduce young people to a relatable role model who may challenge already-embedded stereotypes. These surrogate proximal role models can provide a more holistic understanding of the

charm and the rigours of their jobs and build a more realistic understanding of the skills and training commitments involved. This can improve recruitment and student persistence, as pathway selection is more likely to be a good 'fit'. This is especially important with programs that are aimed at girls (i.e. Jane of All Trades, Techsploration), and other under-represented groups, for whom a relatable role model is a scarce occurrence.

Some ongoing challenges and opportunities with these programs are;

- Many of the current programs are aimed at students in grades 10-12, and thus often occur after students have already selected an education pathway, or have already developed deeply embedded biases against and towards certain career choices. More programs need to be developed that cater to younger students (grade 3-9) to develop an understanding of, and appreciation for skilled work and technology early on, so that high-school course and pathway selection is more well-informed. These programs should also be developed with strong linkages to STEM curriculum outcomes to reinforce the relevance of the learning.

- Other current programs are voluntary, and thus their reach is predominantly limited to students (and parents) who are already considering the option. This limits the potential impact of exposure and awareness building programs, and misses students whose socio-cultural networks may not have coached them towards considering these pathways.

- It is difficult to evaluate the effectiveness or impact of current programs, as many don't (and aren't permitted to) track students to cross-reference those who attend the programs with those who ultimately select (and persist in) trades or technology training. It is also difficult to evaluate, as funding is often limited, and funding periods expire before they've had time to gain momentum and create enough impact to evaluate their success. Additionally, it is difficult to quantify the success of a program that also helps young people to screen themselves out, as the experiences help them to understand as much about what they do want to do, as what they don't want to do. Correlating student persistence and declines in attrition from programs (a success metric) would require sufficient funding and program duration to allow a longitudinal interval for tracking of students through k-12 to PSE selection and completion. In the absence of robust program evaluation, it is difficult to determine if these programs are indeed having the intended impact.

- There are very few awareness and exposure-building programs for other careers that are relevant to the marine industry, such as engineering and the ocean sciences. A recent study by WISEatlantic (Franz-Odendaal & Blotnicky, Career choices and influencers in science, technology, engineering and math: An analysis of the Maritime provinces, January 2014), revealed that students have relatively poor awareness of

the math and science requirements for STEM careers (or of the variety of STEM careers available to them). Similarly, the study showed that the majority of students reported that engineers 'build things', but had limited understanding of the role beyond that. A survey conducted by Ipsos Reid on behalf of Engineers Canada (Reid, 2014) showed that lack of awareness of the role is even a problem among engineering students, where more than a third of those engineering students who choose not to pursue a career in their field, indicate that it is because engineering is not what they thought it would be. These findings speak to the need for more targeted initiatives to raise awareness and build career literacy through exposure to an array of careers, and the skills and training they require.

On the east coast, OCEANS-NS (Nova Scotia), Oceans Learning Partnership (Newfoundland), and CANOE (British Columbia) are three regional initiatives that have emerged to fill this gap for the marine industry, offering hands-on learning opportunities for students and their teachers aimed at raising ocean literacy and awareness. More funding is needed for these programs to scale them for broader reach. And, while many of these initiatives have a strong ecological focus, it is also important to balance these programs with a focus on the oceans economy and the various careers that are linked to research, innovation and sustainable commercialization of the ocean's resources. Additionally, more similar programs are needed to provide early hands-on exposure to skills, knowledge and careers in the broader STEM category.

- Nationally, there are many fragmented and disconnected small regionally focused programs targeting the same or similar objectives. This scatters funding, effort and support, and results in situations where programs are funded to the point of survivability but not of impact. Initiatives that are funded provincially or federally find their endurance is limited to the term of government or to the portion of the pot that they must share. When money or tenure are exhausted, many of these projects fold just as they are beginning to gain momentum and awareness. There is an opportunity to consolidate programs with same or similar mandates to have fewer but more integrated programs that can benefit from deeper budgets and from more-experienced champions working together rather than against to compete for funding. There is also an opportunity to nationalize some programs to take advantage of consistency and economies of scale.

- There is an opportunity for Government initiatives aimed at supporting training, development, and engagement of underrepresented workers to sync with labour market opportunities and job availability. Poorly timed initiatives and funding result in a widening divide between industry employers and the workers disappointed by a labour market mismatch.[6]

[6] See section Developing workforce in Skilled Trades and Technology for recommendations

4. Developing Essential Skills, Workplace Skills, and 21st Century Competencies

Essential Skills

Essential skills (ES) are foundations for living, working, and learning, and are used in all jobs in varying degrees. They go beyond basic numeracy and literacy to include skills for everyday living, including tools needed for successful careers. The nine skills include reading, document use, numeracy (operations and applications), writing, oral communication, working with others, thinking skills, computer use, and continuous learning (Manitoba, 2015).

The impetus for focusing on essential skill development is found in the compelling correlation they have with several important metrics of success and achievement. Essential skills support effective learning, enabling workers to learn new skills and to possess workplace knowledge more readily. Essential skills also help workers adapt to workplace change, and make better decisions. Individuals with essential skills at level 3 -the highest complexity level for performing basic tasks (ESDC, 2015) - or higher are better able to apply technical skills to the more demanding and non-routine parts of a job, and are better able to articulate task-level challenges and problem solving. And, well developed essential skills allow workers to integrate information from multiple sources, summarize a situation accurately, compare and contrast advantages of different approaches, and apply criteria to a solution (CAF, Youth Apprenticeship Across Canada: Regional Roundtable, May 28, 2015). With all of these powerful outcomes, it is easy to see why higher levels of essential skills can make employees more effective in their jobs.

Unfortunately, many marine industry employers and educators report that new entrants to the workforce and to post -secondary education programs are lacking the minimum level of these skills to be successful and to contribute at the expected level. In a recent study by the Conference Board of Canada (The state of skills and PSE in Canada, November 2014), over 70% of employers who were surveyed reported gaps in the critical thinking and problem-solving skills of candidates and recent hires. This same survey found that employers cited challenges with insufficient oral communication (46%) and basic literacy skills (42%) among their workforce.

Numeracy fared slightly better with 22% of employers seeing deficits in the skills of their workforce.

The same report showed corresponding results from both Colleges and Universities, reporting declining student performance in areas of literacy, numeracy, and problem solving skills. And according to employers, new hires are entering the workforce without a sense of how to effectively apply their skill and knowledge in the workplace. The result, according to the Conference Board's study, is a PSE system that is failing to produce the volume or skill level of graduates that we need.

A study conducted by the Programme for the International Assessment of Adult Competencies (PIAAC) evaluated information processing skills that included literacy, numeracy and problem solving in technology-rich environments across Canada and compared the results with international data (OECD O. f., 2012). The study did not find a large variance in overall performance across most of the provinces and territories, but did find a significant (and validated) decline in numeracy and literacy scores among the 20-24 age group, and found a continuing gender difference in numeracy performance. While the subsequent cohorts seem to be on track to meet expected outcomes for essential skills, the decline appears to manifest in the 20-24 age group. Among this same cohort there has been an increase in attrition rates from post-secondary education that is often attributed to inability to 'keep up' due to gaps in essential skills. According to an expert in STEM education, some of this variance might be explained by the rise of mental health issues that tend to manifest during this same age period (interview notes). Longitudinal research will reveal whether or not this theory holds, but in the meantime, more investigation is needed to understand the apparent trend of essential skills decline among our youth.

According to an OECD study, roughly 13% of workers are under-qualified for their jobs, and deficits in literacy and essential skills confound the problem because adults who already show ES deficits tend to benefit less from training that sits atop basic skills (OECD, Skills Outlook, 2013). Essential skills, it seems, provide the foundation upon which technical skills can be developed and exercised. This has important implications for skills upgrade training for existing and returning employees to the marine industry, who may lack this critical foundation.

For some young adults (and older adults), these basic skills have not been well-developed, or have not been applied in a meaningful way, or they have eroded over time from lack of regular applied use. There is much evidence that continuous use

helps to maintain numeracy and literacy skills, and facilitates the acquisition of new workplace relevant skills. While adult learning programs may not be able to nudge the needle much on improvements (Reder, 2011), they can mitigate the slide and decline and atrophy of skills that can occur from lack of use (OECD, 2013).

Some important questions to ask are, *how are we graduating so many young people who lack the required level of these essential skills?* And even more importantly, *how can we reverse this decline for the next and future cohorts participating in our education system?* Research into these questions point to the following possible explanations;

- **Essential skills development may indeed be in decline in our school system**. Some learning professionals contend that math and numeracy skills have declined over the years due to a combination of factors that may include pressure to keep students in age-groupings rather than competency groupings, pressures to permit students to progress through the grades regardless of outcome achievement, and the influence of technology that can disguise numeracy and literacy gaps and allow students to meet curriculum outcomes without developing the skill level required to perform a skill independently and in the absence of technology (interview notes). Where technology can potentially allow learners to bypass certain essential skills, social pressure can produce more forgiving assessment standards that stretch the range of expected achievement to the point that it includes all but the most exceptional outliers at either end.

  Additionally, according to interviewees from industry and academia, programs like the applied math or trades math have scaled back content and outcomes to make the curriculum more accessible to a broader range of achievement levels. However, anecdotal reports indicate that this has resulted in a math 'light' course that boosts course completion at the expense of building essential skills and competencies. These issues can result in a graduating class with a vast capability range. The challenge, then, is that the high school diploma becomes an unreliable endorsement for standard skill and knowledge achievement.

- **Esssential skills are shifting as new technologies require different minimum qualifications to access and learn these technologies.** In fact, adaptability to new technology is now itself an essential skill. This highlights a significant paradigm shift as the skills and knowledge and teaching and learning styles that have gone uncontended for years, suddenly come into question. At the centre of this paradigm shift are questions like; *are we teaching the right kind of literacy for a digital world where content transcends form and structure? Are we teaching math skills and concepts that are relevant and most-useful in the 21st century?* These are difficult

questions to ask and to answer, given that we are ourselves the product the very education system in question.

- **There is a mismatch between how essential skills are taught and evaluated in our schools, and how they are applied in the workplace.**
  According to the OECD (2013) report, the top priority for today's learners are information processing skills, including the ability to access, analyse and communicate information. Not only are these skills relevant in the marine industry, they are also highly transferable. What is not a priority for today's learners, is committing large banks of information and facts to memory. Our digital world is rich with information and data, and the skills our learners need today involve accessing, filtering, synthesizing and analyzing this plentiful data. This shift highlights the evolution of a work environment that has not seen a parallel shift in the education system that feeds into it. *Are we teaching the most relevant skills for a modern world? Are we fairly evaluating the acquisition and application of those skills? Have we unfairly allowed essential skills, namely literacy and numeracy, as they are presently being taught and assessed, to become barriers to participation in a work world, where what it means to be 'literate' is itself changing?*

These are complex questions to explore, and the counter side of these queries wonders what will happen if the lights go out? If the technology fails, is there enough deep understanding of a skill and process to be able to perform or problem-solve without technology? 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 continuous learning and development becomes unquestionable, and so too does recruitment of a workforce with the necessary foundation that will enable skill progression throughout a career.

Essential Skills Training and Support for Adult Learners

Industry and PSEs have been swift to provide a response to these purported gaps in essential skills (ES). Several community colleges and Universities now offer online assessment and training programs, including a MOOC (massive open online course) offered by Saskatoon Polytechnic, a pre-technology program called Academic Career Connections at the NSCC in Nova Scotia, and the SRELT (ship repair entry level

training) program offered by Camosun College in partnership with IMTARC in BC. Additionally, ES training is also offered by several apprenticeship agencies and private training providers, and by Union and trade associations. Unions have been particularly supportive of programs that support basic education insofar as it supports equity and participation in the workplace, and contributes to employability (Bratton, Helms-Mills, Pyrch, & Sawchuk, 2003).

However, the efficacy of these essential skills development and upskilling programs has come into question. A study by Reder (The Longitudinal Study of Adult Learning: Challenging Assumptions, 2011), however, found no correlation between adult basic skills programs and proficiency gains. According to this study, proficiency improvements were linked to engagement – in other words, people who were interested in improving their basic skills, tended to practice more at home with authentic literacy and numeracy, and improved equally with or without formal training. This was consistent with earlier research by Purcell-Gates et al (2000, 2004) which also found that it required 5-6 years to develop significant proficiency improvements, which calls into question the efficacy of the condensed (i.e. 3-12 week) ES training programs that are currently being offered.

In contrast, a study conducted by Social Research and Demonstration Corporation (SRDC, August 2014) found a positive correlation between workplace literacy and essential skills training and workers' skills, job performance, and other social and economic outcomes. Similar findings were reported following a five-year study of training initiatives that showed improvements in technical and math skills, and literacy and computer use skills. These improvements were also linked to improvements in firm productivity, error rates, and relations between colleagues and customers (CBoC, November 2014). How much improvement was achieved was not quantified or shared, and it is difficult to know if the purported improvements were related to the training itself, to engagement effects, or to a Hawthorne-type effect[7]. This reveals an important need for more study to determine the efficacy (and ROI) of adult-oriented essential skills training.

Several provincial departments of education have highlighted as a priority, tightening the alignment between k-12 curriculum and future workplace skills. This includes objectives relating to curriculum relevance and practical application (BC, 2014; Ministers Panel on Education, October 2014; Education, January 2015).

[7] The Hawthorne effect refers to behavioural changes that are brought about by the awareness of being observed. (Wickstrom & Bendix, 2000)

Workplace Skills

'Workplace skills' is a colloquialism for the non-cognitive and non-technical skills that people need to enter, stay in, and progress in the world of work. Ostensibly, this term refers to the banal collection of attitudes and behaviours that many of us take for granted, but which are sometimes absent. Comprising personal management skills such as showing up on time, putting in a full day's work, being responsible, dependable and accountable, having a positive attitude and a willingness to learn, and knowing the difference between social time and work time, these workplace skills, or employability skills (CBoC, November 2014), describe the attitudes and behaviours that relate to someone being a reliable employee (CBoC, November 2014).

With young people entering the workforce, the absence of these skills is often interpreted as defiance, but may in fact be a function of lack of awareness or opportunity to cultivate these skills. Interviews with stakeholders from industry and academia revealed anecdotal evidence of a growing problem with workplace skills among new entry employees and PSE students. One possible explanation for this growing gap is that young people are entering the workforce at a later age than ever before (Centre for Generational Kinetics, 2015). In fact there is a growing number of young people who don't have their first employment experience until after they've completed their post-secondary education (Council of Economic Advisors, October 2014), which means they are starting entry-level roles without any of the workplace experience they might have developed with a part-time job in their teens. Instead of learning some of the 'hard lessons' of workplace dynamics, protocol, behaviour, and time management (Industry Training Authority, 2015) in a part-time job where the risks are low and the supports are high, young people are entering careers with an empty arsenal of workplace skills to rely on.

This is a confounding challenge in any industry, but especially in the marine industry where mentoring ratios will be stretched and workforce numbers will grow quickly and steeply. Having to monitor and coach workplace skills on top of essential skills and the technical skills of the job could produce unwieldy demands on supervisors and senior staffers who are themselves adapting to the rigours, pace, and change of modern-day production.

21st Century Competencies and Workplace Relevance

A central question in our education system is, and should always be, '*what are we educating our students to be able to do*?' This question highlights the economic imperative to '*ensure young people entering the workforce have the lifelong skills and competencies that employers are increasingly looking for: creative thinking, problem solving, initiative, curiosity, and the ability to lead and work well in groups*' (Ministry of Education, BC's Education Plan: Focus on Learning, January 2015). Interviews with partners from the marine industry indicated that our education system is falling short in this regard. Several employers cited particular challenges among new employees to apply skills such as document use, numeracy, oral communication, working with others, and especially thinking and reasoning skills on the job (interview notes).

Most interviewees also reported that young graduates demonstrate a deficiency in applying their knowledge to the work environment, and communicating ideas or solutions with colleagues from different departments. This points to important opportunities for more and earlier industry experience throughout the phases of a diploma, degree, or designation, to provide opportunities to lift learning from structured concept to applied discovery, and to develop skill in working with collaborative teams with diverse world views and expertise. Opportunities that include co-op programs, capstone projects, and internships provide the industry experience needed for students to see how flat curriculum concepts are given dimension in the 'real world'.

Departments of Education in several provinces are presently overhauling their provincial curricula, with an aim to more readily target the development of 21st century competencies (interview notes) such as adaptability, critical thinking, creativity and innovation, communication and digital literacy, to name a few, and to provide an earlier introduction to these skills so that graduating students will be ready for the workforce or for advanced training and learning (BC, BC's skills for jobs blueprint: Re-engineering education and training, 2014).

These competencies align well with the nine essential skills and reflect a transition towards an emphasis on engaged thinking, critical assessment and evaluation of information, and deep analysis. These 21st century competencies also outline the attitudes that are essential for success in a present and future workplace, including lifelong learning, self-direction, entrepreneurial spirit, and personal management. To

support these curriculum upgrades, there is also a need for updated teacher training and development.

Linking Curriculum and Workplace Relevance

Most regions across the country offer opportunities for students in grades 11 and 12 to take specialized courses that yield a 'dual credit' towards both secondary school graduation and toward a post-secondary program. Also referred to as 'dual enrollment' or 'concurrent enrollment', these programs are regionally driven by key objectives of providing support for career-oriented students, to increase high school retention and completion (especially among at-risk students), and conversely, academic acceleration opportunities aimed at challenging high achieving students seeking advanced standing in an academic or professional program (FitzGibbon, March 2015). Ultimately these programs provide an alternative credentialed learner pathway that can accelerate academic careers.

Research has shown promising benefits to these programs, including the development and implementation of rigorous preparatory curriculum, reduced remediation demands, increased credential completion (Krueger, 2006), smoother transition experiences for students (Ministry of Education, Recognition of post-secondary transitions programs for funding purposes, 2005) and preparation for that transition. Participants in these programs have identified the additional financial benefit of trimmed tuition costs (FitzGibbon, March 2015) as some of the course requirements are completed in the public education system. The recruitment benefits to partner PSIs present an additional positive outcome, as does the increased focus and intention of first year students who transition along the dual-credit pathway. It will be interesting to study student persistence and performance among these cohorts to gain deeper insight into the benefits of these models.

Provincial programs like the ACE-IT program in BC and the Pre-Apprenticeship and Technical/Workforce Entry programs program in Nova Scotia offer opportunities for students to get a head start on apprenticeship training while concurrently completing their high school credentials. These programs offer numerous advantages of awareness and exposure building, skill and experience building, credit granting, and

also strategic attrition, where young people can make a relatively informed decision to opt-out before making an expensive and morale-eroding commitment to a career path that disappoints.

Many schools and PSIs (post secondary institutions) across Canada participate in dual credit granting partnerships, however several administrators report that these programs remain undersubscribed (FitzGibbon, March 2015), likely due to lack of information and awareness of dual credit programs and the transitions they can facilitate (Ontario, March 2013). This speaks to the importance of more strategic career counseling for students (and their parents) at a much younger age to support important course and pathway decisions that need to be made at the end of grade 9.

Despite these numerous and laudable positive outcomes, the dual credit model is an imperfect one. Improvements can be made in alignment between exit outcomes and entrance expectations of partner schools and PSIs. Greater consistency between these expectations and the sequencing of learning can also facilitate articulations or MOUs between broader networks of education partners.

Similarly, there is also more opportunity for early-commencement of post-secondary learning for high-achieving students, offering challenge, specialized instruction, and expedited learning in marine-oriented fields such as engineering, technology, and marine sciences. These options fulfill an appetite for career-relevant learning and practical application.

5. Developing Workforce Capability among Under-Represented Workers

The scope and scale of the workforce needs for NSPS present an ideal scenario for exploring caches of underrepresented workers to fulfill the demand, and to advance diversity initiatives and mandates within this conventional industry. In the context of the marine industry, under-represented workers include women, immigrants, Aboriginal people, visible minorities, and people with disabilities. While on the surface these cohorts of people seem distinctive with little in common, they are united by career marginalization from an industry that has been slow to update its hiring practices and the composition of its workforce.

While society as a whole has made substantial progress toward more diversity and tolerance in the workplace, the marine industry has lagged in efforts to stir-up its homogenous workforce. This has been due to multiple factors that include;

- low turnover across the industry for the past two decades, resulting in few new hires
- the presence of numerous SMEs with low staff counts coupled with highly specialized role requirements, or with reactive rather than strategic hiring practices
- low relative visibility over recent years resulting in low awareness of the industry among diverse job seekers,
- practices and policies that may unintentionally undermine recruitment and retention of non-traditional workers, such as seniority-based retention (during lay-offs) and call-backs (during booms) that make it difficult to enter the industry or progress through trade certification or career development
- perceptions of discrimination from employers and fellow-employees
- good intentions but low awareness of how to hire an under-represented worker, or of the financial incentives and other supports available to employers
- conventional recruiting strategies that have not included a diversity mandate, or that privilege social familiarity over performance potential
- lack of awareness of the innovation-driven adaptations that have lessened the physical requirements of many roles, and that could make these roles more accessible to people with disabilities

The marine industry is embarking on a long term project with spin-off opportunities along its supply chain that ripple out to secondary and tertiary sectors. At least from a workforce development point of view, the 2011 NSPS announcements presented an ideal runway for building workforce strategy. The scope, scale, and term of the NSPS projects will transform jobs into careers, and will require such bulk recruitment as to allow for the rejuvenation of its conventional workforce to include a broad range of employee cohorts. The lead-up time has been substantial enough to allow for the

development of strategic recruitment plans. Employment and training support agencies and programs like FNES (First Nations Employment Society), Women in Trades and Immigrants in Trades in BC, MEBO (Mi'kmaw Economic Benefits Office) and Women Unlimited in Nova Scotia have had significant time to understand the barriers, and then locate, develop and train talent, and build relationships with employers to support job competitions from a broad range of under-represented workers. Hiring cohorts (i.e. groups of two or more from an under-represented group) has been shown to support retention (MNP, June 1012) and performance on the job (interview notes), as it facilitates social support and integration, reduces the self-consciousness and alienating effects of being a "token" representative, and helps to shift culture and build tolerance among existing workers. And as teams become more diverse, and as succession pulls diversity upward in the org chart, these recruitment and progression practices become normalized, and the shift towards a more heterogeneous workforce becomes standard practice.

This is the theory around workforce diversification, and for larger yards and suppliers in the marine industry this strategy is slowly taking shape. But among SMEs along the broader supply chain the shift is less smooth or convincing. Because the bulk of the expected workforce demand will be in skilled trades and technology roles, this is the point of entry into the industry that employment support initiatives are targeting. Ideally, a long term strategy will see under-represented workers across the spectrum of marine-oriented careers, levels, and professions, but the short term focus is on building capacity in skilled trades.

Unique Obstacles and Challenges

Women

Women continue to be under-represented across the sectors of the marine industry, from skilled trades work (CBoC, The State of Skills and PSE in Canada, November 2014) to senior roles in ocean science and research (Holmes, 2014). According to the Canadian Council of Directors of Apprenticeship, participation of women in Red Seal trades has remained fairly steady with respect to completions and new registrations since 2010 (CCDA, 2013), however there continue to be few female trades in the marine industry for a variety of reasons, including;

- the 'brotherhood' culture that predominates shipbuilding and repair presents a significant social deterrent

- females are not socialized for trades work generally, and even less so for marine oriented trades, which are regarded as highly physically demanding and are perceived to involve harsh working environments[8]
- continuing preference among girls for non-STEM careers (Franz-Odendaal & Blotnicky, January 2014)
- career counseling that continues to under-promote entrepreneurship and non-academic pathways for females
- perceptions of workplace discrimination and harassment
- absence of proximal female role models in STEM careers (Franz-Odendaal, Blotnicky, French, & Joy, January 2014), trades careers, and industrial marine-oriented careers

Ocean technology and manufacturing industries are still dominated by males, in professional roles (i.e. engineering) and entrepreneurial roles, though there are many women in lower wage production roles.

Immigrants

Across the marine industry immigrants tend to be under-represented, except in R&D and ocean science roles where individuals are often recruited internationally for the deep expertise they possess. In other career areas like skilled trades and technology roles, immigrants comprise only 3% to 5% of apprentices nationally, but represent 20%[9] of the Canadian population (Canadian Apprenticeship Forum, 2010). This may be in part due to selection criteria which tends to privilege academic and professional qualifications for those immigrating to Canada[10].

It may also be due to the preference for some marine-specialization or experience, and awareness of Canadian regulations and codes, which restricts even those who arrive with trade qualifications from competition for these roles.

A third potential explanation may be that immigrants often aren't able to forgo early employment in favour of training and educational pursuits, and so don't consider the skilled trades (and the requisite training) as an initial option. For those who do, the

[8] Technology has removed many of the physical barriers of marine trades relating to strength and reach requirements.

[9] 27.5% of total population of BC (BCSTats, November 2011)

[10] 42% percent of immigrants who arrived between 2001 and 2006 had a University degree, compared with only 16% of Canadian-born individuals
had a university degree compared to 22 percent of immigrants who arrived prior to 2001, with only 16 percent among the Canadian-born (King, March 2009)

biggest challenge cited is discrimination when trying to find an employer (Canadian Apprenticeship Forum, 2010; CBoC, November 2014). This hurdle can be more pronounced among SMEs where less sophisticated recruitment policies and strategies (or none at all) may be in place, where employers may feel more comfortable with a familiar hire, where there may be skepticism about the validity of foreign credentials, or where there may be a tendency to infer incompetence from communication challenges (i.e. an accent or ESL). Furthermore, in the shipbuilding and repair sector, defense contracts make it difficult for many immigrants to participate due to Controlled Goods regulations that restrict recruitment[11].

The topic of stigma already addressed in this report (see *Section A: Social and systemic challenges to attracting talent to the skilled trades in the Marine industr*y) may be more pronounced for immigrants – at least for the second generation. Interviews with immigrant trades workers revealed a common 'improvement' motivation for their choice to move to Canada. For some, trades work is seen as a relatively easy and acceptable point of entry into the workforce, but confess that the allure of Canada, and the expressed purpose of immigration, is the promise of a better life for their children. For many immigrants this promise is manifest in a white collar career. It will be very difficult to legitimize a different version of this achievement dream for many immigrant parents.

Visible Minorities and People with Disabilities

Many of the issues already mentioned present similar entry and retention barriers to visible minorities and people with disabilities. The absence of visible and relatable role models is a significant challenge, as is the reluctance of some employers to step outside of the comfort zone of a familiar hire. Some employers expressed concern with how a visible minority or person with disabilities would 'fit in', and showed lack of awareness of how differently-abled individuals could contribute with minor modifications and accommodations. Others said they would be very happy to hire from these cohorts, if only they would apply. This speaks to gaps in career awareness and a tendency to overlook the marine industry as an available option. It also speaks to an opportunity to highlight the contributions that these groups have made to other

[11] At the time of the writing of this report, this was primarily an issue for NSPS contracts involving Irving Shipbuilding Inc.

industries, and educate employers on the accommodations and supports that are available for people with disabilities in the workplace so that employers don't dismiss these workforce cohorts with hyperbole.

Aboriginal Peoples

The Aboriginal population in Canada is younger and growing faster than the general population (Industry Training Authority, 2015), with a 45% growth rate from 1996 to 2006 - six times faster than the non-Aboriginal population (Statistics Canada, 2013). This growing cohort of young Aboriginal people will yield considerable generational strength, and is expected to play a key role in Canada's workforce (Statistics Canada, 2008, 2013) at all levels. In the short term, strategies are focussing on addressing the most compelling workforce needs in skilled trades and technology, and in SME regional suppliers.

Many Aboriginal communities across Canada have expressed a priority of looking to engage with employers and industries that are interested in sponsoring careers versus temporary jobs. In the past, opportunities to engage with industry have either been narrow (one or two temporary opportunities), or the opportunities have been sporadic and random, where sudden conclusions to projects resulted in a concurrent bust in employment for many community members. NSPS presents multiple potential opportunities centred in, and branching from, a single sector. And while there is a risk in aligning a community too closely with a single industry, the duration of these contracts and of the committed regional benefits provide an anchor for many communities and individuals to have faith in this promise.

According to a report by the Conference Board of Canada Aboriginal people are already proportionally over-represented in the skilled trades, with 14.4% of Aboriginal people in Canada holding trades certificates versus 12% of general population (The state of skills in Canada, November 2014, p.21). For the most part, these workers have pursued careers in the construction, forestry and oil & gas industries, but proportionately fewer have ventured into the marine industry or its supply chain in trade, technical, or professional roles. Low participation in the marine industry may be attributed to a variety of reasons, such as;

- **Collectivity**. Many Aboriginal communities are collectively- versus individually-oriented, and often possess strong notions of intergenerational raising of children, both of which give rise to a heightened sense of belonging to the community. Career development is often cultivated within the context of community involvement and finding a place and a way to contribute to the collective well-being through within-community employment. This adaptive inward focus builds strong community connections, and the safety and familiarity of belonging confers a strong motivation to remain within the community. The adaptive community benefits of collectivity do come with some notable drawbacks;

    - As communities grow, populations of working-age individuals outgrow the available positions within an Aboriginal community, and so outward search for opportunities becomes necessary. But, inward focus may limit the awareness of alternative careers and roles to play that exist outside the community. The visible jobs are the ones in the community, so it is difficult to develop awareness of the range of available options. Additionally, many young people are unaware of how to initiate a job search outside of the community, and proximal role models may in turn have little or no experience to share. Aboriginal people looking to develop careers need to reconcile collectivism with the need to leverage opportunities in the broader regional or sectoral community.

    - Leaving a very close cultural community has a much higher social cost than that of other students or workers from rural settings. Community and familial obligations, and the loss of direct community support can be powerful deterrents to exploring different career options outside of the community. Proportionately high drop-out rates from colleges and Universities (Finnie, Childs, & Wismer, 2011) is often attributed to the crises of identity and separation that many young Aboriginal people experience from leaving their communities.

    - The challenges with supports for relocation can be especially difficult for individuals who have developed dependence on social assistance for financial and practical supports. The need to 'fend for oneself' in terms of housing and utilities can make it very difficult for those ready and willing to leave the community for opportunities based in large urban centres for entry level wages. The challenges of relocation support is especially difficult for Aboriginal Women and single parent families.

- **Project Mindset.** The preference for seasonal work is still the norm, according to some community leaders who have highlighted 'building a career mindset' as a priority. Where trades careers associated with the respective shipyards are generally being promoted as full time positions, there is a disconnect between industry and Aboriginal worker needs. According to Aboriginal leaders and researchers, this

preference for temporary work has been socialized over several generations of alternating employment and unemployment seasons. Additionally, interprovincial mobility trends among non-Aboriginal youth are being repeated in Aboriginal communities. And while this does show a promising surge in employment participation outside of the familial community, the temporary-nature of this work is reinforcing the temporary project mindset, which is counterproductive to the career priority of many Aboriginal community leaders. Interprovincial mobility, for many Aboriginal workers, is seen as the compromise between leveraging employment opportunities outside of the familial community, and having downtime to return home. This speaks to a strong need for career coaching in schools to socialize alternative career paradigms that will allow interested youths to explore more permanent options outside of their communities. The shift in mindset also reinforces the need to train for skills that are transferable so that individuals develop broader employability.

    - Where mobility is on the rise, many aboriginal youths are finding surrogate communities in 'friendship centres' established by industries or post-secondary institutions. These centres provide the cultural connection, formal supports and services, and the informal social support to help young people transition away from home and build new connections. These friendship centres are much more well-established on Canada's west coast, presenting an opportunity for Atlantic Aboriginal communities to partner with Government, PSIs and industry to establish these centres of support.

- **Tax exemption motivations.** There is a belief among some employers that Aboriginals are not interested in considering work that is 'off reserve' because of the exemptions from income tax that apply only to employment on-reserve. This has resulted in some employers simply not bothering to engage with communities during workforce searches for projects distally located from reservations. According to some nation leaders, the significant boost to take-home pay that comes with tax exemption is often countered with higher-wage or higher status employment outside of the community. Many Aboriginal community leaders are working to modify the mindset towards off-reserve employment, reinforcing the message that the pride and dignity associated with a good job for a prestigious company can compensate for the tax advantage, and for the departure from the community.

- **Awareness and exposure challenges.** Many Aboriginal communities exist in small, rural locations, often far distances from marine-oriented industries or from PSIs that offer marine-oriented training and education. Where communities are coastally located, such as the Coast Salish people of the Pacific North West, there is often more awareness of career opportunities and engagement occurs more readily. In rural and remote communities, however, these jobs that are not proximal or visible and role models may not be present to represent attainable options.

- **The myth and cynicism of employment opportunities.** For many Aboriginal people, the good jobs for big companies are unicorns – myths that are discussed, but no one has seen it happen. There is a prevalent belief that these jobs are unattainable, even with the right training and credentials, and so lack of faith in the promise of these jobs has discouraged many Aboriginal workers from even trying. This challenge also limits SME engagement along supplier lines, as some small companies believe 'regional development of SMEs' is rhetoric or is limited to suppliers who have already established points of entry into Prime or Tier 1 and 2 players in the industry. This perception gap has interested Aboriginals intimidated to approach industry, and industry assuming disinterest from Aboriginal communities. Once people start to see that the jobs are real, and that education and training are legitimate pathways to these jobs, and that supplier development is a regional and national priority, there will be a shift in optimism and confidence in the opportunity to participate in this industry. But this will take time and careful recruiting and selection and support of SMEs to optimize successes, and it will take noisy celebration to announce and celebrate community successes. Often there is too much emphasis on the failures which sends negative and demotivating messages to community youths.

- **Disconnect between Government initiatives and Aboriginal interest.** There is some criticism that Government employment oriented programs like the ASETS program (Aboriginal Skills and Employment Training Strategy) fail to meet the demand for training. These programs generally have training objectives that link directly to labour market demands, such as helping Aboriginals complete apprenticeship programs and find careers in the skilled trades (Government, 2015). While these objectives are employment oriented, funding usually does not extend to trades or skills not identified by labour market forecasts, regardless of interest. The disconnect here is a philosophical one, between a broad Government mandate to democratize education, and a regional mandate that doesn't extend beyond labour market demand.

- **Ability to quickly assess capability and capacity at community level.** On both coasts communities reported challenges with keeping track of community-level capability and capacity, information that needs to be readily at hand to respond to industry or government requests for workforce. Often the data does exist, but antiquated database platforms make it difficult to conduct advanced searches. Additionally, the effectiveness of these databases is reliant on the quality of the data and the recency of the data – both of which are compromised by regional and inter-provincial mobility. This challenge is repeated among the general population of skilled workers as well, where an integrated digital strategy is needed.

In the territorial north the key workforce focus is on building capability to advance economic development across the region (CANNOR, 2015). The Northern Adult Basic Education program is intended to improve access to training and post-

secondary education (Canada, Northern Adult Basic Education (NABE) Program, 2015), to build an engaged and skilled northern workforce. Through NABE, three northern colleges, including Yukon College, Nunavut Arctic College, and Aurora College are receiving funding to increase intake, build new courses, and improve teaching resources. The guiding assumption with this workforce development strategy is that investment in the north is presently hindered by the absence of an available and capable local workforce. For some companies, the expense of transferring non-local capability into and out of the region is prohibitive to project viability. The hope is that local capability will be the draw to attract investment into the region. The challenges with this strategy lie in predicting the required skillsets, engaging local workers in these skillsets, and in matching workforce readiness to project start dates. Timing is paramount to mitigate the risks of skill erosion or workforce defection that result from readiness mismatches. This presents a classic chicken-and-egg challenge, as capability is needed to attract investment to a region, but jobs are needed to justify investment in workforce development. Readiness mismatches are costly to industry and demoralizing to workers. And in the marine industry, most of the jobs that are expected for northern regions involve highly specialized expertise – not the types of roles that fall under the purview of an adult basic education agenda (interview notes).

Aboriginal youths are presently the fastest growing demographic in Canada. But this will likely level out, as most countries and communities have shown a strong direct correlation between higher graduation rates and post-secondary participation, and decreasing birth rates. But as PSI participation increases, and as the marine industry becomes more visible and welcoming to Aboriginal workers, there will hopefully be an increase in participation in marine-oriented academic, professional, and trades careers at all levels of employment.

Common Obstacles and Challenges

The marine industry is a lesser-known industry generally among Canadians, and for under-represented workers, it is even less familiar and less-easy to navigate. Among under-represented workers there are a number of common obstacles and challenges that restrict these individuals from conventional participation.

- **Absence of role models and perceived restricted accessibility of the industry**. This challenge is not unlike that facing the general Canadian population, where exposure to a proximal role model (family member or friend working in trades or in industry) is a key factor in decisions to enter the industry (MNP, June 1012), but is amplified by the interrelated barriers that appear in the absence of role models.

    - For under-represented workers, the historical low participation in the industry serves only to perpetuate this pattern. The absence of relatable role models presents a significant hurdle to diversity initiatives, and reinforces perceptions of chauvinism, racism, and Canadian nepotism. The absence of proximal role models not only restricts awareness of potentially curious job seekers, but it also eliminates the positive influence of in-house champions who could advocate for like-candidates, and who would signal the presence of a social network to support integration into the workforce.

    - Many under-represented workers are discouraged by the perceived lack of accessibility, or lack of a way 'in' to the industry, which is reinforced by the appearance a homogeneous workforce. In trades and technology roles, workers often rely on the diversity mandates of union halls who do much of the hiring. In the trades, some recruitment practices restrict hiring to 3rd and 4th year apprentices, or Red Seals exclusively, which makes it nearly impossible for under-represented workers who are new to trades to enter the industry. The complexity of marine-oriented trades and technology roles, and the preference for 'marinized' credentials can also be a deterrent to under-represented workers who may be considering a transfer from another related industry, but who don't want to commit to a deep specialization on top of their existing qualifications.

    - Under-represented trades workers who were interviewed reported a reluctance to approach employers for apprenticeship placements, citing worries that they won't be given fair consideration, or that they won't be treated justly by co-workers. These expectations are not unwarranted, as the lack of employer willingness to provide diverse

people with jobs has been well established (Canadian Apprenticeship Forum, 2010), as are the retention challenges of having an employee base that is not accepting of diverse employees. This speaks to the need to develop an awareness initiative for employers, to educate them on the demonstrated organizational benefits of workforce diversity (Stevens, Plaut, & Sanches-Burks, 2008), and to inform them on the availability of Government incentives to do so. Pre-apprenticeship mentoring with relatable role models programs can provide the guidance and the connections to help under-represented workers meet potential employers who are interested in diverse recruitment.

  - In other sectors, like marine R&D, marine science, and ocean technology, immigrants possessing the desired credentials and expertise, or who yield investment power, find a warmer welcome.

- **Awareness and 'fit' challenges**. Awareness of marine-oriented careers is reported by many interviewees as a significant challenge; especially for under-represented workers. Females interested in the trades are often coached into softer, more feminine trades. Aboriginal youths are often directed towards trades roles that meet the demands for industries more proximal to the community (i.e. construction, forestry, oil & gas, LNG). And immigrants are often directed towards larger industries where diverse networks have already been established, and where jobs have traditionally been more plentiful, and where a more traditional skill-set is required. Biased career counseling has directed under-represented workers away from marine careers, and this has allowed the industry to establish practices and cultures that perpetuate the challenge of fit, such as;

  - Lack of broad access to relevant training in more remote regions

  - Inflexibility in scheduling and lack of social supports for trainees. Personal barriers such as childcare, language training, family support issues, transportation barriers, and settlement issues can make it difficult for many under-represented workers to participate in training and employment programs

  - Lack of awareness at the community level results in lack of positive exposure to trades through family and friends (MNP, June 1012) and lack of endorsement for a non-traditional career choice

  - In production roles there is much emphasis on 'fitting in', which effectively alienates diverse workers (interview notes with Supervisors)

- **Sequencing, timing, sustainability and effectiveness challenges with Government-funded initiatives**.

    - Across each region there are numerous employment support programs for under-represented workers, but these programs are numerous, fragmented, underfunded, and often have operating periods that are too short to achieve a measurable effect. Additionally, politicized programs often focus on short term program effectiveness metrics such as initial registration numbers or early industry engagement, rather than medium and long term measures such as student persistence, job placement, on the job performance assessments, recurring industry sponsorship, and worker retention, which more accurately reflect the return on investment (ROI) of adaptive supports and training programs.

      Employment support programs for under-represented workers rely on 3 key pillars: 1.Business engagement, to understand workforce needs and to build trust in the process; 2. Training and job matching; and, 3. Ongoing support to individuals during training and once they have jobs to monitor performance and facilitate persistence in the role. An additional key pillar is the support of co-workers to build a welcoming and respectful work environment, which supports early transition, and ongoing performance, and retention.

      There are challenges along each of these pillars that can undo the good intentions of employment support programs for under-represented workers. For example;

        - Funding is sometimes received spontaneously, with a 'use it or lose it' requirement over a short time period. This produces reactive rather than strategic activities that can rush interactions with industry partners, or result in misaligned outcomes (i.e. readiness mismatches, skills mismatches). Reactive activities rarely produce favourable outcomes, which can build cynicism among key stakeholders, and can ultimately damage efforts to establish relationships with industry partners.

        - Ongoing support is often restricted by short funding cycles or resource limitations. Programs that terminate once resources are expended (Canadian Apprenticeship Forum, 2010), or that receive only negligible funding for sustainability but not for impact, neither serve the trainees abandoned of support, nor the sponsors who are unable to evaluate the outcomes of their investment. The meagre promise of short term employment makes it difficult to recruit experienced workers to operate these programs, and short funding cycles redirect the focus of activities away from the programs and towards funds sourcing. Finally, short funding cycles don't offer

sufficient program longevity to evaluate effectiveness, which results in a continuous cycle of programs starting and stopping before they've had a chance to gain momentum and establish successful practices, and effectuate a positive outcome. These programs need to have a minimum 5-year guarantee of funds and support, and need ongoing evaluation of a variety of success metrics to determine progress and impact. The ability to provide ongoing support once training is complete and employment has commenced has been shown to significantly improve employee retention (MNP, June 1012, p. 17). Effective program models should be scaled more broadly and shared with other regions to establish common supported best practices and mitigate the time and resources spent on re-establishing an already-proven model. With this comes the need to establish common success metrics that drive the right types of activities and that reflect the most robust ROI for all stakeholders involved. Often there is too much emphasis on training registration numbers, and not enough on medium and long term metrics which are a better reflection of program effectiveness. Regrettably, it is often the deep politicization of these employment support programs that promotes the myopic focus on provocative, but largely irrelevant, metrics.

- The importance of co-worker support cannot be overstated. Success along the other three pillars can be quickly unraveled by a hostile work environment that rejects under-represented workers. Workplace diversity and culture initiatives will be a critical component of successful programs, as will organizational culture and diversity awareness training for managers and supervisors across the industry.

- **Lack of Entrepreneurial supports along supply chain.** Access to credit and to a support network is often a big barrier to under-represented workers in any industry. Where the marine industry is itself making a tenuous resurgence, new entrepreneurs hoping to wrestle a place in the supply chain can be vulnerable to restrictive lending practices, pessimistic expectations, and splintered networks. Aboriginal people, women, and immigrants often share the challenge of having few mechanisms to create a credit history, and often lack credible sponsors who can build connections or provide endorsements to critical stakeholders.

- **Skepticism about cohort training programs.** There has been much discussion about the benefits of providing cohort training, whereby skills programs are brought to remote Aboriginal communities (MNP, June 1012), or programs are offered to a specific cohort (i.e. women, Aboriginals). These programs are accountable for meeting the same curriculum outcomes, but may offer a modified venue, schedule, or duration, to accommodate the cohort. While these limited-enrolment programs

do provide a familiar social environment to study in, they do not accurately mimic the integrated work environments trainees will eventually be entering into. There is also some skepticism among employers about the integrity of cohort programs. Some employers and supervisors claim that cohort programs are 'easier' or are diluted to accommodate the learners, and they are thus dubious about the calibre of trainees from these programs.

- **Limited opportunities due to the "call back" seniority system.** The "call back" seniority system, which is part of the unionized trades, requires that yards extend invitations to previous employees to return to their roles, before opening the job for competition. In the marine industry this can significantly limit the ability to refresh workforce, as the slots become re-occupied by traditional workers recruited under dated strategies.

The Federal government may be "kick-starting the industry by facilitating demand" (Cairns, Fall 2006), but it is up to industry to weave together the threads of sustainability that include workforce, supply chain, and R&D to ensure the industry endures beyond this promise. The involvement of under-represented workers in the marine industry demonstrates not only a commitment to social progress, but also strategic awareness of previously ignored resources, who with some attention and investment, can resolve the looming skills-shortage to further bolster the revitalization of the greater marine industry.

6. Developing Management and Leadership Capability

A recent report from the Forum of Labour Market Ministers (Building Skills Together: A report from provincial and territorial labour market ministers, 2013) estimated that 70% of future jobs will be in management and/or will require some type of postsecondary credential. Individuals who possess both technical know-how and strong management skill will become highly sought after. According to a report on the shipbuilding industry in Australia, the quality of management is the fundamental determinant of shipyard productivity (DefenceSA Advisory, December 2009). This highlights the critical people and resource management requirements of the marine industry as research, innovation, and production arms become increasingly digitized, collaborative, and integrated. Interviews with industry stakeholders revealed that high demand management skills will include project management, LEAN manufacturing, change management, and the ability to manage broad and diverse teams of skilled (and sometimes unionized) and professional employees in an orchestrated and multi-layered environment. Not only will these complex management skills be in high demand, but they will also be highly transferable, exacerbating the recruitment and retention challenges for the marine industry where the main imperative may be for management to provide a source of continuity to an industry in rapid evolution.

Among the numerous negative boom/bust echoes of the marine industry is the gap in domestic management and leadership capability (interview notes). As the industry leaned out, yards and related sectors retained few skilled people in these roles, and have recruited or developed even fewer. This has resulted in diminished capacity and frail succession bridges at the mid-level/supervisory level (i.e. the 'little middle'). It has also resulted in similar succession gaps in senior management and leadership roles. The industry is now faced with the challenge of trying to bulk up their bench strength at the top, but have weak succession pipelines to draw from. International recruiting can provide a short-term (albeit expensive) solution, but robust succession strategies will need to be developed to continue to seed teams with domestic talent, and to develop management capability in-house, and deliver on promises of career progression. (The 'little middle' and management issues in a unionized environment are examined in more detail in the section *Workforce issues in a Unionized Environment*).

Continuing Gap Areas and Recommendations

- **Training and skills development programs need to be well-timed to allow for proximal on-the-job application**. Research into learning retention shows us that learning and training are most effective when the opportunity to apply new skills or knowledge is proximal to the training and learning event (Burke & Hutchins, September 2007)This has implications for essential skills development, as some graduating students may have significant pauses between their last relevant literacy or numeracy course, and the PSE program or employment role in which they are required to apply those skills and knowledge. This also has implications for training programs where Government funding for registrations are out of sync with job availability and upgrade use. Without opportunities to apply and embed the learning, these training programs can result in lack of retention or transfer of skills. And without continuous use and maintenance of essential skills, they are very prone to erosion.

  Educational research shows us the value of providing opportunities for learners to apply their skills in a real-world setting (Ministry of Education, BC's Education Plan: Focus on Learning, January 2015). Similarly, the OECD study (OECD Skills Outlook 2013: First Results from the Survey of Adult Skills, 2013), highlighted the importance of developing links between the world of learning and the world of work, to establish the relevance of skill development, and facilitate the transition between school and work worlds. This is pertinent to the development of more dual-credit programs, and trainee programs, and co-ops at k-12 and college/university level, across a broader range of career areas (i.e. engineering, ocean sciences, technology, as well as trades roles) to keep students engaged and to establish deep connections between learning content and workplace skills.

- **Shift Perceptions of the industry**. Lingering perceptions need to be addressed to mitigate the extent to which they continue to impair the ability to recruit new workers to the marine industry. A Federally funded marketing campaign aimed at changing the narrative of College education and Trades and Technology training generally is needed. This is really about culture change, because at the heart of culture is a communal understanding of what is valued and of how that value is communicated and celebrated.

- **Planting the seed for entrepreneurism**, and providing training around basic business acumen could facilitate earlier and more successful ventures into small business ownership. This should be happening in the k-12 system, so that the next generations will be raised to wonder, not if they will be an entrepreneur or innovator, but how they will.

- **Need a national strategy and funding to provide career Literacy programs for young people and their parents.** One-to-one career coaching by counsellors in the k-12 system is paradigm that is likely un-scalable and unviable in today's world. Educators lack the capacity to provide such customized counsel, and they couldn't be expected to possess the working knowledge of updated labour market forecasts, education pathways, earning potential, and competency requirements for the breadth of careers in today's and tomorrow's markets. Our young people would benefit from a centralized one-stop-shop that integrates the data relevant to career selection on a user-operated platform that can offer scale, relevance, and timely data, that can be centrally maintained to stay current, but also regionally customized, and that can offer access to national data to cater to the mobility interests of our workforce. Already several regional career tools exist, including *Work BC*, and *Career in Gear* (NS), however they remain regionally focused and don't offer the breadth of information outlined above. A centralized program would offer efficiencies of maintenance and single-design, and could provide a platform to link with already-developed regional online tools and resources.

  True Calling[12], an initiative originating in Vancouver, BC by film company PinkBuffalo, provides a solution that meets most of this criteria. True Calling's interactive and media-rich platform offers a venue to reach young people and their parents, as well as people already in the workforce who may be looking to upgrade a designation or shift careers.

  The advantage to the marine industry of a structured national career literacy platform is in awareness and exposure. Such a platform would provide a medium for reaching a broader audience, provide accessible information about the variety of marine careers, and would expose users to surrogate role models (through the videos) working in that career. Users would also be able to identify qualifications for each career, and locate regional PSIs and training providers offering those qualifications. Furthermore, users would be able to envision the progressive and flexible career paths that emerge from each role. The career counseling function of such a platform would educate young people and their parents about earning potential, labour market opportunities, and the adjectival descriptions of the job that can facilitate better choices of 'fit', and remedy some of the weak attachment that occurs when young people are more dazzled by the idea of a role than by its day-to-day realities.

Conclusion

[12] Truecallingcanada.com

A few decades ago there was a period when Velcro was thought to signal the end of civilization. Children were now able to fasten their shoes without tying a knot – this signaled the beginning of the end of skills development in our children! This anecdote is tongue-in-cheek, but it reflects how as the world evolves, so too must the skills of our young people. There are growing calls for our schools, including PSIs, to keep apace, as playing skills catch-up with adults is much less effective than ensuring that the right skills are developed in childhood (Pearson, 2015). Reluctance to remove or modify existing programs and content is often grounded in a fear that one is sacrificing the integrity of the curriculum. But the credibility of our education system is found in relevance – not in tradition - of content. Some of the skills that signal fluency and comprehension and competence are changing, but even where teaching practices have evolved, methods for assessment and evaluation have lagged.

Today, information is constantly evolving and being updated. What was once contained between the covers of books is now contained in every student's back pocket and is just a click away. Today, young people need to learn how to read and evaluate that information, how to screen out what's relevant from what's not, how to search through the vast virtual cabinets of information to find the most accurate and relevant information, and how to collaborate with others as they do these things. This requires a dramatic paradigm shift in what and how we teach young people.

At the same time, we also need to review some of the dismal assessments of the skills and behaviours of our youth and separate objective fact from anecdotal opinion. We need to ensure that this negative view of young students and employees isn't just a generational artefact. Older folks have always wondered, 'what has become of this younger generation?!'. Perhaps the reported decline in capability is partly due to a shift in capability that our assessment practices haven't caught up with yet. Velcro didn't signal the end of skills development for kids– it signaled progress and it showed how innovation can simplify a task.

Generational bias may also account for the perpetuating stigma of non-academic pathways and mobility trends. Interviews with students and young workers shows that this stigma is changing rapidly as community colleges outpace universities in providing high value job-directed education. One could argue that community colleges provide a much better return on investment both for government and for students & parents. In fulfilling the promise of life-long education and career pathways and options, there is a continuing need to remove barriers to good cross-PSI articulations. And as young people look to interprovincial mobility as a virtue – rather than a hardship- of the resource industries, employers need to shift their focus

to providing young people and experienced workers with a reason to stay or return to their home region, or find creative ways to benefit from a broader, mobile workforce.

These priority issues reflect the social, psychological, systemic, and practical challenges to workforce development in the marine industry. As we work to mitigate their impact, we do so whilst carrying the weight of boom and bust. But if there is an upside to this boom and bust history for the Canadian marine industry, it is the reminder it submits, that complacency will render 'bust' a sure thing, and the industry will only endure if we make some changes.

Section B: Developing Workforce in Skilled Trades and Technology

Section Summary

- Frequently described as the 'poor second cousin' of trades, marine jobs are perceived as being lower paid, less secure, more routine and traditional, and conveying less prestige than their counterparts in innovative and high profile sectors like oil & gas and construction.
- According to industry, the concerns with capacity in the trades are hyperbole; the real concern is with capability (I.e. skills and experience levels)
- There is a need to develop improved recruitment strategies
- There is a need to provide more incentives to employers to find and keep apprentices until they complete their full training
- A national dialogue needs to be held to discuss issues relating to professionalizing trades and technology roles

The Demand

The growing demand for skilled trades and technology workers has been narrated in the popular press and government and industry reports for several years now, the mounting concern triggered by a series of factors, including an aging population of qualified trades workers, underwhelming certificate completion rates with newer workers, and an increase in the proportion of young people pursuing University pathways of education (CBoC, November 2014). And confounding these factors is the growing demand for skilled workers across several resource-based industries, coupled with an emerging socio-cultural norm of interprovincial mobility. There was a time when only highly educated, white collar workers had the sort of leverage to draw them to highly compensated roles in other regions; now and for more than a decade, our skilled trades and technology labourers do, and the trend is far from abating.

Despite the promise of robust career opportunities and earning potential, the availability of skilled workers across Canada is growing at a more casual rate than one might expect. Interprovincial mobility to the Prairie Provinces, triggered by opportunity and lavish compensation have left the east and west coasts suffering from dwindling pools of remaining workers. Unprecedented workforce migration is a reality on the two coasts, albeit for different reasons. In the east coast highly skilled workers have been drawn west because of lack of employment opportunity and relatively low wages in their home regions. In British Columbia, workers are fleeing the high cost of living in cities like Vancouver and Victoria, or working out-of-province to support their urban families.

And alongside this drift towards mobility is an underlying trend reported by several interviewees to 'get in and get out' – or make some big money with minimal qualifications, and then move on to a real career elsewhere once the industry tanks. Ostensibly this trend accounts for an ongoing problem with persistence and completion in the skilled trades that is rooted in the notion that these careers are lucrative, but temporary.

This also speaks to the prevailing belief that these industries are fleeting, and perhaps recent events in Alberta's tar sands give further lather to this argument. The potentially harmful outcomes of these viewpoints gaining credence are twofold; that they can produce cross-over from a transient industry or project to another that is striving to be more sustainable (i.e. shipbuilding); and, it damages efforts to

professionalize the trades and build career paths by characterizing skilled trades opportunities in Canada as provisional and unreliable, where opportunities materialize and vanish, without the mindful influence of a long term strategy.

The Challenges

According to a report by the Organization for Economic Cooperation and Development (OECD) there is a shift in Canada towards more highly skilled jobs, with similar trends observed in most OECD countries (OECD, OECD Skills Outlook 2013: First Results from the Survey of Adult Skills, 2013). This report also showed a decline in traditional non-skilled manufacturing roles in Canada, but a steady increase in employment in high-technology manufacturing. Among these highly skilled jobs, the OECD report has revealed several interesting findings;

- An increase in job tasks requiring non-routine interpersonal skills
- a decrease in routine manual skills
- an increase in skills related to adaptability to change, as change has become the constant state
- an increase in jobs requiring more education and cognitive skills (OECD, 2012)

These speak to significant changes in the profiles of most skilled trades and technology jobs away from the hard manual labour images that stamp public perception, and towards more integrated, team-oriented roles that involve problem solving, creativity, and use of sophisticated technology. Despite these trends, school-based career counseling and apprenticeship registrations have evolved little to underscore these evolving competencies, resulting in student persistence and retention challenges that may derive from poor program fit. The absence of earnest counseling towards the trades may also reflect the social stigma that renders trades and technology careers as the 'plan B' career option.

The source of these stigma are largely related to limited awareness on the part of those (i.e. parents) who yield the greatest influence over young people's education and career choices (Dryler, 1998; Otto, 2000). The less favourable perception of trades education and jobs remains a daunting hurdle to recruitment and retention of youth in these roles. According to several recent studies conducted by the Canadian Apprenticeship Forum (CAF), looking at perceptions of youth, parents, and educators of skilled trades careers, found that 57% of parents believe that University degree is

the top choice. There is still a perception that skilled trades are short term but not long term careers. These findings speak to a key gap in career literacy and career counseling for our young people (and their parents). Without broader and more accurate awareness of the potential for full and diverse careers in the skilled trades, kids aren't encouraged to pursue a skilled trade (at least not the 'smart' kids). At the entry level, employers are looking for smart, engaged youth who understand the requirements of the trades or technology roles early on, and who will persist in their roles beyond the initial formal or informal training period so that employers can realize a positive ROI.

But the challenge isn't limited to recruitment and retention of young trained skilled workers, it is also about more effective matching of employment opportunities with the skills of highly experienced workers. There are ongoing inefficiencies in regions and worksites related to skills mismatches or lack of succession strategies that lead to skill atrophy and worker disengagement, and that contribute to underutilization of a still willing pool of skilled trades.

These and other related challenges will be explored in more detail in the following section.

Apprenticeship Programs

The apprenticeship model for training is perhaps the oldest proven pedagogical approach, grounded in the transfer of skill, knowledge, and wisdom from older and experienced journey people to novice workers. As such, the apprenticeship model is really an archetype of succession and development strategy; the cornerstones of any workforce plan.

In 2012 Canada had 444,672 registered apprentices across the nation (Conference Board of Canada, 2014). The key focus of apprenticeship training is on applied learning and employability skills, outcomes which are practiced throughout the typical 2-5 year program, as apprentices 'earn while they learn' (Canadian Apprenticeship Forum, 2015). At its core, apprenticeship is essentially practical training in exchange for labour, but this exchange has been formalized over the years so that most programs follow a structured outcomes-based learning plan during the on the job training, and a consistent core curriculum in the classroom component. The key draw for many apprentices is the hands-on learning style itself, coupled with the opportunity to participate in the workforce concurrently while pursuing certification. And because of this strong link with industry employers, apprenticeship and skilled trades training is driven by supply and demand. Ideally, this allows training providers to expand or scale back programs or create new specialized trades in response to industry needs.

Although apprenticeship is regulated by the provinces and territories, there has been some standardization of qualifications nationally. The Red Seal program outlines common standards for final certification for 57 trades, which allows for greater mobility of these journey people across regions. Presently the Canadian Council of Directors of Apprenticeship (CCDA) is pursuing a harmonization strategy that will standardize the trade name and definition, and the training sequence, hours, number of levels and learning outcomes (ITA I. T., Skilled Trades Innovation Forum, 2015) for apprenticeship programs for 10 compulsory Red Seal trades (CCDA, 2013) to facilitate the regional mobility of young apprentices, for whom poor regional market outlooks have often necessitated interprovincial travel in pursuit of gainful employment. Harmonization will also offer young apprentices a broader range of on-the-job experience and could expedite completion times (and concomitant wage increases), as time working 'away from home' is recognized towards certification.

Harmonization also offers benefits of scalability of training programs, and offers efficiencies in terms of maintenance and updates, as curricula changes can be negotiated and developed once and distributed across the regions.

There are numerous employer benefits to the apprenticeship model, including better productivity and relations with customers, easier retention as young workers can more readily envision a career path once they are engaged in the local apprenticeship system (Forum, The Apprenticeship Advantage: Earning return on training investment, February 2015), stronger employee commitment arising from investment in training, which in turn leads to less absenteeism, lower turnover, and less seeking of jobs outside the company (Halbesleben & Tolbert, 2014), improved morale, strengthened corporate culture (CCL, 2009), and the opportunity to establish expectations for work quality and productivity from the start.

Technician/Technologist Roles

Skilled technicians and technologist programs are generally offered at Community Colleges or equivalent institutes of technology, although some fall under the apprenticeship model. These designations involve specialized practice within a field of engineering or applied science technology. Programs generally have a 2-year minimum requirement to achieve a level of practice at the technology level and graduate as Certified Engineering Technologist or Certified Technician (OACETT, 2015).

High demand roles in the greater marine industry include; industrial and manufacturing engineering technologist/technicians, marine architecture technologists, computer information and systems managers, and ocean technologists (new program offered by NSCC), as well as valve technicians and calibration technicians which are apprenticed trades (interview notes).

Most skilled technician and technologist programs do not involve apprenticeship. Some include a co-op component, or a capstone project which helps to orient students to their future work environments. According to industry interviewees, most technicians and technologists require an additional 2-3 years of on-the-job experience before they are able to fully contribute in their roles. Industry members overall seemed to concur that post-secondary programs are deploying well-educated and skilled graduates, but contend that the organization or industry-specific skills are

so complex and detailed, that this period of development and progressive contribution are inherent in these roles.

The general attitude of industry employers of technicians and technologists views this preliminary hire period as an unofficial internship, during which skills are refined and developed to the organization's unique expectations. In short, this period of development and training is viewed as an investment in their employees, the ROI of which is reflected in low attrition and high employee performance (interview notes). Presently, low registrations in technician and technologist roles have produced recruitment challenges and competition for talent has resulted in soaring wages.

Technology and technician roles seem to enjoy more diversity and higher prestige as 'science-oriented' than their 'labour-oriented' trades counterparts. It would seem that the prevailing public perception seems to orient towards high-technology/low-touch careers, and away from high-touch/physical labour jobs in estimations of esteem and career future.

Implications for the Greater Marine Industry

In the greater marine industry defined by this study, the majority of skilled trades and technology roles are found in shipbuilding and repair in commercial and DND yards, and in supplier and ocean tech companies. The highest demand roles in shipbuilding and ship repair across the country tend to be steel workers, welders and pipefitters, (Trade Gap Analysis, Industry Training Authority, 2015; NS Apprenticeship Agency interview notes). In supply chain manufacturing and ocean technology companies, typical trades roles involve valve technicians, calibration technicians, engineering technicians and technologists, metal fabricators, welders and machinists (interview notes).

The biggest workforce challenges relating to the shipbuilding sector are the historical boom and bust cycles that have turned temporary lay-offs into permanent losses of skilled and experienced trades, coupled with a young demographic that is comparatively more difficult to recruit to the marine trades (interview notes), and even more difficult to retain given the competition from other sectors and regions for the same high demand roles. This has resulted in a present-day apprenticeship training challenge where we have new apprentices in shipyards learning under Red

Seals who don't have recent (or any) experience in shipbuilding in a modern manufacturing environment.

Conversely, we have trades workers in ocean tech firms where hiring volumes are a fraction of those in other sectors (i.e. there might be only one or a few of each skilled role in an organization). Where slow turnover has meant that there has been little rejuvenation of the workforce, it has been historically (and presently) difficult to cultivate new apprentices and technologists. However, these roles tend to require such specialized skill and knowledge, that on-the-job training and cultivation of new skilled workers is the most effective model. For small firms, this training investment is necessary but puts a tremendous strain on the company in terms of resources and productivity. Few of these trades are Red Seal certifications, so these firms are rarely able to access the Federal financial inducements.

Where experienced journey people and technologists in the combined sectors are available to mentor young apprentices, the ideal one-to-one training ratio is stretched to accommodate the influx of newcomers, raising concerns about safety, the amount of dedicated mentoring hours each newcomer is receiving (and hence the quality of the on-the-job training), and the utility of a model that has the most experienced employees teaching rather than doing. Furthermore, where completion rates among young apprentices are declining (Conference Board of Canada, 2014), this will strain succession plans further, as the ratio of journey persons to apprentices could become too imbalanced to effectively provide the training and attention needed to develop young apprentices. Without support and incentives for completion, and without strong strategies for more effective recruitment and retention, this model of strategic succession of marine-oriented trades could ultimately collapse.

The following highlights the key areas of challenge or opportunity for workforce recruitment, development and retention in the marine-oriented trades.

Recruitment & Retention

According to Statistics Canada (CANSIM table 477-0053, 2012), apprenticeship registrations in Canada have increased by 24% between 2007 and 2012, but completion rates have remained low. So where trades recruiting has improved, student persistence in the trades has not, meaning that we are driving more young people into trades training, but not keeping them. This speaks to a need for more effective recruitment which involves more and earlier exposure to trades and skills programs and careers, and a more realistic understanding of the day-to-day competency and skill requirements of the job. Attrition rates are highest among first year students, although this number is often not captured in a province's net completion rates (Klingbeil, 2015).

The two biggest challenges with apprenticeship recruitment in the marine industry are;

1. How do we engage young people in skills based education? This requires a better understanding of how to effectively recruit well-informed candidates who possess a strong competency fit for the role and who will remain engaged in the learning and persist throughout the training. We don't need to increase recruitment, we just need to get better at it.

2. How do we engage young people in trades careers in the marine industry, when history and stigma have painted these the 'poor second cousin' of the trades, defined by instability, uncertainty, and cycling lay-offs, and where specialization in a marine-oriented trade will not insulate them from the next bust cycle?

Exit interviews that are conducted with students on a pre-employment path (who complete 1-2 years of the classroom component prior to registering as an apprentice) or who follow a direct entry pathway (i.e. where the employer is found first, who indentures the apprentice to commence the apprenticeship) have revealed that the top three reasons why students quit is because they discover that the trade isn't a good work-fit for them, they lack the essential skills (typically math) to succeed in the program, or they experienced a poor mentoring work culture (Klingbeil, 2015; Canadian Apprenticeship Forum, 2011).

In the ocean technology sector, there has been some challenge with recruiting young people to technologist programs (especially naval architecture technologists). Some of these programs are consistently undersubscribed despite impressive post-graduate

job placements and attractive entry level salaries. The challenge may be due to the significant math competency requirements for the program that give more allure to the relative benefits of a 4-year degree program over a 3-year diploma.

These point to five key opportunities to mitigate attrition levels by enabling more targeted recruitment, including;

- Developing more programs aimed at building awareness and exposure to trades and technology roles;
- Conducting more active recruitment to apprenticeship and technology training in schools;
- Offering more dual-credit programs for each pathway; putting trades training back into the K-12 curriculum;
- Development of more hands-on technology programs integrated into the existing science and technology curricula;
- Explicit teaching of real-world application of math and science concepts across curriculum levels;
- Review of existing applied trades math programs to ensure the outcomes align with requirements for PSE and for level 3 of essential skills;
- Development of a robust career literacy tool to support earlier and more accurate career awareness. (See Recommendations section for more details.)

These strategies may also help to fade some of the stigma of trades and technology training by depolarizing skills and academic achievement, uniting them into common curriculum requirements. Additionally, emphasising numeracy competency in trades and technology roles builds students' realistic understanding of training requirements and contradicts the notion that trades are non-thinking careers.

The mentoring challenge is a more difficult one that will only change over time with stronger leadership and better role models in trades councils, unions and workplaces. Improvements to learning culture and to worker identity will also help build the esteem of the mentoring function, and deepen the sense of connection between the learning process and pride in the work outcomes. Addressing this challenge also

requires a better understanding of how to effectively teach skills so that we can make learning accessible and relevant and more readily transferred, without compromising safety, security, competence and productivity. Future research should investigate more effective ways to teach and assess these skills, integrating new with traditional paradigms of teaching, learning and evaluation.

Completion and Certification

In the apprenticeship system completion refers to;

- attendance at all technical training sessions,
- completion of a prescribed number of hours,
- meeting required competencies,
- passing all required exams

Completion of these requirements awards the Certificate of Apprenticeship, and determines apprentices eligible to write the Certificate of Qualification. Once apprentices have passed the provincial or territorial Certification of Qualification exam they become certified journeypersons. Compulsory trades do require certification to legally practice, however there are also non-compulsory or voluntary trades that do not have this requirement.

With the announcement of NSPS contracts there has been growing concern about declining supply of trades workers in Canada. This concern is driven by low completion rates of 56% (Forum, Investigating Apprenticeship Completion, 2010) in the apprenticeship system coupled with growing demand for the same trades from competing industries in oil & gas, forestry, construction and offshore energy projects.

According to a study conducted by the Canadian Apprenticeship Forum (2011) there would be enough trades if completion rates were more in line with registrations (CBoC, November 2014). This same study showed that the most common reason cited for non-completion of an apprenticeship program was lack of sufficient work or income. Apprentices are sometimes unable to complete training because a business downturn leads to lay-offs (Sharpe, 2005) or slashed training budgets. Occasionally a

business cycle downturn can stretch an organization to the point that the apprentice is assigned unsupervised work which doesn't count towards training hours. Other reasons included lack of funding during block training and challenges with finding or keeping an employer.

Research has shown better completion rates among students who begin their apprenticeship careers through youth apprenticeship programs, and many provinces already working to involve younger students (Langill, 2015). These programs have been shown to facilitate the transition between high school and PSE, and have been shown to support the retention of at-risk students through to graduation, re-engaging them through an alternative program of interest.

Challenges with Finding an Employer

The employer/apprentice partnership is central to this training model, and yet an effective facilitated process for meeting and matching persists as a significant gap in the system. Regional apprenticeship agencies regulate the training and certification processes and inform the block-training curricula, but they do not provide a matching service, and few offer a database through which employers and candidates could search and meet (one exception is 'Find your Fit' in BC, which is informally described as the e-harmony of the apprenticeship system).

This is a considerable gap given the difficulties many young people encounter in trying to find an employer who is able and willing to support their training and development over the scope of the apprenticeship term (The Conference Board of Canada, June 2011). This can dissuade direct-entry apprentices from even trying to enter the system, and can boost first year attrition rates among apprentices pursuing the pre-employment route. The gap seems to impact employers and aspiring apprentices equally. In a study conducted by the Canadian Apprenticeship Forum, 30% of employers commented that they would be motivated to hire more apprentices if they could just find them (June 2009).

There are several variables at play in the disconnect between employers and apprentices. One is the common point of view that perceives training as a cost rather than an investment. In a 2009 study by the Canadian Apprenticeship Forum (It pays to hire and apprentice: Calculating the return on training investment for skilled trades employers in Canada) examining the return on investment (ROI) of apprenticeship training it was found that on average Canadian employers receive a benefit of $1.47 for every $1 spent on apprenticeship training, and it showed that the net benefit increases throughout the apprenticeship period. Yet, despite these success metrics, Canadian employers in trades in general remain skeptical of the promise of training investments.

This skepticism has been brought about by a few factors, not the least of which are;

1. **Productivity and efficiency challenges for apprentice and mentor**. Many employers are looking for skilled workers who can arrive on the job ready to perform and the notion of upfront and ongoing investment in an apprentice's training can seem an unnecessary productivity and efficiency hurdle.

2. **The mobility and attrition threat of young apprentices.** Interprovincial mobility trends emerged as a response to contracting job markets in some regions, and rapidly expanding job markets in others. But what emerged out of necessity has become a continuing trend that young workers report as being part of the appeal of trades careers (interview notes with trades workers and apprentices). But where mobility benefits young apprentices, it erodes the ROI of apprenticeship training for some employers in less-active regions. It is difficult to justify investment into the training of young apprentices who depart to different regions once they have become minimally (or fully) qualified to secure roles elsewhere (The Conference Board of Canada, June 2011). Some employers prefer to hire experienced journey persons who require little or no training investment, and who can be laid off when contracts are completed. This exacerbates the succession challenges in some regions as the bottom layers of the workforce pyramid are continuously drawn away, making it difficult to rejuvenate a local workforce.

   This has been especially challenging in the marine industry where lack of predictability and stability created an industry preference for temporary workforces. Commitment to a sustainable and growing marine industry can be reinforced with Federal incentives to invest in new generations of apprentices throughout the training. Commitment from industry can in turn be reinforced through hiring of young apprentices as FTE (full time equivalents), honoring the training cycle (including block-training), and offering competitive wages to incent retention and progression through the apprenticeship levels. Articulations between programs, and opportunities to upskill or cross-train will also facilitate mobility along a career path

within their trade, allowing skilled workers to build on their experience and progress without requiring them to withdraw from the skilled trades.

3. **Competitive project bids.** Project bids have also become increasingly competitive, and where ratios permit, employers will trim their bids with less-qualified apprentices (i.e. first and second level) to push a tender to the top of the pile. This can dilute a workforce and reduce the motivation for trades workers to pursue trade certification at the risk of qualifying themselves out of employment. To protect against this worrying race to the bottom, stronger procurement policies that emphasize bid compliance (i.e. qualifications, capabilities, and price), should become the norm.

   But having less-qualified apprentices is only a problem if they are not being supervised or mentored properly, or if they are not being utilized in a way that supports their development. Indeed, the involvement of young apprentices in large projects is essential to building workforce capacity and diversity, and to providing meaningful experience for developing workers. On May 26th, 2015 the BC Ministry of Jobs, Tourism and Skills Training announced an *Apprentices on Public Projects* policy requiring that contractors sponsor apprentices throughout the entire project cycle for any major public construction projects with a $15-million-plus government investment. Contractors will be expected to report on apprentice involvement in the project prior to receiving their final payment (Ministry of Jobs, 2015). It was not evident if this policy stipulated which, if any, apprenticeship levels were to be prioritized, and thus may not resolve the challenge of 3rd and 4th level apprentices securing employment to complete their training. This is, however, a step in the right direction towards supporting strategic workforce development to meet future labour requirements.

4. **Pre-employment pathways.** Where colleges now offer foundation level programs for several trades, this permits some employers to disengage from the apprenticeship process until students have completed this level. This shifts the risk to the students as they incur the training expense without guarantee of an employer at the other end. This challenge is rooted in the paradox of who should invest in workforce training and development.

5. **Deep versus broad knowledge.** According to some interviewees, the scope of apprenticeship training is too broad, producing well-rounded apprentices where some employers want new hires who possess a narrow range of deep skill and expertise who suit their own business. This creates some skepticism in the quality of college-based block training that emphasizes general skills, and that sometimes leads employers to 'untrain' young apprentices before developing skills that are customized to their business or industry. This position counters the previous, promoting the value of direct-entry apprenticeships over pre-employment programs.

6. **Lack of hiring and retention incentives for 3rd and 4th level -apprentices.** Well-intended government incentives aimed at promoting hiring of new apprentices have sometimes had the inadvertent effect of dissuading the hiring or retention of 3rd and 4th year apprentices, whose employment offers no or less subsidy. Worsening this challenge is the common two-year cycle that characterizes many projects in marine and related sectors that result in the return of seasoned apprentices to the search for employers. Incentives are maneuvering young people into apprenticeships but not sufficiently supporting their subsequent training or completion.

7. **Work-flow and scheduling challenges during block training.** Most apprenticeship programs include an annual block training over a 5-8 week period. Program intensity of this full-time learning program typically prevents apprentices from also working with their employer. This pause can create work-flow challenges for the employer that challenge scheduling or client commitments. Regional apprenticeship agencies and authorities are looking for innovative solutions to mitigate time away from the work site, and maximize learning value during block training. Web-based learning solutions that offer self-paced online program options are being offered for essential courses for which a physical presence is not essential (i.e. safety training, WHMIS), and also for in-class training where students want to review content in their own time to aid comprehension, retention, and for studying. Improving industry commitment to the apprenticeship process and to the ensuing value of intensive development periods will also help to diminish the view of block training as a subtractor of labour rather than builder of force capacity.

Interview responses with regional apprenticeship agencies across the country have revealed that the challenge of finding an employer is amplified for under-represented workers. Despite education and incentive programs, employers are still reluctant to hire women, aboriginals and immigrants, trends that continue to limit diversity and that exclude a viable potential workforce. Larger industry players like Irving and Seaspan shipyards have taken the opportunity of the NSPS contracts to transformation and diversify their yards.

While these companies have the will and the might to pursue diversity initiatives, smaller players in the industry have been less willing to invest in diversity. Where the risks of apprentice non-persistence or defection to another employer, industry or region are high, many employers prefer the perceived predictability of a familiar hire. Additionally, many employers are uneducated about tax credits and subsidies for hiring apprentices – especially for hiring First Nations and female apprentices, and justify conservative hiring with financial prudence.

While valid all of these challenges may be, they are the product of myopic thinking that looks at the immediate business cycles while ignoring the complex metrics of a long term plan. Without a robust succession strategy to build a skilled and experienced workforce, these employers could inadvertently undo the need for a long term plan. If we can't build a strong and continuous workforce, people will not choose to invest in our regions.

Funding

Funding for apprenticeship occurs along three key channels; funding for students to drive registration and completion, funding for employees to incent hiring of apprentices and retention throughout the duration of their training, and funding for colleges and training centres to run programs and build capacity (and wait list reduction) for high demand trades.

Funding for Apprentices

Some apprentices cite funding challenges or financial burden as a reason to quit a trade or at least stop pursuing the certification. Federal programs exist that provide incentives for young people to register in trades training at colleges, such as the Canada Apprentice Loan program which offers interest-free loans of up to $4000 per period of in-class training for apprentices registered in Red Seal trades (Canada G. o., 2015).

The burden of post-secondary education funding is common to students regardless of the educational pathway they choose. The burden to students of skilled trades and technology may be a social-cultural one, as some apprentice interviewees reported that their parents were employed in skilled trades or in unskilled labour and didn't save for their kids' education, and couldn't afford to provide financial support. Other apprentices reported that their parents endorsed a different (i.e. University) pathway and didn't want to provide financial support for a 'hobby diploma' (interview notes). Other apprentices reported that they simply didn't manage their money effectively during their paid employment, and thus struggled financially during the unpaid block training. This speaks to a lack of financial acumen that is not uncommon among students along all education pathways.

Additionally, there may be a disconnect of expectation for apprentices who are persuaded by the 'earn while you learn' mantra, but who have failed to consider the financial commitments that are still required for the program. This challenge likely requires some expectation management for young apprentices, to help them to see the investment they are making in their education as akin to their non-apprentice College and University peers. No education comes without some investment.

Funding for Employers

Apprentice Job Creation Tax Credits are also available to employers for the first two years of Red Seal apprenticeship training (Agency, 2015). These incentives encourage recruitment of new trades, but as the first-year attrition statistics coupled with underwhelming completion rates show, they don't offer sufficient commitment to boost completion rates. Additionally, these programs tend to be undersubscribed, mainly because employers aren't aware of these financial supports. The Canadian Apprenticeship Forum conducted two studies looking at employer funding and found that only 50% were aware of government funding and only 36% had applied (CAF, Employers and Apprenticeship in Canada, 2011). This speaks to an opportunity to raise industry awareness of, and in turn, engagement with regional apprenticeship initiatives.

While several provinces do offer completion incentives to apprentices in the form of tax credits (ITA I. T., Grants and Tax Credits, 2015), they may not be sufficient inducement when contrasted with the financial incentives offered by some industry players to remain on the job and delay completion and certification in favour of continued employment and earnings. Similarly, incentives aimed at employers may be insufficient to offset the costs of recruitment, training, and coverage when the apprentice departs for block training. These cost can be especially burdensome for smaller companies, especially when there is no guarantee of ever seeing the ROI of this investment (i.e. due to the risk of the trainee departing once the training is completed).

In the shipbuilding and repair sector, Red Seal trades account for roughly 80% of the skilled trades workforce (interview notes with industry HR representatives), and thus these larger players in the marine industry can benefit from these incentives targeting Red Seal completions, and gradually build out their workforce and succession plans from the bottom up.

Funding for Community Colleges and Training Centres

Funding for skilled trades and technology training covers operational costs, but not curriculum development. While there is meant to be strong alignment between labour market forecasts and program registrations, this is not always the case. Scaling back registrations for low demand roles can be challenging, especially where wait lists exist, reflecting student interest over market opportunity, and where the bottom-line reflects a crude equation of 'bums in seats'. Here, the social mandate (and the financial solvency requirement) trumps the workforce development mandate, prioritising accessible education over employability and potentially contributing to a labour-market mismatch which will be explored in the next section.

Labour-Market Mismatch

Interviews with industry councils and associations have asserted that there is not a shortage of skilled trades – there is a shortage in cheap labour. Some employers agree that the problem isn't workforce availability – its workforce capability. Others contend that there may be a surplus of workers in some trades, and insufficient supply in others, and that this is due to a mismatch between capacity and registrations in certain trades. Colleges have wait lists for some trades (i.e. electrical, welding), and empty seats in others (naval architecture technologists, engineering technicians), and classroom capacity may reflect student interest but may not align with labour market demand.

Or, variability in large regional projects can create sudden shifts in demand, leaving new or continuing apprentices without employment. This creates a labour-market mismatch – people without jobs and jobs without people - that alternates between glut and scarcity of key trades. This dis-synchrony points to competing social and workforce mandates in our colleges that on one hand promote accessibility of education to all, and on the other hand, have some obligation to students and employers to deploy capable and skilled graduates into a markets where supply and demand correspond.

According to a study conducted by the Conference Board of Canada (2014), many industry players believe that current capacity in apprenticeship programs will meet

the growing needs. "..despite there being proportionally fewer certified tradespeople and proportionally more college and university graduates among the younger cohort, the absolute number of certified tradespeople in the younger cohort is higher than those in the cohort about to retire' (CBoC, November 2014, p. 85).

Some of this mismatch could be managed with more effective scheduling and management of special projects at the regional level. Establishment of a database of trades workers could also facilitate the scheduling and deployment of high demand trades so that workforce can be absorbed and utilized efficiently and mitigate draws on EI by workers. Finally, labour market mismatches can be addressed by more effectively aligning program registration capacity with labour market demands, and by diversifying the trades workforce with cross-training where appropriate to build utility and broaden skill application.

Employment Culture

Some of the challenges outlined above are rooted in an employment culture that espouses diversity and development, but that doesn't practice these powerful workforce principles. Like other industries that have progressed to more evolved employment cultures (i.e. Finance and Professional Services Industries), the gap in hires of non-traditional trades workers will likely shrink only as more non-traditional workers are elevated to recruitment positions or employer roles, and as prejudices are contested with successes and new role models (Hill & Thomas, 2010).

The employment culture also needs to accept multiple pathways into a trade profession. One-size-fits-all training pathways will preclude participation by a range of traditional and non-traditional workers, and apprenticeship agencies have become increasingly interested in finding innovative ways to overcome obstacles to participation and completion. Essential skills development support is sometimes the solution that retains talented workers who might not progress along a traditional pathway in the same sequence or timeline. Articulation agreements within and between PSIs and trades programs can help to redirect students towards better-fit programs or career advancement training to ensure that talent is being well-utilized in the right roles. Some experienced journey people reported that cross-training or

career pathing is viewed as a slight to the initial trade of choice. These attitudes can be addressed as the employment culture shifts away from the narrow concept of trades and technology jobs, to the broader paradigm of trades and technology careers.

Employees also need to take a role in shifting the employment culture. Young apprentices need to take more initiative in finding and adapting to new employers and workplaces. Where a generation of young trades people have enjoyed an employee advantage in the forces of supply and demand, this has created some apathy on the part of young apprentices to seek out employment or to accept regionally fair compensation.

Some First Nations communities and rural development agencies have voiced an interest in trades work for their youth, but not a willingness to travel for training or employment. Mobile training can bring skills development to remote regions, but training cannot create engagement and motivation if it is not present at the outset, nor can it relocate jobs. If practical intelligence coupled with engagement, motivation, and self-efficacy (belief in one's own ability to perform and be effective) are precursors to learning success (Pintrich, 2003), then ideally these need to be the drivers of recruitment and employment seeking strategies in the skilled trades, not simply the availability of idle youth. This speaks to opportunities to build engagement, motivation and self-efficacy among youth from under-represented groups through exploration and dual-credit programs.

Professionalizing the Trades: Pathways and Certification

There are two distinct sides to the debate on the importance of apprenticeship completion and certification. Many assert that the profession benefits as a whole from having all trades workers complete certification, as uncertified workers can dilute the professional brand, increase risks to workplace safety and quality of work, and strain wage tension. The occurrence of both compulsory and voluntary trade certification is also a point of confusion for the layperson, and cross-over tendencies and lack of awareness can dilute public confidence in the qualifications of skilled workers. The absence of compelling professional branding may also be part of the reason why trades work doesn't enjoy the same profile as other professions requiring mandatory degrees or diplomas as minimum requirements.

The opposing debate argues that if the work requirements only need the employees to be able to build doors, then why support them in learning how to build the entire house? This is the trades-world equivalent of choosing a surgeon to remove a splinter. This same question was posed in a report by the Conference Board of Canada (The state of skills and PSE in Canada, November 2014, p. 94) that suggested, '*we should ask whether the system, as currently operating, provides more training than is needed by the labour market*'. If people aren't pursuing completions and certifications because they have reached a sufficient level of training and skill to gain employment, then perhaps completion should be awarded by levels with progressive credentialing (Bull, 2015), allowing for partial to complete training. This is a question of practicality and of how we professionalize roles, and is a vitally important question to debate.

The key shortcomings of this latter viewpoint is that it establishes a minimum requirement for certification that might find employees working above their qualifications and pay grade. It also endorses a 'do the least' philosophy of education and development that runs counter to a marine workforce development strategy that is focused on sustainability and advancement of an industry, driven by a competent and world-class workforce that can perform the work of today, tomorrow and the future. A system that diminishes certification value by reducing minimum requirements and validating lesser qualifications, could produce a labour market with fewer and fewer highly skilled and experienced workers to lead the industry forward and keep apace of the constantly evolving requirements of a modern production or manufacturing facility.

Conversely, it could produce a workforce that still ultimately achieves full qualifications, but that takes longer to do so, that explores other related pathways, and that gains substantial and relevant experience along the way. This might be a more alluring option for young people who haven't solved the riddle of 'what do I want to do when I grow up?', and for whom relevant early work experience helps to highlight an answer. It might also mitigate the passionless pursuit of certification for those who aren't convinced they are on the right path.

A third argument points to the over-emphasis on certification versus experience. When labour markets are tight, requirements for certification can compel a push by industry to get people through apprenticeship programs faster. However, it takes many years to become a journey-person with the skill, competency, experience and wisdom that this designation connotes. And workers are equally motivated to expedite completions to receive the associated compensation bump. But as this argument highlights, certification might not always be synonymous with the presumed competency and experience level it connotes.

Interview respondents largely reported that the timing of apprenticeships is appropriate, but skill and competency gaps can occur when apprentices are not provided with enough diversity of skill-building experiences and breadth in their roles. In marine trades and technology roles, this speaks to the need for strategic and well-mapped out learning and development plans for apprentices during their on-the-job training, to ensure that they are receiving the most training benefit from their hours of labour.

This speaks to a philosophical question of what is more valued; work experience or certification? Ideally one should connote the other, but as one interviewee stated, "*they come in with these qualifications and they think they know everything, but they don't know anything until they've had a chance to do something over and over again perfectly, and I can trust them to do it perfectly even when I'm not watching them, or when conditions aren't perfect, or when there's a problem and they need to figure it out for themselves. That's when they're really qualified*." Where certification becomes the standard metric of success for training institutions, performance is the standard metric of success for industry, and there is an opportunity to ensure that the two metrics are more closely aligned.

General versus Industry Specific Training

According to interview participants, the point of view of industry is that colleges do a great job of providing career exploration opportunities and general technical training but there is still opportunity for development of skill sets that more closely match the on-the-job requirements. Some of these knowledge gaps are simply in awareness of workplace and role requirements, such as comfort in working on a ladder, or awareness of the physical requirements of the job – seemingly banal prerequisites that can actually be deal breakers once on a worksite.

One interview participant commented that '*colleges are not in the business of training people to be industry-ready – they're in the business of providing an education*', a comment that summarizes the philosophical tension between PSIs with a social mandate (i.e. education for all) versus a workforce one (i.e. job readiness).

This comment also illustrates the source of dissatisfaction among industry employers with the generic and broad trade and technology skills and knowledge of new graduates. This movement towards broad and general training is partly motivated by a desire for consistency. The harmonization strategy is a case in point of this, and one which has its merits. The movement towards broad and general training is also a market play that deploys graduates whose skills will align to a broader array of potential employers' needs – albeit, only generally.

This begs the question, *Are we pursuing consistency at the expense of deep and tailored learning?* The criticism of the current apprenticeship system is that it is too customized to each region, resulting in training sequences and timings that vary regionally. At the same time, the appeal of the current apprenticeship system it is that it is customized to each region, and curriculum, capacity and timings can be readily adjusted to meet the needs of industry. By de-tailoring it, are we making it too generic so that everyone comes out with the same basic training and knowledge, but without the deep industry-specific training that allows for the just-in-time placement of workers who can hit the ground running in their own region? Are new employees arriving on the job site ready for work, or ready for more training?

These concerns are the impetus driving industry to look to other channels for training, including trade associations and private training companies. These alternate training

providers argue that they can be more responsive to industry needs, can adapt their curricula more readily, and utilize instructors with current and relevant industry experience. At the top of their list of benefits is the fact that these programs are entirely industry sponsored.

An additional compelling benefit to this model is that they claim to be driven by industry need, and are not governed by a social mandate. This means that they can balance apprenticeship registrations with labour demand to ensure they are deploying workers where there is a need. Critics of these alternate options argue that if trade associations control training registrations, that they will ultimately control the workforce supply, which can restrict training and employment to the union pathway and bolster negotiating power by intentionally keeping labour supply low. Additionally, instructors in these alternate models often do have deep Industry experience, but lack teaching experience and awareness of the importance of mindful instruction.

Continuing Gap Areas and Recommendations

- **Integrate more 21st century competencies into apprenticeship and technology training** to ensure that new cohorts are entering the workforce with a relevant mix of 'hard' and 'soft' skills. More emphasis should be placed on courses in digital technology for trades (i.e. for scheduling, materials mgmt., timesheets), change management, project management, critical thinking and problem solving, entrepreneurship, and human resource management skills relating to working in collaborative teams[13]. These competencies support the shift away from paradigms that anchor skilled trades to a single job or role, and towards the conceptualization of skilled trades as a means to a broad and diverse career pathway.

- Similarly, there is an opportunity to **develop training related to people management in a modern manufacturing environment**. These abilities to coordinate and plan production, adapt to technology changes, manage union issues, and coach development and performance to the precision requirements of a modern manufacturing environment, while managing training and development plans and integrated teams of multi-generational peers are key competencies for present and future industry managers and supervisors.

- Industry expressed some interest in marine specializations, but most respondents felt that the **customized marine-oriented skills and knowledge could be better trained in-house and on the job**. Marine Fitter, Shipwright, and Marine Electricians are three exceptions to this general preference. Similarly, employees who were interviewed did not communicate a strong interest in deeper marine specialization (from a certification point of view). Most commented that they were able to adapt their trade skills to a marine environment with on the job experience and mentoring. Employees did not perceive a benefit from the additional time and financial investment of a formal marine qualification, and some were concerned that developing too focused a marine-orientation could preclude them from participation in other industries.

- Interviews with industry members revealed a strong interest in **elevating capability and utility of workforce through cross-over training** (or cross-certification). Employees and employers collectively benefit from diversifying a workforce, as cross-over training opens additional pathways through and across industries – allowing for sequential workforce absorption as industry projects ramp up or decline. There is an opportunity to develop more cross-over training pathways where there are natural convergences in specialization. Cross-over training should be developed that requires minimal time away from the central job, and that builds broader skill on top of a

[13] During the writing of this report, several Community Colleges and private training providers have developed add-on training programs focusing on these broader range of skills and knowledge

central trade. Cross-over training into project or people management pathways should also be valid options.

- **More awareness and exposure building programs are needed to provide young people an opportunity to learn about trades careers.** There are several excellent programs across the country, including *Try a Trade* in Alberta, and *Techsploration* in Nova Scotia, however many of these programs are solely aimed at girls, or focus on older students (grades 9-12), who may have already established relatively firm perceptions and intentions for their futures. Additionally, research shows that young people begin to form awareness of social stigma and stereotypes of groups between the ages 6-10 (Weinstein, 2003), and thus more programs are needed that offer exploration options to all students in younger grades before social biases regarding career intentions are too firmly embedded. Integrating trades and technology back into the mandatory grade 6-8 curriculum could provide an opportunity to reach a broader group of young people than existing voluntary programs do, and could help to validate trades choices as they would be explored alongside traditional academic-track choices, and not only once those tracks have been exhausted.

- **A digital strategy is needed for all regions to track apprentice development and to track ongoing career development once certification has been awarded.** This would enable apprenticeship offices and agencies to track pathways and progression, to gather more accurate workforce data (to measure program performance and the impact of interventions), and to provide a channel for accessing alumni. Ideally these databases would use the same platform across all regions so that interprovincial mobility could be tracked, facilitating transfer of apprenticeship program records and data collection on mobility trends.

- **The challenges of pairing employers to apprentices needs to be addressed.** In some regions where trades industries are populated with more SMEs than big firms this can be an even bigger challenge – as smaller companies might only take 1-2 apprentices every few years and may offer a narrower range of skills they can develop in that smaller firm. For these smaller firms a strategy may be to form a consortium of SMEs that shares and circulates apprentices, so that new generations of workforce are being continuously cultivated and strategically developed and utilized in a way that matches the needs of local businesses, that provides the breadth of experience that builds a rich apprenticeship period, and that retains the younger workers in the region. The challenge with this option is that apprentices would be developed without attachment to a single employer, and thus without the promise of full-time employment upon certification. The aforementioned digital strategy could also include a 'matching service' that allows industry members and apprentices to more readily search and find one another.

- **More support is required for development of all 9 essential skills**. In particular, pre-assessment of numeracy and literacy skills will provide valuable information to education providers so that they can offer (or require) remedial support to mitigate student attrition and disengagement related to gaps in these key essential skills. (For more information, see section on Essential Skills)

- **Increase the number of dual credit program offerings in the secondary school system.** Research has shown that high school graduation rates improve with dual credit programs that create a seamless connection between high school and apprenticeship. BC has shown significant success with their ACE-IT program – especially with Aboriginal students (CAF, Youth Apprenticeship Across Canada: Regional Roundtable, May 28, 2015) (Langill, 2015). These dual-credit programs offer a jump-start on careers that effectively keeps kids engaged in school. Research has also found that kids matured more quickly when dual credit programs were offered at the college setting, and when students were in a mixed-age cohort (Langill, 2015). More of these programs should be established to reach students earlier, and to facilitate their integration into PSE. Additionally, dual credit programs could also benefit students interested in technology and technician roles, and programs should be developed to help bolster awareness of, and registrations into these undersubscribed programs.

Conclusion

The biggest challenges in apprenticeship training are finding employers (CAF, May 28, 2015), elevating the prestige of trades careers so they are perceived as valid and worthy pursuits, raising awareness of and exposure to trades and technology roles earlier so that they are considered among career options, and refining the recruitment process.

The biggest challenges in technology roles are recruitment into programs, competition for graduates, and finding ways to heighten the utility of workers during their first 2-3 years on the job (shrink the learning curve, or accelerate their ascent of it).

Resolving these challenges requires a collaborative effort between industry, government and our PSIs, but to get the best return on investment into skills development requires robust information about the skills needed and the best way to train and cultivate those skills, in the classroom and the workplace. We also need to have some common metrics for evaluating the success of programs, such as student persistence and completions, identification of (and early support for) students requiring essential skills support, alignment between labour demand and registrations, student placement, and feedback from industry.

This collaborative effort also needs to extend to curriculum development and harmonization discussions. By nature of the workforce development mandate, industry's involvement is essential, however PSIs have an important role to play in representing the needs of the learner and ensuring that programs are developed in alignment with effective pedagogical principles. Where industry has the pulse of what is current and essential in terms of skills and knowledge, educators have the pulse on how to effectively sequence and layer learning concepts to support comprehension, application and retention.

Perhaps we also need to look at early and ongoing industry investment in workforce development. Some claim that industry employers are not yet engaged enough in resolving these looming workforce challenges. And why not? Perhaps because the situation is not yet dire enough for them to fully engage. If we can learn one thing from the oil & gas industry it should be the advantages of proactivity. Engaging early

in workforce development means that industry will have more access to labour of choice, rather than simply to labour of availability. The adage - *our people are our most important resource* needs to be reflected in the commitment to workforce development.

Arguably the most difficult workforce development role in the marine industry is the fortune teller, who is tasked with predicting when and how many workers will be needed, and possessing what skills. Without more certainty around project commencements and scheduling, there is a risk of deploying cohorts of skilled workers only to have them sit idle waiting for projects to begin – or worse, migrating to other regions or sectors where employment is immediate.

But industry can't be expected to bear this burden alone. If the revitalization of a national marine industry is the espoused objective, then government can show its commitment to this goal by supporting a national workforce development strategy with employer and student financial incentives that support the full training and development to certification, and that provide additional supports to skilled trades and technology workers wishing to upgrade or cross-train.

At the industry and PSI level there is an opportunity to build continuous learning expectations into skilled trades and technology programs. This is improving, but there is still a prevailing attitude among journey-people (and some apprentices) that formal learning terminates with certification. If there is one trend that is common to all industries, it is the presence and pace of continuous change. And this continuous change drives a parallel demand for evolving skills and knowledge of existing workers so they can adapt to workplace advances or refresh underused skills. An early emphasis on career pathing, skill upgrade, and cross-certification opportunities will help to inculcate and reinforce this 21st century competency (Alberta, 2015).

Continuous improvement is also a key principle of modern work environments and of professionalized roles. Most importantly, this competency helps adults to see how they can personally benefit from improved skills (OECD, OECD Skills Outlook 2013: First Results from the Survey of Adult Skills, 2013), and will help to shape the learning cultures of organizations where the ongoing mentorship and in-house development of new and existing talent is crucial to their workforce.

Interview participants frequently cited professionalization of trades and technology roles as a key priority for shifting public bias and elevating the perceived prestige of these career choices. But professionalization goes beyond changing the negative images and adjectives that have become the common definition. Roles become professionalized when;

- they develop formal structures and governance for performance management, mentorship and feedback
- when there are clear and established opportunities for career advancement
- when those roles have opportunities to demonstrate leadership within their industry
- when peers engage in collaborative practice aimed at improving safety, efficiency and effectiveness of their work processes
- when guiding principles or codes of professional conduct are established – and enforced
- when licensing and certification requirements are established and enforced
- when annual professional development requirements (hours) are established for all registered workers

Several of these criteria already exist in skilled trades and technology roles, however a national-level dialogue needs to be had to consider the others, especially the latter three.

There is an opportunity to develop a more robust recruitment strategy for skilled trades and technology training. Funding incentives, it would seem, have been effective at driving enrollment but not completion. One of the key challenges here is in matching students and employers who are equally committed to the mentoring process and to program completion. While migration is a concern for employers, there is a poignant adage in the industry that conveys the occasion for employers; *trades workers go where they are needed and stay where they are well-treated*.

There is also an opportunity to broaden the reach of exposure and awareness building programs to influence young people who might not be otherwise socialized

or influenced to consider these pathways. Additionally, recruiting the right student to the right training program is essential to mitigate early attrition and to yield the best ROI on training investments from government and employers. This also requires better early exposure-building programs that provide an opportunity to try the exciting aspects of the role, and to also develop a fuller and more realistic expectations of the day-to-day requirements of the role. (see section on Awareness Building programs for more information).

Early identification of essential skills gaps and provision of support and remedial learning is also vital to mitigating attrition and to enabling achievement for students whose talents are more skilled- than academically-oriented.

This also speaks to an opportunity for research into effective teaching, learning and assessment of skilled trades and technology training. As workplaces and roles evolve, so too do skills and competencies and the methods for embedding them. Where programs are evolving to use blended learning approaches there may be an opportunity to develop a blended assessment strategy to ensure that the evaluation phase of training is as accessible as the teaching and learning phase.

There is also a need for research to better understand what motivates new young trades and technology workers. When developing recruitment (and retention) strategies, it is important to have a finger on the pulse of what drives young people to choose one industry, job or employer over another. If our strategies are based on dated information, they will miss the mark. What are the key drivers for today's youth in skilled roles? Is it stability and job security? Is it money? Is it the prestige of being involved in high demand and cutting-edge industries? Is it flexibility and mobility? Is it lifestyle and a chance to return or stay home? Do social conscience and personal values play a role? Is it some combination of these? There is some urgency to better understand these drivers, as recruitment strategies that focus, for instance, on repatriation and job security may prove to be only minimally effective. We may be offering the wrong carrots, or not incenting the highest performers into the marine industry.

And finally, despite all of the focus on recruiting young workers, we also need to focus on development and engagement of existing workers in the marine industry. Regardless of the challenges that older workers bring to the worksite in terms of reluctance or difficulty in upskilling or adjusting to a modern manufacturing work

environment, productivity and capability decline in terms of ability to meet the physical or technological demands of the role, requirements for workplace accommodations, and related safety concerns, this experienced cohort also possesses institutional and industrial memory. They hold the social power to influence culture shift, and they possess a deep understanding of build or manufacturing processes that only experience can allow. They are also the practised mentors who will play a central role in the skill, knowledge, and behaviour development of the industry's apprentices.

From a purely pragmatic point of view, this cohort helps to round out the ratios that permit the recruitment of new apprentices. So a workforce development strategy must necessarily include the development requirements for the full career continuum of its workers. And where recruitment of the highest potential new recruits is a key priority, so too is retention and engagement of those experienced journey people who possess positive mentoring skills and attitudes, and who demonstrate the desirable workplace culture behaviours and practices that the industry wishes to embed. A robust workforce development strategy isn't about building a static pool of talent, it's about building a dynamic workforce that is strategically evolving to keep stride with changes in industry and technology. And committed mentors with positional and social power are the most salient mechanism to influence how that workforce will evolve.

Section C: Workforce Development Issues in a Unionized Environment

Section Summary

- There will be a need for training for managers and supervisors to more effectively manage resources, develop workers, and do so in a constantly evolving environment where their own skill might be matched by that of their subordinates.
- Contracts that protect workers from training requirements benefit no one. Exemptions from necessary training and development will result in employees in a work environment from which they are increasingly disconnected and redundant and where the gap between their competence level and the required level (and confidence) continues to widen.
- Management and Unions need to work together to explore ways to reconcile the focus on seniority and tenure with a deeper focus on skills, training and competency

Section C: Workforce Development Issues in a Unionized Environment

Current State

The marine industry has unionized workers in shipyards, fleet maintenance facilities (FMF), within organizations in the supply chain, and in a handful of ocean tech firms, and the unionized workforce is largely divided among skilled trades workers and production employees.

Workforce development issues within these roles have been brought about by;

- anticipated vacancies relating to mass retirements,
- new roles projections to meet demands of large-scale industry projects,
- industry innovations necessitating upskilling and new skill development
- (previously) reduced commitment to workforce training, development and strategic succession as a result of fewer long term projects

The Shipbuilding and Ship Repair Sector

The dominant workforce-related change facing shipyards with the NSPS contracts is the shift away from repair and maintenance and toward new vessel construction. This requires a shift in skills and knowledge, and also in mindset, as production evolves towards the paradigm of modern manufacturing. This shift is akin to the different skill and approach required to fix something in your house versus building that house from scratch. The modern manufacturing paradigm involves more people working along-side, more layered and integrated processes, and thus more coordination and opportunities for cross-utilization of workers.

Ocean Tech and Supply Chain Manufacturing Sectors

In the Ocean Tech sector, and supply chain manufacturers, the dominant change facing manufacturing workers is the adoption of technology that will replace processes that have been traditionally done manually. This will require a very different skillset and comfort level with the technology at hand. In each of these settings there will be a need for more formalized quality controls and adherence to principles of efficiency, effectiveness, and continuous improvement. While this

outcome is ultimately in the best interests of both the industry players and the workers, there are some union-related hurdles that need to be overcome to achieve it.

Fleet Maintenance Facilities: Defense Sector

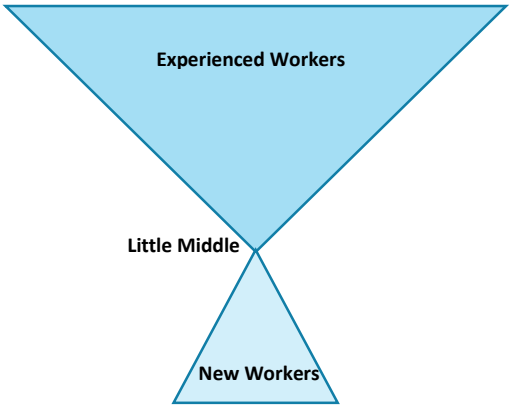
The Fleet Maintenance Facilities (FMF) operate in Halifax (Cape Scott) and Victoria (Cape Breton) and employ trades that include shipwrights, electricians, welders, machinists, and sail makers, to name a few. Most employees are civilian, although the minority who are military also go to sea to conduct repairs there. The facilities generally operate with a ratio of 75%:25% permanent to term employees, and build their workforce from the bottom up, recruiting new apprentices and funding all 4 years of the apprenticeship term (performance depending). Trades employees finish their apprenticeship training debt-free and without obligation to the employer. As a result of these practices, the FMFs boast a very reliable, competent, and dedicated workforce, with a higher proportion of Red Seals than in private sector, and higher retention (interview notes). The dominant issues impacting FMF workforces are uncertainty about the sustainability of separate maintenance facilities, and performance questions about this insulated workforce.

As the industry evolves and commercial yards develop the costly infrastructure and workforces required to provide in-service support and maintenance, the presence of a parallel DND maintenance capability may prove redundant, and the expense of matching the infrastructure requirements, unjustifiable. Additionally, low employee turnover may be a sign of commitment and engagement, but it may also signal complacency and comfortable performance expectations (interview notes). Interviewees allege significantly reduced activity levels at these facilities in comparison with commercial yards. As the marine industry evolves and the broader workforce is elevated in terms of capability, sophistication, and effectiveness, the ostensibly modest efforts at our FMF will expose glaring shortcomings in comparison.

This section will not attempt to mend the common tensions between management and union, but will examine the implications that collective agreements coupled with the polarising dynamic of a pure production focus from employers, can have on learning culture and on programs aimed at recruitment and retention of a young cohort of workers, upskilling tenured employees, and ongoing training and development of an existing and evolving workforce.

Demographic and Succession Challenges

Trades work continues to be dominated by male workers (CBoC, November 2014), and this reality is reflected in the demographics at several shipyards and maintenance facilities across the country (interview notes). The valued currency in any union is seniority, and traditionally it has trumped other conventional metrics in determinations of placement, promotion, and even participation in training. The demographics across Canada's unionized marine sectors have shaped an inverted triangle (not to scale) of older, experienced workers balanced upon the point of a comparatively dwarfed pyramid of younger workers who are newer to the industry.



The top of this shape reflects the current and returning employees who;

- may have had some early experience with shipbuilding, but whose skills have been utilized in ship repair and maintenance for the bulk of their careers,

  or,

- do have current build experience, but not at the scope and scale and level of complexity of the builds to be undertaken in a modern manufacturing environment.

The majority of this cohort will be entering retirement just as NSPS projects reach full activity levels.

The bottom of the shape reflects the newer journey people and apprentices who are in the early years of developing their craft. By and large, this cohort has no or little experience applying their skills to a full-scale build project. Over the next 5-10 years, this illustration will flip as retirements shrink the experienced cohort, and it in turn becomes dwarfed by the group of newer apprentices and journey people in the industry.

The most recent bust cycle in the industry left yards without sufficient work to maintain the capability that had been developed. Seniority decided the fates for those who would be kept, and the rest moved on to other industries and sectors where their skills were readily transferable, and where project cycles were more consistent and predictable. This also meant that yards retained a fraction of their trades, and recruited even fewer to their teams over the past 20 years, creating a 'little middle' of workers who possess experience and who still have lengthy career paths ahead of them.

This little middle represents the cohort that will be the future managers, supervisors, and mentors as the NSPS projects gain momentum and their 'boomer' peers retire. They will develop apprentices and lead operations in a modern facility. They also need to learn to apply their own skills in new and evolving ways, adapt to technologies, and manage the workflow and development of a large cohort of new trades. This illustrates a significant workforce gap, as companies will find themselves with unwieldy ratios of mentees to mentors, and a significant competency gap in management skill. This also presents a filigreed succession plan, where there is urgency to build layers of experience and expertise quickly before the broad top of the pyramid is shed to retirement, and before newer workers are too deeply integrated into the workplace cultures that owners wish to shift.

Ocean tech manufacturing firms have a similar demographic challenge, with the bulk of their workforce looking at short (i.e. 5-10 years) transition periods to retirement. The workforce illustration mirrors the one above, reflecting an aging production workforce that has been historically difficult to rejuvenate because of appealing wages and union contracts coupled with limited mobility options. The consequence of negligible turnover is a workforce that has aged together but not replaced itself at a rate sufficient to build the succession required to balance the mass departure of retirees. An additional consequence of an aging workforce has been the need for more workplace accommodations, resulting in overall productivity and efficiency decline (interview notes). The early learning curve advantages presumed of a loyal workforce have in some organizations been stemmed by the inefficiencies of aging or disengagement curves.

Many of these employees in production roles joined in an era before the high school diploma was a minimum requirement. Manufacturing in this sector is becoming less labour intensive (in terms of hands-on) but highly technologically intensive (low

touch). Many of these roles now involve software defined items, and thus require a very different set of skills. While retirements are on the horizon, there is still a 5-10 year period of productive employment to bridge, necessitating a workforce development strategy to upskill and re-engage tenured employees. Not surprisingly, gaps in literacy and technology literacy among this aging cohort have emerged as tangible challenges to development strategies.

Employers can feel trapped by inflexibility in union agreements that restrict them from rewriting and updating job descriptions, and bringing in more qualified technicians to replace retiring production workers. What Unions perceive as job losses, ocean tech manufacturing firms see as opportunities to redefine and realign critical roles in order to benefit from the efficiencies of technology and progress, and respond to shifting complexity in the products themselves.

This evolution from manual to high tech also has implications for succession and effective management, as tenured workers will find themselves managing or supervising younger workers who may be more educated and skilled in the new technology than they are. This same awkward dynamic may occur in shipyards, where mentors will have more trades-based experience and knowledge, but whose modern-build experience may be matched by their subordinates. And where newer employees may be more comfortable and conversant with technology and have a higher regard for its use in the workplace (Elias, Smith, & Barney, 2012; Tams, 2011; Morris & Venkatesh, 2000), their learning curves in adapting to a modern build environment may outpace that of their superiors. This could create some tension in the traditional tenure-based relationships between supervisors and mentees that are not unlike those experienced in other industries today.

This highlights the importance of training for effective management in a unionized environment, to develop supervisors and managers who are skilled at managing both production and people. To have credibility and influence with subordinates, these managers and supervisors will require authority and power that are related to resource management and skill development, rather than defined by tenure (Espinoza, Ukleja, & Rusch, 2010). This in turn will require modifications to collective agreements to either shift or maintain these management roles outside of the union, or to endorse non-tenure selection criteria for these roles.

Challenges with Adapting to Change

The necessary technology shifts will require upskilling existing workers who may view these changes as threatening or demoralizing. Adapting to technology and new processes requires adaptability to change, and a strong learning culture that values training and development as an investment in human resources. But few interviewees reported strong cultures for learning and change in their organizations, citing more common employee attitudes that viewed change with skepticism, and training as a tool for disciplinary measures. Even the notion of remedial upgrading is viewed as derogatory and punitive as it is perceived to underscore gaps rather than progression of competencies. According to respondents in this study, workers were likely to express insult at being invited to training and development courses.

There are two key issues at the core of this. One reflects a common belief in trades and manufacturing careers, that learning is a terminal event that is concluded in certification. A terminal learning mindset perceives the worker as 'full and complete' upon certification, and underlies some of the resistance to ongoing learning, as workers believe they are already in possession of the full repertoire of skills and knowledge required for their role. This is in contrast with a continuous learning mindset that prevails in most modern workplaces.

The second key issue is the common resistance response that arises from organizational change that has the potential to jolt workers out of their comfort zones, highlight deficiencies, and strain adaptability skills – all compelling triggers for resistance (Van Dijk & Van Dick, 2009; Trader-Leigh, 2002). Change can also shake-up informal and formal social networks, which in turn can disturb coveted positions of power and influence (Goltz & Hietapelto, 2002). Where change unsettles these crucial power dynamics, resistance can be expected from those with the most to gain from preserving the status quo.

This response can arise from a sense of uncertainty, fear about job loss, worry that gaps in capability or performance will be revealed, fear of inability to learn or keep pace with change, and feeling increasingly disconnected from workplace and peers who are adapting more readily. This fear of change is really a proxy for fear of failure to adapt, learn, evolve and perform as well as before. Where the reaction might be to confront the privilege mindsets and attitudes, a more effective remedy will involve strategic and adaptive training models that celebrate the adoption of newly-relevant

skills and knowledge. Whether this resistance to change is a function of willingness or ability or mistrust with a perceived hidden agenda, the outcome is a dysfunctional culture for learning that leaves some workers lagging behind. Furthermore, the conventional wisdom that older workers hold future utility in the role of mentor only holds true if those older workers have actively progressed to stay relevant.

Espoused vs Enacted Commitment to Training and Development

There is a disconnect between the espoused and the enacted commitment that that employees and employers give to training and development. There is often strong messaging about the importance of investing in the upskilling or ongoing training of a workforce, however this messaging isn't always supported with funding or dedicated development time from employers, or with engaged participation from employees.

- **Employees** - Some collective agreements in the marine industry have wording that devalues learning by exempting more senior workers from participation in training, and protects them from redundancy if that training becomes a selection criteria during lay-offs. The message this conveys is that training & development are only for newer workers - that there comes a point when nothing new can be learnt. It also reinforces the 'training is bad' mentality that was reported by several interviewees.

- **Management** – The marine industry has not typically offered many apprenticeships (interview notes). This is partly because of the inability to provide continuous work to tradespeople to achieve their certification, and partly because where all things are equal, companies have also shown a preference for "cherry-picking" certified tradespeople from the competition or other employers rather than investing in the development of new apprentices. It has been largely due to union involvement that many workers received any formal training to achieve their certification, and that employers were held accountable for qualification standards in their recruitment. This reflects a lag in managements' attitudes towards training and development, that remains focused on short term workforce scheduling rather than on long-term capability development as a recruitment and retention strategy. The notion of training as an agent to enhance performance and productivity may be espoused, but practice has traditionally been constrained by a focus on the investment and not the return.

Progress in the industry will require that yards and supplier- and ocean-tech firms align their processes and outcomes with other modern manufacturers, and that they

invest in the necessary evolutions in skill, mindset and practice to do so. It will be important to ensure that negotiation tensions between unions and employers don't generate a false dichotomy between rights of the employees and progress of the industry. The two objectives aren't inherently competing and don't need to be at odds. It will require courageous leadership on both sides to dismiss the habits of previous thinking to see the opportunities for productive partnership and reconfigure the perception of competing mandates.

Perception of Competing Mandates

There is a sense, and to some extent a reality, of competing mandates between employers and unions. This perception polarizes the central employer mandate for productivity, efficiency, and quality with a central union mandate for preserving stability and security of employment. Interviewees reported a positive but gradual shift away from the staunchly antagonistic union/employer relationships of the past, but confess that the starting point for many discussions is often still guarded and skeptical.

In the context of workplace learning and development, however, the interests of both groups converge. Both want to evolve the workforce to be safe, competent and competitive, however democratising learning for workers can allow some to excel and others to fail, with results that defy the conventions of tenure.

Union involvement in training and development is not a new phenomenon. Some unions, like the International Brotherhood of Electrical Workers (IBEW), have been heavily involved in the training of apprentices since the dawn of their trade. Despite this, the development of a prevailing learning culture that welcomes training, and the formation of a broadly supported workplace learning strategy still evades many organizations in the marine industry. The contested terrain generally involves;

- Who should finance the training?
- Who should lead and provide input into curriculum development?
- Who should deliver it?
- Who should be required to attend?
- How will training be evaluated?

- What are the consequences of a poor assessment?
- And, what are the consequences of not participating? (Bratton, Helms-Mills, Pyrch, & Sawchuk, 2003)

Thus, the underlying conflict between Unions and employers is not derived from lack of support for training and development. Rather, it is rooted in the marketization of skills training that shifts decisions regarding content, delivery and access to the employer (Bratton, Helms-Mills, Pyrch, & Sawchuk, 2003). These tensions are exceedingly important to negotiate, as unions can play a powerful role in shaping the everyday learning experiences of workers. And, where collective agreements form the legal framework for many training and development commitments, unions can play an important role in shaping these policies.

In parts of Canada, the workforces of some industry sectors are largely controlled by a union hiring hall model, whereby members join the union, which in turn performs collective bargaining on their behalf and helps them to find an employer. With this model the responsibility for validating employee qualifications is shifted to the union. This model can work well if respect and integrity define the actions of and relationship between the hiring hall and the sector employer(s). The burden of quickly finding and deploying skilled worker, or of absorbing or reassigning them is managed by the union hall, liberating employers from these tasks. However, the counter side to this benefit is that union halls are afforded more negotiating power by their very size and authority over available workforce. They are able to negotiate beyond wages, benefits, and working conditions to prescribe training requirements and exemptions, and mentor/mentee ratios, all of which impact an organization's capability to build in-house succession. From an identity perspective, this has implications for building organizational identity as the protective union becomes the more salient identity group. The result is that industry players could be excluded from the powerful cohesion-building benefits (Tyler & Blader, 2001) of having a highly identified workforce (Fiol, 2002). (For more information on identity and cohesion benefits see Identity section).

In many regions industry or trades councils provide varying levels of apprenticeship or journey-person upskill training. This allows the benefit of directly connecting industry to the training curriculum of apprenticeship programs, and may offer a training option that has is more credible, and palatable, to older trades workers.

As industry looks for better strategies to aid engagement and retention and transfer of skills and knowledge to the workplace, it's vitally important to understand what produces the best learning environment for adult learners. It may be that effective pedagogy with young apprentices is less effective with their older, experienced peers. This an interesting avenue for further applied research, that could provide collaboration opportunities between Union and non-union training providers. A life-long learning philosophy must necessarily be promoted with current information about how to teach and upskill new and existing workers more effectively.

Leadership

Interviews with employees and HR representatives from firms in the marine industry revealed that employees are interested in seeing more leadership development opportunities for those in management or supervisory roles. This interest is partly driven by a new cohort of young workers who are interested in modern management practice and in negotiating a career pathway that could eventually involve a management role. Others expressed an interest in promoting culture change and replacing the 'old guard' with skilled leaders in planning and scheduling, negotiation, conflict management, and contemporary strategies for broader talent management. And from a practical point of view, these modern production projects will require a complete shift in management skill, from directive supervision, to sophisticated orchestration of resources, people, schedules, and technology, coupled with the requisite business and HR acumen to understand the financial and morale implications of this effective orchestration.

Employers cite a need for stronger leadership on the union side to model a more productive and contemporary attitude towards learning and development, towards performance and highest quality work, and towards relationships with authority. Both employer and Union leaders need to model more productive relationships that focus on the common goal, rather than on amplifying the divide through contentions relations.

Union Influence on Learning Culture

Within the union model of tenure-based assignment and promotion there is a perceived inherent contradiction with any learning culture that endorses competency or performance based assignment and promotion. Ideally, the union model also endorses competency based promotion, allowing seniority to reign where equivalent competencies exist. However, it is the assessment of these equivalent competencies that arouses skepticism. Furthermore, as workplaces modernize and adopt innovative processes and technologies, competency at the bottom of the workforce pyramid may match or exceed that at the top, especially if unions use training exemptions as a protective mechanism for seasoned workers. This could present a glaring incompatibility between tenure- and talent-based structures.

Regardless of this apparent paradox, some large unions have evolved to become the de facto providers of skills and upgrade training for their trade. These unions have developed learning and development capability in order to effectively impart the deep expertise of their trade(s) with sound pedagogy and practice. Many of these groups have led the charge on developing blended learning curricula to meet the varied learning preferences of their audiences and provide programs that are broadly accessible. Additionally, several union training providers were early adopters of assessments and programs for essential skills development and mentor training (interview notes).

But reports of challenging mentoring atmospheres within organizations in the marine industry suggest that good teaching practice isn't always making the jump from formal classroom to the workplace. This speaks to the powerful influence that employees in general, and Unions in particular, can play in shaping the learning cultures in their organizations. Some journey people are very committed to providing robust and attentive mentoring, while others, according to interviewees, view the dynamic as an opportunity to redirect work to those lower on the pecking order. Dated notions of 'earning your dues' may have the counter effect of frustrating or disengaging young workers with a bully-style pedagogy of informal learning. While this may seem like an individual challenge rather than a union issue, it does speak a culture that privileges tenure over competency. And where the competency in question is mentoring skill, it can communicate powerful messages about how an organization values learning and development, and how it links personal effectiveness to career success.

Cross-Certification and Career Pathways

Another potential hurdle may be in the union directive of preserving rigid approaches to who does what task in a work process. The point of debate here is the issue of cross-certification. Where natural alignments occur in the trades, for example with welders and pipefitters, many trades workers are acquiring additional certification. Cross-certification promotes a richer mix of skills in a workforce, building trade flexibility which in turn minimizes downtime related inefficiencies, and raises opportunities for employee engagement through broader role accountabilities. Cross-certification also facilitates career path mobility and improves opportunities for continuous employment. The primary argument against cross-training is that it could dilute trades by eliminating pure trades and building a workforce of generalists lacking deep expertise. However, apprenticeship agencies across the country confirm that certification requirements are just as rigid for cross-over certifications as for the primary designation. The second key objection from unions is that cross-certification could eliminate jobs. If one skilled trades employee can perform the work of two then this threatens employee counts.

Collective agreements need to be reviewed and work processes better understood to mitigate impediments to cross-certification efficiencies. This will require contemporary labour leadership with an understanding of modern manufacturing to skilfully balance the interests of workers with the progress and sustainability missions of an industry in need of evolution. This will also require a significant shift in mindset to understand that becoming a more efficient workforce will expand rather than shrink opportunities for continuous employability for competent workers. Diversifying the trades opens additional pathways through and across industries such as LNG and oil & gas, benefiting workers by absorbing labour as regional projects ebb and flow.

Continuing Gap Areas and Recommendations

- **Build training and development programs aimed at Managing in a Unionized Production/Manufacturing Environment.** There is opportunity to scale this training across several other sectors and industries. These programs should integrate the business acumen skills required to understand the manufacturing process from a business development and sustainability perspective, with the people management skills required to skillfully develop and deploy human resources within a modern manufacturing setting, and with the labour relations savvy to mitigate employee/management antagonism while managing within contract margins.

- **Review and revise** wording in collective agreements to ensure that exemptions from training aren't permitting workers to suffer skills and competency declines that protect their employment but hinder their ability to safely contribute, perform, or progress.

- **Privilege the role of mentor.** The mentor's role is one of both positional and social power, and as such, mentors can have potent influence over an organization's culture. Privileging the role means building prestige through exclusivity of selection and training. Strategically assigning the best (i.e. those possessing the desired skill level, attitudes, and behaviours for younger workers to emulate) skilled journey people to the role of mentor, and providing exclusive mentor training, ensures that young talent is being cultivated in the right way, and builds the esteem of those in a mentoring role. This practice can become self-reinforcing and rewarding as long as selection criteria and mentor training remain robust. A strategy of building exceptional mentors also benefits the unions, as efforts to professionalize trades are supported by the quality of the people who are in these influential roles. Exclusivity builds identity and commitment, and is self-reinforcing – anyone can be a Journey-person – but not everyone can be a mentor. Challenges to this strategy are that ratios and union contracts may require the full and inclusive deployment of journeys to the role of mentor.

- **Engage Unions to help actively build a stronger learning culture.** A strong learning culture includes attitudes for continuous improvement and adaptability to change as well as openness to training and accountability for one's own personal development - and are thus socially- and strategically-adaptive aspects of an organization's overall culture. Offering learning and development opportunities that are both mandatory and voluntary can support this. It is important to change the narrative around training so that mandatory training is reframed in terms of commitment to enhancing capability and continuous improvement, and voluntary training is communicated in terms of its enrichment and career progression benefits. Where possible, develop more in-house leader-led training to profile high performers and reinforce desired attitudes and behaviours skill attainment. Unions can play an important role in

building this culture, through endorsement, participation in training programs, and partnership in program development and delivery.

- **Develop a comprehensive talent management strategy** that outlines development opportunities for employees at all levels, that targets and cultivates high performers to aid retention and to position them for influential roles, and that focuses on building a sustainable workforce with succession derived from in-house capability and continuous rejuvenation from entry level. Such a strategy would need to balance deeply engrained Union-oriented notions of collectivity and tenure with contemporary practice that privileges performance and progression over seniority.

- **Incentivize more industry investment in long term training programs** focused on building a pool of capable and skilled workers for the revitalized marine industry. Some government incentives are too short-term to establish an enduring commitment from industry

Conclusion

There is an opportunity for Management and Unions to work together to support and facilitate workforce development at the organization level, as well as at the industry level. Unions are by definition workforce focused, and significant expertise and enthusiasm exists within their membership for learning and development. Marine unions will need to evolve to ensure their missions stay germane to the present and future members they serve.

The primary opportunities for organizations in the marine industry are to recognize their accountability through investment in workforce development; and, to establish more effective relationships with union leaders and explore collaborative training solutions to build engagement in training; and, to cultivate a stronger learning culture at all levels of the organization. Change is a constant in any industry today, and with continuous change comes the perpetual need to upgrade skills and practices.

The corresponding primary opportunity for unions in the marine industry is to reconcile their focus on seniority and tenure with a focus on continuous skills improvement, competency, productivity and efficiency. This will be a challenge in an industry that historically has had relatively low productivity (interview notes). And

adding to that challenge is the possibility that the first builds will take longer than forecasted (interview notes) as trades workers and professional employees (i.e. engineers) alike adjust to new technologies, new requirements, and new working dynamics with integrated and layered teams. Orchestrating these new and established activities will require experienced leadership and management -talent that will likely need to be purchased from outside of the company or the country during the early years of the projects, until in-house capability can be developed. This may also increase the costs of the initial bid, but arguably less so than not hiring experienced management.

Where there's a tendency to use the first builds to predict subsequent builds, there will be added pressure to shave initial learning curves. The numbers of person-hours per vessel launched will have to go down over time in order for the yards to remain competitive. This isn't just ideal – it's been mandated. NSPS contracts have established requirements for continuous productivity improvement with financial incentives and penalties attached (interview notes).

In fairness to the Unions, having rigid accountability for person-hours and resource-use is a relatively novel concept in some sectors in the industry – in particular in the yards. Traditionally there has been little incentive for either management or employees to improve efficiency, since escalating costs were typically recoverable as change orders on the base contract. This old-style contracting for repair work is what inspired the adage, "*bid low and make your profit on change orders*", and what led to a modest work-pace (interview notes).

Finding innovative approaches to meet the ongoing development needs of the industry's workforce will serve both employee and employer alike, but this is a difficult argument to convey to a group of employees who have watched their industry boom and bust repeatedly, and whose lived experience has shown them that sustainability of work is found not in heightened efficiency, but rather in prolonging projects until the next sure thing floats up to the dock. Even Unions with more encouraging lived experiences, and long-standing strong relations with management, like the International Association of Machinists and Aerospace Workers Local S6 at Bath Iron Works, show some resistance to this trend in expectations. Recently, an article on BDN Maine reported a solidarity rally led by the primary union at Bath Iron Works. Their chief concerns? Outsourcing of work and cross-training of employees – recommendations made by BIW's new President with the objectives of increasing efficiencies and reducing costs to remain competitive (Moore, 2015). Rational

arguments of competitiveness and sustainability are often flipped to pronounce a profit agenda at the expense of employment. But agendas aside, the reality is that without improved efficiency and effectiveness, the global competitiveness and sustainability objectives of the NSPS program will fail and the next bust will cycle in with certainty.

Section D: Developing a Workforce of Professionals

Section Summary

- We have sufficient professional programs and numbers of graduates in each region, and sufficient numbers of graduates to meet demand in each region, assuming continued trends for interprovincial mobility to higher demand regions
- Many working professionals are not looking for more certification – they are looking for learning and education opportunities that can be done in modular approach to mitigate time away from work
- There is a need for more structured mentoring and on-the-job training for new professionals to support rapid up-skilling and strategic development

The Demand

There has been a great deal of focus on building capacity of the skilled trades workforce, and considerably less focus on building a workforce of skilled professionals with deep and distinctive expertise who will provide the leadership, research and development capacity, and innovation to drive the industry forward. As the Canadian marine industry looks to the future and seeks to carve out its own competitive advantage in the global marketplace, it will more likely be found in knowledge-intensive practices of design, project management, consulting, and innovation than in labour intensive production and manufacturing. Revitalization of the marine industry will thus require a shift in emphasis that includes design as well as build, and the ostensible myriad of professional roles that support this shift. Many industry players believe there is an opportunity for Canada's marine industry to become the itinerant leaders in specialized ship construction for harsh environments, ocean engineering and ocean technologies. But for this to transpire, a sustainable workforce of educated and experienced professionals, committed to building domestic capability is needed.

The Challenges

Interviews with industry employers highlighted areas of concern and opportunity in the development of a workforce of professionals that includes engineers, naval architects, project managers, and ocean and technology researchers, innovators, designers, and developers, to name a few. These professions generally require a University degree or a knowledge-intensive college diploma (or advanced degree or diploma), and tend to require deep cognitive faculty as well as some technical expertise. For the purposes of this paper, this workforce is distinguished from the skilled trades and technology workforce as the *professional workforce*.

Engineering

Several employers have raised concerns with the quality of engineering graduates from University programs and College technologist and technician programs. Among

their concerns are gaps in written and oral communication skills, interpersonal skills, and skills in communicating ideas to a customer or other stakeholder. Some might counter that this has always been the case with engineers, but the reality is that work environments are becoming increasingly collaborative and inter-disciplinary, requiring a better balance of technical and interpersonal skill from their professionals. Also cited as a significant gap is the lack of workplace experience, a challenge which is already being addressed by PSIs through the use of more co-op and internship programs and capstone projects. And finally, there is some evidence that declining essential skills competencies in numeracy, literacy and problem solving may account for increasing failure and attrition rates among first year students. This may point to a need for more PSIs to require standardized essential skills assessment as a prerequisite for these post-secondary programs. (See section on Essential Skills for more information).

According to a report conducted by Engineers Canada (C4SE, June 2015), the labour market outlook for engineers (in particular for civil, mechanical, electrical, electronic, and computer engineers) anticipates steady demand for the next 5-10 years, as markets respond to drivers that include industry growth in several resource industries, and the replacement demands created by retiring boomers. Engineering managers are predicted to see a sizeable replacement demand, with 70% of job openings in this category over the next five years created by retirements (C4SE, June 2015). According to this study, a normal market situation will endure for most of the engineering professions over the next decade, meaning that there will be a sufficient supply of workers and organizations will be able to rely on traditional methods for obtaining workers. This is true for most of the provinces except for BC, Alberta, and Manitoba, where interprovincial mobility shows a strong westward pull due to replacement as well as expansion drivers. In these provinces recruitment will be competitive for the next five years. This has several implications for the profession;

- The significant retirement related turnover over the next decade will result in a skills gap as the proportion of experienced workers shrinks in relation to new workers
- Interprovincial mobility of engineers will likely increase, as companies endeavor to recruit experienced workers
- Senior engineering professionals will be in high demand as organizations endeavor to rebalance their workforce demographics following retirements. This may produce a salary premium for seasoned staff which may in turn entice recent retirees to return to their roles in a temporary or consultant capacity, thus bulking up supply

These outcomes could have a significant impact on the marine industry, as the presence of senior, experienced engineers will be critical to the success of the NSPS projects, especially in the early design and production phases, and for in-service support contracts. Companies will need to leverage strategic mentorship models and in-house training models to more quickly upskill new workers and to provide the diversity in on-the-job experience that will be needed to emulate the development outcomes traditionally gained by years of experience.

Additionally, an echo of a strong employment market is often a decrease in entrepreneurship, as workers are lured by the ease of available employment and good compensation. This could have implications for the ocean technology sector which is largely comprised of small start-up companies and the innovations that define their origin. The Engineers Canada report (C4SE, June 2015) did show a promising increase in females and immigrants to the engineering profession, which points to more potential supply points to meet the growing demand.

> During the research and writing of this report the oil & gas industry suffered a significant global slow-down that has resulted in considerable layoffs of workforce of at least 150,000 globally (News & Technology, August 2015), including trades and production workers and professional staff. Declining activity in this sector has produced slack in the supply of available workers, which, according to industry employers, has already facilitated the repatriation of some migrant workers back home and back to the marine industry. If this trend continues, it could simplify the search for experienced workers (and diminish the salary premium) for the marine industry, where competencies generally have significant cross-over between the two sectors. But recovery of the oil & gas sector will present a test of workforce stability. Will recovered workers choose to stay in the marine industry, where projects have the promise of career-long durability, or will they be drawn back to the prosperity – albeit unpredictable – of oil & gas? And what will be the impact to the marine industry should a large group of employees choose the latter?

Naval Architecture and Marine Engineering

Naval architecture and marine engineering programs are presently offered at the college (technologist), undergraduate, and graduate levels in schools across Canada, from the University of British Columbia, to the Institute maritime du Quebec, to the Marine Institute in Newfoundland, and the Nova Scotia Community College. These are capital-intensive programs that produce well-skilled graduates. Presently, supply and demand of new grads seem to be well-aligned, with the exception of the marine

engineering technologists, naval architecture technologists and marine systems design technologists who are in high demand, but whose programs tend to be undersubscribed. This may be the result of career counseling that steers engineering-oriented young people along degree pathways.

There may be an opportunity for professional associations and industry employers to partner on career awareness programs in the k-12 system, which could include sponsoring the development of dual-credit programs[14] in engineering technology, or providing the subject matter expertise for developing engineering courses or extracurricular awareness programs in the intermediate and secondary school systems.

Professional roles in manufacturing, production, research, and ocean technology firms range from research scientists to design engineering roles. Recruitment tends to focus on either very experienced senior professionals, or very new graduates (or pre-graduates, leveraging co-op and internship programs to cultivate new talent early on). These roles tend to be highly specialized and close to the customer, and so in addition to the gaps reported above in communication and interpersonal skills, these organizations cite the ability to communicate with customers as an important competency (and present gap), as well as organization-specific skills and knowledge which often entails the un-training and re-training of new employees to refine the customized skills and knowledge that are required for performance in their new firm. An example of this is the reported gap in the use of the software, which may be a function that is highly customized to each company. These challenges can in turn be addressed through more industry experience concurrent with post-secondary education. Most internship programs or capstone projects occur only in the final year of an academic program, pointing to opportunities for practical experience to be embedded in each year of an academic program. Consistently undersubscribed programs could also look to an apprenticeship-type model where students can earn while they learn to incent registration, and where employers can foster tailored skill and knowledge development from the start with formalized on-the-job training and mentorship. This also offers the potential benefit of retention of young talent.

[14] Dual-credit programs allow secondary school students to take courses towards a college or apprenticeship program that count towards both the high school diploma and the post-secondary certificate. These programs allow students to fast-track their education, while facilitating engagement in a specific career path. Dual credit programs are offered in most provinces.

Pathways

Recently there has been a strong emphasis on education and career pathways. These pathways represent a philosophical shift towards continuous learning and development, and also an acknowledgement of the practical shift towards multiple, continuous, and (ideally) progressive careers, and the attendant training and designation-earning that accompanies those careers. Pathways have long been the norm in professional roles where experience plus credentialing has typically been rewarded with promotion or lateral shifts. But the notion of pathways has now diffused across the career spectrum, and young apprentices, and technologists and production workers are being encouraged to contemplate the progressive steps they could take from entry level to executive, or other branches along the way. The optimism behind this theory is unmistakable, but there are some practical challenges that continue to block the realization of broad-reaching pathways. Central to the notion of pathways is access to training or education. Decisions made at the end of the intermediate years regarding academic streams can make it difficult to switch from an applied to an academic pathway during the high school years, and afterwards. Bridging courses or programs and articulations can facilitate the transition across pathways, but these options are still limited, and have some inherent practical challenges, including;

- **Students may be limited in their pathway options by math and science prerequisites.** For some students, these are high-school-level transcript gaps, for others, undergraduate level gaps. Bridging programs can fulfill some of the course requirements, but they are often condensed, intensive programs that can be challenging to students who have taken considerable or even small pauses in their related academic studies. For some students the notion of having to backpedal to grade 12 algebra or physics can be too disheartening or can seem like too much of a side-step to consider. More post-secondary bridging programs are needed to provide pre-requisites or simply knowledge upskilling, and to set performance expectations that support articulations between academic programs or institutions.
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- **Many community colleges operate on a 'first with pre-requisites to register' basis**, meaning that they cannot screen for the best students, but must take the first who meet the minimum requirements. This intake policy reflects the democratization of education, but is in stark contrast with many University programs, like engineering, where entrance is highly competitive and grade driven. This can pose articulation challenges for students hoping to shift to a University track, as average academic achievement in the former program could fall well-shy of minimum performance in the latter.

Getting through an undergrad engineering degree is not easy with challenging material and workload requirements. Anecdotally, there is little evidence that the majority of community college technology graduates would be able to succeed in an undergrad engineering program. We need to be careful that the pursuit of democratized education and pathways doesn't result in setting false expectations for students, or watering down the undergrad content to accommodate a broader range of learners in specialized programs like engineering.

- **Under-developed essential skills** can produce a porous knowledge and skill base that can make it difficult to make the academic exertions needed to rapidly upskill to bridge or articulate into programs. PSIs may need to consider mandatory essential skills assessments (literacy and/or numeracy) as a prerequisite for articulation.

- Due to the **specialized nature of marine-oriented careers**, career pathing has been less sophisticated. Roles will need to be calibrated to see where qualifications and competencies align to support novel career progressions. Some of this work is already being done by regional apprenticeship agencies like the ITA and the Nova Scotia Apprenticeship agency.

Generally, students transitioning from universities to colleges are doing advanced diplomas or are changing directions with their studies, and so rarely are reverse bridging programs required. However, as practical advanced diplomas become more common place and popular, registrants who are typically drawn from a broad range of educational backgrounds may find some bridging options beneficial to elevate necessary skills that may be outside of their previous area of concentration, to ensure that the level of instruction and expectation remains high. A key benefit of post-graduate programs at the University and college level is the learning that occurs between students. This synergy requires students with strong theoretical and applied backgrounds in their respective fields, and requires that students have functional skills and knowledge in secondary subject areas that are common to the program. Bridging programs can provide rapid upskilling to ensure that students are successful in regular course content, and to ensure content is not diluted to accommodate a broad range of capabilities.

The key benefit of pathways and the articulations that facilitate these options is that of choice. People are less likely to be leashed to an early choice, as articulations give

opportunities for students who started on one path to merge onto a new one and continue.

Training and Development for Existing Professional Workforces

There has been much emphasis on the training and development of skilled trades workers and of new employees to the marine industry, but there is also a need for on-going training and development for existing professional workforces. Training needs range from traditional technical and management skill, to new skills and competencies that arise from technological or process innovations. This speaks to a need for both off-the-shelf programs and just-in-time new programs that are responsive to rapid industry changes. Training programs need to be adaptable to adult learners in terms of accessibility of content, hours, learning style and delivery channel (i.e. in class, online,). But until recently, ongoing training and development in the marine industry has not been a priority. The results of this are;

- Relatively poor learning cultures that perceive training as punitive and remedial rather than developmental, and a lack of commitment to training campaigns that are dismissed as the 'flavor of the month'. Additionally, there is often a sense that training is for new employees or non-professional roles, and that professionals are exempt from this requirement.
- Few domestic training providers for just in time training or for deep technical training
- Relatively novel relationships with existing domestic training providers
- Scheduling challenges arising from a sudden surge in training demand
- Professional development and talent management strategies may be under-developed or missing entirely, resulting in learning & development that is haphazard, not purposeful, or provoked by spend requirements rather than development

According to a study conducted by the Conference Board of Canada (CBoC, November 2014) less than a third of Canadians aged 25 to 64 participated in job-related informal training. Those who did receive training received on average of 49 hours of training – well below the OECD average of 59 hours. There are no published stats on training in the marine industry, but interviewees estimate that annual training has been significantly below the national average. Many industry employers expressed an interest in changing this, although they are often confounded by budget and capacity challenges. And commitment to development is needed from employers and employees alike. Professional workers have been found to be generally more

receptive to training and skill development than their non-professional peers, however this receptivity is contingent on the perceived need and relevance of the training, and the perceived credibility of the training provider.

Interviews with industry leaders and professionals revealed that the interest in training is development- rather than credential-focused, meaning that these cohorts of employees are interested in improving their capabilities, but are less interested in dedicated learning that takes them away from their work for extended periods of time, or that necessarily results in further credentialing. For many professionals there is a growing sense that once one has achieved a certain level of education[15], that credibility and contribution are more likely generated by experience and the ability to stay current than by the alphabet soup that trails their signature line.

This has important implications for training providers in the marine industry, as professionals are more likely to be interested in training that can be consumed in modular, condensed bites in a punctuated series that produce immediate capability or performance or productivity benefits and that minimize time away from work. Industry employers are likewise less concerned with credentialing, beyond the minimum expectation. Most employers expressed that experience in the marine industry and relevance of ongoing learning are the distinguishing factors in a workforce. The Canadian engineering profession has moved towards a documented continuing education requirement to maintain the professional designation. These requirements are provided by the Canadian Engineers Qualifications board, and the primary objective of these professional development requirements is to support the ongoing assessment, development and maintenance of professional competencies (Engineering Qualifications Board, 2004). Provincially, the continuing professional development (CPD) requirements vary in terms of voluntary and compulsory requirements, and the expected hours of annual development range from 60-80 (CPD, 2015), which is well above the OECD average. These CPD requirements highlight a mechanism for public or private training providers to offer customized and 'marinized' training to these cohorts of professionals to support the industry while also elevating the expertise of its workforce with accessible and convenient learning options.

[15] There are definite reported compensation and career mobility benefits to further credentialing, though once a post-graduate designation is achieved there are smaller incremental benefits of further credentialing. Employers and employees alike reported that the outcomes of continuous professional development should focus on new learning to support maintenance and skill relevance.

Regional Community colleges and Universities offer customized training and development programs to several emerging industries, including the marine industry. Industry/PSI partnerships have developed flexibility in programming and capacity to be able to scale up or down in response to demand, and these close partnerships can facilitate the incorporation of curriculum modifications that arise from policy or innovative changes. There will be an opportunity for PSIs or private training providers or professional associations to develop standard or customized training for professionals to support the rapid upskilling of mid-level employees who will shift into senior roles as their boomer colleagues retire. There will also be a need for just-in-time training and modular continuous training to respond to continuous innovation-driven changes, and to build management capability. These opportunities apply to training providers across the workforce continuum, where skilled trades workers and professionals alike can benefit from flexible schedules that offer courses during evenings and weekends to mitigate time away from work. Flexible scheduling from PSIs for customized training is occurring in some schools in the west, but is still not the norm on either coast. This adds costs for employers and employees who must give up work time to accommodate the day-only schedules of education institutions, and creates scheduling challenges for instructors.

Continuing Gap Areas and Recommendations

- **There will be a need for more structured mentorship and on-the- job training of professionals to mitigate learning curves.** Industry employers contend that, given the deeply customized nature of the work in the marine industry, it takes 3-5 years for engineers, architects, and technologists to really begin contributing to a company, despite the high quality of the new grads. Rapid upskilling, experience-gaining, and knowledge transfer can be achieved through strategic mentoring programs that pair new or mid-level employees with tenured workers.
- **One of the challenges reported by some engineering professionals is the real lack of part- time graduate degree programs – more so on Canada's east coast.** According to some employers in Atlantic Canada, this has posed a recruitment challenge in trying to attract talent from away, as regional schools have not traditionally offered convenient, after-hours access to part time graduate degrees. It has also presented a scheduling and retention challenge, as engineers who do wish to pursue further education must take considerable (12-24 month) work sabbaticals to do so. Several employers have reported that the benefit to the company of a post-graduate degree is mitigated by the inconvenience and experience gaps produced by multi-term departures for school.

- **Improve ocean literacy of our young people by building interest, engagement, awareness, and knowledge base.** There is an opportunity to develop ocean literacy through the k-12 curriculum and through awareness and exposure building programs. There need to build stronger curriculum links to the ecological and economic connections we have with the oceans, and to the diversity and range of potential marine careers.

Conclusion

In recent years the employment culture in Canada has seen an emphasis on credentialing that has inspired for some young people, a race to the top academically, without work experience. Meanwhile, marine industry employers assert that the best grads are those who arrive with some practical work experience as they seem to have more realistic expectations of their own skill level and of their reasonably expected compensation when they graduate into full-time employment (Garavan & Murphy, 2001). Employers report that those without experience tend to have an inflated idea of their initial contribution and are sometimes affronted by expectations that they participate in on-the-job training or mentoring during their early employment periods. Furthermore, research has shown that practical experience leads to higher employability for the students, and more positive perceptions of graduates and the programs in which they study (Gault, Leach, & Duey, 2010). This suggests an opportunity to continue to modify the education paradigm that informs much of University education in Canada, to reflect the need for more applied learning and workplace relevant skills, and to socialize the expectation of continuous learning.

Post-secondary education in Canada is already evolving to reach a broader audience of students, with programs and courses along the full continua from deeper concentrations with intensive skill or knowledge building to broader curricula that build rounded generalists who can adapt to a variety of roles and industries. Across the country, several community colleges have transitioned from technical training facilities to research focused, diploma and degree granting institutions. In turn, some Universities are emerging as teaching-intensive institutions that place work-place relevance of skill and experience as a priority outcome of their programming.

As we look to our PSIs to provide new cohorts of skilled graduates, we see evidence that education paradigms are already shifting toward a more applied learning direction, as many programs now include co-ops, internships, or capstone projects to provide work experience and interdisciplinary exposure, as well as an early connection point with industry. These partnerships in turn provide a feedback loop with industry to ensure that academic programs are reflecting the KSAs and competencies required by employers.

There is a strong sentiment in the marine industry that qualifications for professional roles are partly credential driven and partly experience driven, with a bias towards the latter for more senior professional roles. The foundations for shipbuilding,

design, systems design and integration, research, and marine technologies are established with PSI credentialing, but what distinguishes good from great is marine experience. And expertise takes years to develop. This presents a recruitment challenge as well as a retention challenge for industry employers.

Recruitment challenge. The most recent bust period scattered many professionals into different industries resulting in a present-day domestic experience gap. Short term recruitment will need to look to other domestic or international regions to find some of this senior talent, which could produce HR budget contractions and public relations woes as local workers see the perceived 'best jobs' go to workers from away.

Retention challenge. This also puts pressure on organizations to keep professionals in the industry so that they can build the deep experience that benefits the firm and the workforce beneath them. Employers will need to find creative ways to stem the allure of other industries that go beyond competitive compensation, which can be readily outmatched. These senior roles also tend to be highly visible, and turnover at these levels can signal discontent, uncertainty, or instability that can have a contagious effect on other talent. Employers will need to build deeper employee connection and engagement and identity with the industry to strengthen attachments and build career endurance.

Stability and predictability in the marine industry provide the conditions under which industry players can confidently invest in innovative technologies and infrastructure, as well as in talent management strategies that focus on recruiting, developing, and retaining professional talent. An audacious goal for the national marine industry may be to invest in and develop our workforce to the point where they drive (and are driven by) innovation, become one of our Key Industrial Capabilities (KICs), and in turn represent our competitive advantage, globally. When the 'stuff' that we export globally is our IP and the human resources who develop or work with it, then we can truly say that we are world leaders in the marine industry.

A final word…or two

There is history to every industry, and some wear that history proudly, while other industries struggle to wrestle free from the mire of their legacies. In some cases, it is more difficult to shake off the dust of the past when it is embedded so resolutely in the lived experiences of its present-day workers and industry participants. A hallmark of the marine industry is its cycles of boom and bust. But the echoes of these cycles have touched workforce, infrastructure, supplier development, and industry confidence and image. Stability and predictability are the prerequisites to confidence and optimism in the future of the greater marine industry. Stability and predictability legitimize career options, justify infrastructure and workforce development investments, and re-investments back into industry and its supply chains. For these reasons, stability and predictability are the core underlying objectives for the greater marine industry across Canada.

There is a tendency to focus on shipbuilding as the nucleus of the marine industry, insofar as it is presently the catalyst for national interest and investment across its inter-related sectors. Shipbuilding and repair, and the value chain that surrounds it, is a broad industry that requires a broad workforce with deep skills, and with higher education and expertise to elevate it to the ring of world class competitors. It is an industry that is both labour driven and innovation driven. Skilled workers and technicians build the ships and produce the ocean technologies, but engineers and ocean scientists and entrepreneurs and innovators will evolve the industry to endure beyond the promise of government contracts, and earn participation on a global scale.

There has been a strong emphasis on the importance (and scarcity) of skilled and experienced trades workers in Canada, and in many ways NSPS is both a pretext and a catalyst for elevating the profile and awareness of trades and technology work nationally. Revived interest in the skilled trades benefits several industries and provides viable and valuable jobs that can be sourced within our nation's borders.

The practicality of a national marine industry workforce strategy is found in the synergies that emerge from systems of innovation. The theory of systems of innovation is predicated on the flow of knowledge, technologies and information

among a complex institutional framework that spawns collaborative innovation. In this case, the flow of knowledge, technologies and information are related to the consistent education, training, and development of a workforce, with regional customization where appropriate.

The benefits of stability, harmonization of skills and qualifications, and strategic mobility in lieu of uncontrollable brain drain can arise from a national and collaborative strategy. Additionally, the resources that are scattered into numerous and fragmented education and training programs can be channeled into common programs or models, that in turn can have scalability across regions, and perhaps also across sectors. The sum total of these benefits can be enjoyed as significant efficiencies and economies of resources and time. Indeed, many of the challenges outlined in this paper are not unique to the marine industry, but are common to several resource industries that share this workforce.

Part of the challenge in understanding the scope of the workforce issues is that we still don't agree on what the demand is. This is partly because labour market forecasting is a political mechanism and is anecdotally evaluated by several industry players as overly optimistic. This is partly because these forecasts tend to look at skills in isolation, rather than recognizing the significant cross-over skills that many trades possess. It is also partly due to myopic forecasting that tend to examine industries in isolation rather than viewing related industries in combination to see where there is significant overlap in high demand jobs, and where there will be high competition for skilled labour and professional roles across a spectrum of related industries (i.e. LNG, construction, mining, oil & gas, offshore energy projects). And it is also in part due to the fact that the numbers cited often reflect peak labour demand as a prediction of continuous demand.

We do know that there will be vacancies from retirements and from natural attrition. There will be vacancies that result from defections across industries. And there will be opportunities from new positions that emerge as projects ramp up and production gathers speed. But what is not yet known is how labour demand and supply will be impacted by advantages arising as learning curves are scaled and production efficiencies are realized, or over the next several years, as innovations and new technologies gradually evolve the production process or give rise to a new cluster of nationally and globally successful local suppliers. Indeed, if we build the first and the last ships the same, or if related sectors across the industry don't evolve, then the transformational potential of NSPS will have been squandered.

There is also a growing argument for cross-certification of related trades which enables more efficient utilization of employees, but also facilitates worker mobility across industries and regions. These are inevitable and necessary trends for this industry to evolve and succeed and to justify investment in an industry that is capable and worthy of sustainment.

Here are the main messages that I hope came across in this report;

- We need to acknowledge the heavy burden the boom bust history has placed on the industry, and the significant time it will take to shed this weight. Stakeholders will need to see investments from industry and government happen across the broader industry, and will evaluate progress with promises kept. Confidence will be built with a focus on early and ongoing successes celebrated with public and media optimism

- We need to recognize the importance of more effective career coaching for our young people and for our existing workforce, as they contemplate careers as pathways. This includes shifting the traditional career paradigm from a terminal to a pathway focus. This also includes informing parents and other relevant role models so that they can confidently endorse alternative pathways and choices

- We need to recognize the Importance of building engagement and interest in oceans related courses and careers in very early years of schooling as part of a strategy for reaching our future workforce. This requires additional resources and programing to compliment in-school curricula, and requires additional support to teachers

- We need to rethink what we consider to be our 'workforce', and take a strategic approach to the mobility trends of our workers

- We need to build an engaged and attached workforce to support a focus on work quality, and to build the workforce stamina that is needed to leverage learning curve and knowledge transfer efficiencies

- We need to give young people more chances to build competency, adaptability and critical workplace skills to support their transitions through the education system and into employment

- We need to review what is needed in terms of essential skills, and focus on relevant skills and knowledge. At the same time, we need to inculcate a mindset and build skills that will support a life-long development capability, that includes adaptability and entrepreneurial spirit, and educational curiosity (sometimes for the very sake of it)

- We need to find ways to open more doors to under-represented workers. Technology has removed many of the physical barriers to involvement in a broad range of careers. What remain are the social and cultural barriers – and it is essential that we pull these down to facilitate workforce evolution for the industry

- We need to focus on meaningful metrics of success. This includes finding ways to balance the sometimes-competing success metrics of Government, industry, academia, labour, trade associations, and special interest groups

- We need to see both industry and government more engaged in the learning and development of the industry's workforce. And we need this commitment to endure beyond the initial start-up period to ensure that industry receives the attention needed to support is evolution towards sustainability

- We need to develop a workforce of professionals who will innovate and find new markets and new competencies that will endure beyond the scope of the NSPS projects

A strong workforce recruitment and development strategy needs to start with understanding why people aren't clamoring to enter the industry. Part of this comes down to the industry stigma that has gone too long unchallenged. And part of it comes down to lack of awareness of the industry, and limited opportunities to profoundly connect with the vastness of interests and sectors that comprise the greater marine industry.

In the ocean technology, ocean sciences, ocean research and other sectors of the greater marine industry, so many present workers can trace their interest in their field to a notable moment from their childhood when they interacted with the ocean or with ocean wildlife, or with a piece of ocean technology like a boat or an ROV or marine robot – and their interest was sparked. For many of our students, these opportunities to interact in meaningful and hands-on ways with our oceans are limited or non-existent. Without these opportunities we are left to rely on serendipity to spark a passion for and awareness of marine-oriented careers. This speaks to the need for more interactive curricula to build ocean awareness and ocean literacy, integrating ecology with economy and innovation.

The opportunity to address these needs is here now. This report and the past year's research is a testament to the great work already being done, and to the optimism in the future of the industry. To reach further, we need to decide if we will allow the

greater marine industry to be forever tethered to its history, or if we will seize the swell of the tides and surge forward, against the pull of cynicism, towards a future of sustainability and new promise.

Appendix A: Summary of Recommendations

Section	Topic	Recommendation
A: Priority Issues in Workforce Development	1).Timing of training and skills development programs	**Training and skills development programs need to be well-timed to allow for proximal on-the-job application**. This also has implications for training programs where Government funding for registrations are out of sync with job availability and upgrade use. Without opportunities to apply and embed the learning, these training programs can result in lack of retention or transfer of skills. And without continuous use and maintenance of essential skills, they are very prone to erosion.
	2). Bias and stigma of the marine industry	**Shift Perceptions of the industry**. Lingering perceptions need to be addressed to mitigate the extent to which they continue to impair the ability to recruit new workers to the marine industry. A Federally funded marketing campaign aimed at changing the narrative of College education and Trades and Technology training generally is needed.
	3). Learning and coaching in the mindset and skills of entrepreneurism	**Planting the seed for entrepreneurism**, and providing training around basic business acumen could facilitate earlier and more successful ventures into small business ownership. This should be happening in the k-12 system, so that the next generations will be raised to wonder, not if they will be an entrepreneur or innovator, but how they will.
	4). Career literacy – digital national and regional strategy	**Develop a national strategy (with funding) to provide career Literacy programs for young people and their parents.** One-to-one career coaching by counsellors in the k-12 system is paradigm that is un-scalable and unviable in today's world. Modern career coaching involves knowledge of updated labour market forecasts, education pathways, earning potential, and competency requirements for a broad range of technical and professional careers. Our young people would benefit from a centralized one-stop-shop that integrates the data relevant to career selection on a user-operated platform that can offer scale, relevance, and timely data, that can be centrally maintained to stay current, but also regionally customized, and that can offer access to national data to cater to the mobility interests of our workforce.

Section	Topic	Recommendation
Section B: Developing Workforce in Skilled Trades and Technology	5).Recruitment to trades and technology pathways	**Develop more awareness and exposure building programs with broader reach to provide young people an opportunity to learn about trades careers.** More programs are needed that offer exploration options to all students in younger grades before social biases regarding career intentions are too firmly embedded.
	6).Recruitment to trades and technology pathways	**Conduct more active recruitment to apprenticeship and technology training in schools.** The majority of individuals who enter into apprenticeship, do so several years after completing high school. Earlier recruitment can raise awareness and connect youth to relevant pathways earlier on.
	7).Facilitating transitions and pathways between k-12 and post-secondary	**Increase the number of dual credit program offerings in the secondary school system.** Research has shown that high school graduation rates improve with dual credit programs that create a seamless connection between high school and apprenticeship. Dual-credit programs offer a jump-start on careers that effectively keeps kids engaged in school. Additionally, dual credit programs could also benefit students interested in technology and technician roles, and programs should be developed to help bolster awareness of, and registrations into these undersubscribed programs.
	8).Supporting awareness and exposure to trades and technology education	**Develop more hands-on technology programs integrated into the existing science and technology curricula.** Integrating trades and technology back into the mandatory grade 6-8 curriculum could provide an opportunity to reach a broader group of young people than existing voluntary programs do, and could help to validate trades choices as they would be explored alongside traditional academic-track choices, and not only once those tracks have been exhausted. Adding to this is the need for explicit teaching and connection of real-world application of math and science concepts across curriculum levels.
	9).Essential skills	**More support is required for development of all 9 essential skills**. In particular, pre-assessment of numeracy and literacy skills will provide valuable information to education providers so that they can offer (or require) remedial support to mitigate student attrition and disengagement related to gaps in these key essential skills. In addition it is recommended that regions review existing applied trades math programs to ensure the outcomes align with level 3 essential skills and with PSE entry requirements

Section	Topic	Recommendation
Section B: Developing Workforce in Skilled Trades and Technology	10).Digital strategy for trades and technology professionals	**A digital strategy is needed for all regions to track apprentice development and to track ongoing career development once certification has been awarded.** This would enable apprenticeship offices and agencies to track pathways and progression, to gather more accurate workforce data (to measure program performance and the impact of interventions), and to provide a channel for accessing alumni. Ideally these databases would use the same platform across all regions so that interprovincial mobility could be tracked regionally, facilitating transfer of apprenticeship program records and data collection on mobility trends. This tool could also include a 'matching service' that allows industry members and apprentices to more readily search and find one another.
	11).Teaching and assessment of trades and technology	**Conduct further research into effective teaching, learning, assessment and evaluation of skilled trades curricula**. As workplaces and roles evolve, so too do skills and competencies and the methods for embedding them. Where programs are evolving to use blended learning approaches there may be an opportunity to develop a blended assessment strategy to ensure that the evaluation phase of training is as accessible as the teaching and learning phase.
	12).Motivating employers to engage in apprenticeship	**Apply stronger procurement policies that emphasize bid compliance with several balanced requirements** (i.e. qualifications, capabilities, commitment to apprenticeship and ongoing development, price).
	13).21st Century competencies	**Integrate more 21st century competencies into apprenticeship and technology training** to ensure that new cohorts are entering the workforce with a relevant mix of 'hard' and 'soft' skills. More emphasis should be placed on courses in digital technology for trades (i.e. for scheduling, materials mgmt., timesheets), change management, project management, critical thinking and problem solving, entrepreneurship, and human resource management skills relating to working in collaborative teams. These competencies support the shift away from paradigms that anchor skilled trades to a single job or role, and towards the conceptualization of skilled trades as a means to a broad and diverse career pathway.

Section	Topic	Recommendation
Section B: Developing Workforce in Skilled Trades and Technology	14).Management Skills	**Develop training related to people management in a modern manufacturing environment**. These abilities to coordinate and plan production, adapt to technology changes, manage union issues, and coach development and performance to the precision requirements of a modern manufacturing environment, while managing training and development plans and integrated teams of multi-generational peers are key competencies for present and future industry managers and supervisors.
	15).Customized marine oriented training	**Develop more in-house training for customized marine-oriented skills and knowledge**. Marine Fitter, Shipwright, and Marine Electricians are three exceptions to the general preference for in-house versus college-based marinized training. Employees who were interviewed did not communicate a strong interest in deeper marine specialization (from a certification point of view). Most commented that they were able to adapt their trade skills to a marine environment with on the job experience and mentoring.
	16).Cross-over training (cross-certification)	**Elevate capability and utility of workforce through more cross-over training** (or cross-certification). Employees and employers collectively benefit from diversifying a workforce, as cross-over training opens additional pathways through and across industries – allowing for sequential workforce absorption as industry projects ramp up or decline. Cross-over training also insulates workers against skills obsolescence. There is an opportunity to develop more cross-over training pathways where there are natural convergences in specialization. Cross-over training should be developed that requires minimal time away from the central job, and that builds broader skill on top of a central trade. Cross-over training into project or people management pathways should also be valid options.
	17).Pairing employers with apprentices	**The challenges of pairing employers to apprentices needs to be addressed.** For smaller firms a strategy may be to form a consortium of SMEs that shares and circulates apprentices, so that new generations of workforce are being continuously cultivated and strategically developed and utilized in a way that matches the needs of local businesses, that provides the breadth of experience that builds a rich apprenticeship period, and that retains the younger workers in the region. The challenge with this option is that apprentices would be developed without attachment to a single employer, and thus without the promise of full-time employment upon certification.

Section	Topic	Recommendation
Section C: Workforce Development Issues in a Unionized Environment	18).Management Skills	**Build training and development programs aimed at Managing in a Unionized Production/Manufacturing Environment.** There is opportunity to scale this training across several other sectors and industries. These programs should integrate the business acumen skills required to understand the manufacturing process from a business development and sustainability perspective, with the people management skills required to skillfully develop and deploy human resources within a modern manufacturing setting, and with the labour relations savvy to mitigate employee/management antagonism while managing within contract margins.
	19).Reinforcing learning culture	**Review and revise** wording in collective agreements to ensure that exemptions from training aren't permitting workers to suffer skills and competency declines that protect their employment but hinder their ability to safely contribute, perform, or progress.
	20).Mentorship	**Privilege the role of mentor.** The mentor's role is one of both positional and social power, and as such, mentors can have potent influence over an organization's culture. Privileging the role means building prestige through exclusivity of selection and training. Strategically assigning the best (i.e. those possessing the desired skill level, attitudes, and behaviours for younger workers to emulate) skilled journey people to the role of mentor, and providing exclusive mentor training, ensures that young talent is being cultivated in the right way, and builds the esteem of those in a mentoring role. This practice can become self-reinforcing and rewarding as long as selection criteria and mentor training remain robust. A strategy of building exceptional mentors also benefits the unions, as efforts to professionalize trades are supported by the quality of the people who are in these influential roles. Exclusivity builds identity and commitment, and is self-reinforcing – anyone can be a Journey-person – but not everyone can be a mentor. Challenges to this strategy are that ratios and union contracts may require the full and inclusive deployment of journeys to the role of mentor.

Section	Topic	Recommendation
Section C: Workforce Development Issues in a Unionized Environment	21).Reinforcing learning culture	**Engage Unions to help actively build a stronger learning culture.** A strong learning culture includes attitudes for continuous improvement and adaptability to change as well as openness to training and accountability for one's own personal development - and are thus socially- and strategically-adaptive aspects of an organization's overall culture. Offering learning and development opportunities that are both mandatory and voluntary can support this. It is important to change the narrative around training so that mandatory training is reframed in terms of commitment to enhancing capability and continuous improvement, and voluntary training is communicated in terms of its enrichment and career progression benefits. Where possible, develop more in-house leader-led training to profile high performers and reinforce desired attitudes and behaviours skill attainment. Unions can play an important role in building this culture, through endorsement, participation in training programs, and partnership in program development and delivery.
	22).Industry investment in training and development	**Incentivize more industry investment in long term training programs** focused on building a pool of capable and skilled workers for the revitalized marine industry. Some government incentives are too short-term to establish an enduring commitment from industry

Section	Topic	Recommendation
Section D: Developing a Workforce of Professionals	23).Mentorship	**There will be a need for more structured mentorship and on-the- job training of professionals to mitigate learning curves.** Industry employers contend that, given the deeply customized nature of the work in the marine industry, it takes 3-5 years for engineers, architects, and technologists to really begin contributing to a company, despite the high quality of the new grads. Rapid upskilling, experience-gaining, and knowledge transfer can be achieved through strategic mentoring programs that pair new or mid-level employees with tenured workers.
	24).Training and development for professionals	**Lack of part- time graduate degree programs for engineering professionals– more so on Canada's east coast.** According to some employers in Atlantic Canada, this has posed a recruitment challenge in trying to attract talent from away, as regional schools have not traditionally offered convenient, after-hours access to part time graduate degrees. It has also presented a scheduling and retention challenge, as engineers who do wish to pursue further education must take considerable (12-24 month) work sabbaticals to do so. Several employers have reported that the benefit to the company of a post-graduate degree is mitigated by the inconvenience and experience gaps produced by multi-term departures for school.
	25).Ocean Literacy	**Improve ocean literacy of our young people by building interest, engagement, awareness, and knowledge base.** There is an opportunity to develop ocean literacy through the k-12 curriculum and through awareness and exposure building programs. There is a need to build stronger curriculum links to the ecological and economic connections we have with the oceans, and to the diversity and range of potential marine careers.

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