Planned (for) Obsolescence: Lessons in Workforce Agility, from Canada's Shipbuilding Industry

Workforce agility is the new competitive advantage

Dr. Sherry Scully, The Marine People Partnership | IORE

When the National Shipbuilding Strategy (NSS) contracts were announced, activity erupted across the support triad of industry, academia and government, as interested parties rallied to action to resurrect Canada's shipbuilding industry. From early days, long before the first sheet of steel was cut, there was a focus on workforce, primarily centring on two key issues; how to recruit entry level, and especially returning experienced employees; and, how to train and upskill new recruits and existing employees to performance levels requisite in a modern production environment.

Preparation of the human capital side of the contracts targeted current skillsets that would enable workers to meet the rigorous efficiency, safety, quality, productivity, and improvement (i.e. learning curve) standards levied by the contracts. Through collaborations with post-secondary institutions, private and in-house training groups, and Government-developed learning initiatives, Canada's present shipbuilding workforce is approaching these capability standards. But if history has taught us anything, it is that the skills of today don't remain current for long.

Across industries and continents, the drift towards skillset obsolescence is accelerating with the adoption of technologies and automated processes. Indeed, automation and artificial intelligence have introduced disruptive technologies into modern production industries that have shifted some skills and roles from human-to-machine. In the past century, this shift primarily pushed routine, mundane or repetitive tasks into the machine domain. But there has been a recent technology creep into the hearts and minds of 'man', as machines possessing human-like dexterity, cognitive and creative functions were developed.

Today's shipbuilding industry is simultaneously state-of-the-art and relatively heavily skilled-labour intensive[1], rendering it vulnerable to these shifts. With technology advances in production environments accelerating across production industries, we can predict a similar shift towards significant automation over the next two decades. For some roles, this shift will be gradual, for others rapid and unyielding. A look at analogous (i.e. automotive) or competing (i.e. South Korean shipbuilding) industries expanding their automated processes has shown us that some of these technological advances will result in structural unemployment and displaced workers.

Domestically, automation and robotics are already changing the workforce composition in high-end manufacturing. It is unlikely that our shipbuilding industry will resist the shift to machine, as the benefits of efficiency, safety and performance of automated tasks are irrefutable[2]. The main impediment to the broad adoption of technology in this particular industry is the high-mix, low volume

[1] (Lee 2014)

[2] (Mokyr, Vickers and Ziebarth 2015)

nature of the contracts, which still makes it less expensive to employ a skilled trades person than to purchase a robot. But this will change as robots become more cheap, adaptable and able to learn.

And while this paper is primarily focused on skilled trades manufacturing and production roles, they are not the only group in a shipyard that will be impacted. High end labour inputs like professional engineering and project management are themselves changing as machine-based design and planning tools begin to emerge. Current breakthroughs in deep learning and big data analytics will likely lead to a displacement of experienced professional human input by CASE (computer aided systems software / systems engineering) tools that can make very objective high-level decisions based on accumulated learning.

Presently, machines are rarely able to perform all the tasks of a role, and what usually occurs is not complete job elimination but job restructuring. The employees who endure these shakeups are those with broader skillsets and more complex cognition that evade artificial replication, and those who are able to adapt readily to technology change. The ability to adapt is one part skill flexibility and one part mindset. Equipping our employees with these two parts equals workforce agility - which may be the new competitive advantage.

Education and training are essential to build workforce agility and mitigate the potentially negative employment effects of technology[3]. But many of our post-secondary (PSI) education and training programs lag in the sprint with technology. Guided by traditional learning paradigms that emphasize core knowledge and conventional skillsets, our certification models may be inadvertently planning for the obsolescence of our workers. In our modern production environments, where technology driven change is continuous, terminal training programs oriented around a paradigm of train, certify, launch, and done, endow credentials with a 'break by' date. Workforce agility requires a paradigm shift to a perpetual learning model that emphasizes high value and future value skills to earn and maintain credentialing, to continuously roll forward the best-before date of workers' skills.

The issue – Agile workforce

Popular literature is plentiful with reports on the threats of technology and automation to employment security. Perhaps what is most unique about the current threat is that the machines are now able to replicate not just routine manual tasks, but human capabilities involving non-routine tasks and cognitive functions such as reasoning and decision-making and learning[4][5]. Some have speculated that nearly half of occupations are at risk of being automated within the next two decades[6][7]. Others offer a more optimistic view, suggesting that automation may replace certain tasks, but rarely will supplant entire occupations. A more moderate view envisages a symbiotic relationship with work restructured to

[3] (Lamb June 2016)
[4] (Arntz, Gregory and Zierahn 2016)
[5] (Autor, Levy and Murnane, The skill content of recent technological change: An empirical exploration 2003)
[6] (Brookfield 2017)
[7] (Frey and Osborne 2013)

integrate human and machine functions[8] that will elevate the value of the work that humans do in partnership with machines[9].

Other studies propose that the actual risk of technological unemployment is low, and that rather the inverse may be true – that more jobs will be created. According to a study conducted by Deloitte UK, technology-driven change has created nearly 4 new higher skilled and higher paid jobs for every lower-skilled job that it has taken[10]. The downside of this apparent upside is that the 4 new higher skilled and higher paid jobs only benefit the displaced employees who have proactively upgraded their skill profiles enough to shift into them. Indeed, the polarization of jobs across production industries means that displaced workers lose the option of simply defecting to a similar role in a new or similar industry[11]. The conclusion that could be drawn is that technology is not the great un-employer – employee complacency and skill obsolescence are.

The general trend across production industries has been a shift from brawn to brains, resulting in a competency mix for new recruits that emphasizes digital know-how, creativity, and complex problem solving, alongside advanced technical or professional skills[12]. In the shipbuilding industry, this new competency mix is also in contrast with the key competencies of tenured production employees which have traditionally emphasized routinized skill application, highlighting a mentoring challenge in an industry where mentorship reigns supreme.

Recent labour forecasts in the shipbuilding industry have predicted an increase of 16,000 jobs at peak employment in Nova Scotia[13], and more than 4,000 in BC by 2020[14]. While the short to medium term employment opportunities are promising, this promise is constrained by the reality that the skill and competency requirements for these future workers will be evolving rapidly over the same period. Further complicating this is the reality that many skilled trades tasks are at high risk of being affected by automation[15].

In the longer term, predicting where and how the industry might shift, and the workforce skills and competencies required for undreamt of ocean vessels built with yet-to-be-invented materials and processes is a daunting but not gratuitous task. Skillset diversity is the best way to insulate against vulnerability to capitulations on defense contracts or opportunities of imagination in new design and technology.

Whether the pivots in workforce requirements are market or technology induced, education will be crucial to build adaptability and skill flexibility, optimize the benefits of automation, and minimize technology-driven inequality. Critical to this will be efforts to accurately anticipate common suites of skill and competency requirements for future roles, and ensure that PSIs continuously update their curricula to align with these unceasingly evolving requirements. Also critical will be the engagement of

[8] (Lamb June 2016)
[9] (Autor, The 'task approach' to labour markets: an overview 2013)
[10] (Deloitte, From brawn to brains: The impact of technology on jobs in the UK. 2015)
[11] (Ford 2015)
[12] (S. Scully June 2017)
[13] (PWGCS 2015)
[14] (SSRB 2013)
[15] (Lamb June 2016)

the support triad to provide relevant training and development opportunities for existing workers, throughout their careers.

What have we learnt from others?

When workforce doesn't keep pace with changes in an industry, it becomes redundant. In a study conducted by Donnelly & Scholarios[16] that examined the experiences of workers displaced from defence-related industries in Scotland in the 1990s, they uncovered a trend of 'downskilling' after redundancy, as highly skilled defence workers tend to find few comparable employment opportunities, or find their skills are too specialized and narrow to transfer readily into another industry. Other studies have examined the significant morale and mental health implications of workers shifting to employment where skills and experience are underutilized, or struggling through long periods of unemployment[17]. According to these studies, the impacts of structural unemployment are amplified among older workers who tend to have more difficulty adapting after redundancy, and endure longer periods of unemployment. These highlight the negative individual, as well as the broader economic impacts, of large scale workforce redundancies.

Having workers cycle from skilled-to-redundant-to-upskilling is expensive and slow and morale-eroding. Across industries, some workers have resisted the under-tow of this cycle by pursuing cross-certification. Cross-certification of trades and production workers builds skillset relevance, and improves utility and productivity in an industry vulnerable to labour-driven inefficiencies. But cross-certification and worker agility can be more challenging in an industry where technical skills are emphatically industry specific. The marinization of trades skills reveal an inherent paradox in the shipbuilding industry where there is both a need for deeply specialized and industry relevant skills, but where deep specialization limits trade flexibility and transition across industries during contract or production lulls.

This paradox highlights a tension of priorities that places an industry's competitive needs for deep worker specialization at odds with employees' needs for skill transferability to yield a cross-employment advantage. The history of Canada's shipbuilding industry is punctuated with periods of bust and boom, and despite the best intentions of the National Shipbuilding Strategy (NSS) to mitigate this pattern, its continuation is a possibility. Our current approach prioritises skill relevance over skill resilience to the very real threat of employment disruption, and reveals a failure to integrate both present and future into our talent development strategies.

This paradox also highlights a contentious economic question of who should pay for preparing workforce with skills that could, but perhaps won't, directly benefit a present employer. Who is responsible for building an agile workforce? Is it Government? Is it industry? Is it the individual? The obvious answer is all three, but how do we fairly balance and track this investment?

A third question highlighted by this paradox asks how we practically train for skill agility with a post-secondary learning system that is anything but agile. Many of our community colleges surpass University institutions in updating curricula to support current industry needs, but better is far from

[16] (Donnelly and Scholarios 1998)
[17] (Leana and Feldman 1995)

great. The accelerating pace of industry change, and the relatively slower pace of institutional responsiveness, means that by the time we identify and respond to 'current' gaps and needs they've existed for quite some time. In many ways, we are continually training for yesterdays needs, and what is current has already been re-defined. There can be a significant competitive advantage in shrinking that lag-time by investing more resources into the prediction and forecasting of future high-demand skills. This may be a grander challenge than it seems, as previous pathways and high-value skills may not give any insight into future high demand careers and skills. Things might be changing too much to lean on analogies from the past. While there is always a risk of anticipating wrongly - building competency in an industry or opportunity that doesn't materialize - this doesn't devalue the competitive currency of a workforce primed for readiness.

In addition to forecasting high value skills and providing responsive updates to curricula, we also need to consider innovative models of credentialing. Skilled production roles are unequivocally certification focused, and the apprenticeship model is the original WIL (work integrated learning) program. As we look to broaden and diversify skillsets, we should consider micro-credentialing options that involve shorter periods of intensive learning for narrower additional skillsets, built upon a foundation certification. This may ultimately stretch the apprenticeship paradigm, but it is never-the-less worth considering, and may find a place in traditional professional (i.e. engineering) credentialing as well, where skill relevance will be as vital. A micro-credentialing model can also offer flexibility and intensity of programming to accommodate the learning schedules and needs of experienced employees looking to deepen or broaden expertise.

For many years practitioners and employees have touted the mantra of lifelong learning, but never has the urgency to enact this mantra been more ostensible. We are no longer graduating finished products – most would argue we never have – but the path of learning that lies in front of a graduate today will exceed that of the path behind, and it is likely that the need for post-graduate learning will only increase as technology replaces routine production roles, and reveals new and unexploited career paths. Skill and competency changes go hand-in-hand with cultural and paradigm changes to smooth the shift in mindset towards perpetual learning. For traditional industries, like shipbuilding, this cultural shift can be substantial. In the world of talent management, the mantra of life-long learning has been long-chanted, but the message is beginning to echo in other offices as a strategic and emphatic imperative. Perpetual learning is more than a self-actualized refrain, it's a requirement to stay relevant.

Final thoughts and enduring questions

Now that the contracts are under way, it can be tempting for the support triad to dust their hands and tick the training objectives box 'completed'. In the face of so much actual and potential change in workforce requirements, it is vital that talent management strategies look beyond the foreground to consider how to proactively develop our workers to evolve with the industry, and beyond the contract. We may be readying our workers for the shipyard of today but we need to weave into their development threads of agility and future readiness to combat the looming threat of workforce obsolescence that will occur if industry changes outpace our workers' ability to adapt, reskill and redeploy. Technology-driven inequality can be toxic to vulnerable workers who fail to adapt their skills

in pace with demand[18]. Conversely, technology-driven inequality benefits those with a will for continuous learning and training. And if that resolve rests with senior industry leaders, and informs their talent management practices, we will see a whole new form of readiness take shape.

In many ways, the shipbuilding industry is a proxy for a broader dialogue about building an agile workforce across industries. As a case in point, much of the European home construction industry has moved to modular in-factory manufacturing. Instead of having skilled carpenters, plumbers and electricians build a house from raw material at a site, 70-80% of that work can now be pre-done by industrial robots in a factory building pre-assembled rooms and wall modules that can be quickly installed and interconnected at the final build site by semi-skilled workers. Even the last bastion of skilled trades - building construction - is relenting to the pull of technology.

As a nation, we need to think about how we establish a position of invulnerability in the face of automation and evolving competency requirements. Workforce agility enables our evolving industries to level the hurdle of a standing start. Agility maximizes worker utility within roles and across careers, and enables industry to ride the swell of productivity and learning curves. In the social domain, workforce agility can minimize the mental health costs, and the inertia effects of unemployment, underutilization, and disengagement. We are on the precipice of a philosophical shift in how we think about our commitment to workforce. But it takes more than nodding heads to push us over that precipice; it takes hands and feet to do the work of change. As an ironic aside, these are the three human parts that are most readily being supplanted by robots.

A perpetual learning model highlights a concomitant need for pedagogical reform in our schools, as well as a need for philosophical reform in our society regarding training and development of existing workforce. We need to invert thinking that placed the bulk of learning investment upfront prior to entry into the workforce, and consider instead of smoothing learning investment over a career. And we need to combine this with earlier entry into workplaces to augment common education with context-specific education through work integrated learning programs and on-the-job training. This doesn't necessarily mean committing young people to a career pathway earlier, it means leveraging early interests to provide a context for learning. In the future, learning how to learn and how to apply learning to novel and authentic contexts will be distinguishing capabilities. Shouldn't our education system mimic this?

In addition to the novel suites of competencies and skills new economies will reveal, we will always have some foundation or traditional skills to cultivate. Research has consistently shown us that essential skills in numeracy, literacy, and technology atrophy quickly over time without continuous maintenance. Aptly named, these essential skills provide the necessary foundation to enable skill progression throughout a career, and support continuous learnability and employability[19]. Despite strong evidence of the importance of essential skills, there are few post-secondary or industry-led learning programs that deliberately integrate non-remedial,continuous essential skill development into their curricula.

We may not be able to predict the jobs of the future, but perhaps we can predict some of the skills and competencies that will be high value and transferable, and produce a workforce that is the most resilient, agile and adaptable to change. PSIs need to be faster at adapting and evolving curricula

[18] (Deloitte, From brawn to brains: The impact of technology on jobs in the UK 2015)
[19] (Bratton, et al. 2003)

to meet the evolving economy. They need to consider new models of study that operate on shorter cycles than the 4-month term or the 2 or 4 year program. Micro-credentialing may be the way of the future, and narrative CVs may be replaced with iterative competency matrices that are continuously updated to reflect gradations and combinations of proven proficiency, experience, and formal learning. Perhaps expertise itself will be denoted not through terminal one-time (or once upon a time) credentialing, but to convey continuous refinement and application of a competency.

Technology is swiftly distributed and duplicated – and technology driven competitive advantages are swiftly neutralized. But with a perpetual learning model, keeping the engine running within a workforce means that workforce becomes the competitive advantage. It has been said that technology advances have now accelerated beyond our capacity to adapt to it[20] – but workforce that can keep best pace in this race becomes the one that endures.

As any white paper should, this one has left us with more questions than answers. Asking ourselves how to solve immediate workforce challenges is an important but insufficient question. We can't stop there – we need to be asking ourselves how to keep our workforce agile and adaptable or else we will perpetually be dealing with immediate or impending workforce challenges. What resources are needed to help an industry adopt a position of invulnerability through cross-training, upskilling, and continuous development – and how is responsibility for this measured out among employers, governments and individuals? How do we prioritize development in critical but seemingly tangential areas like essential skills? What are the union implications of building worker agility? How can we update our formulas for return on training investment to allow for a more utilitarian outcome? Are businesses putting themselves at a disadvantage by thinking of workforce as a static body count instead of as a dynamic assessment of net capability? How do we plan for jobs that do not exist yet? How do we un-mire our education system from its knowledge orientation to truly shift to a competency orientation? And what does this shift mean for how and where and when learning takes place?

Workforce agility ultimately means building the cognitive and competency infrastructure of our workforce. The new-recruit of tomorrow will possess a skillset that is significantly different than that of today, and will begin their career, not by concluding their education, but by shifting into the next stage of perpetual learning.

[20] Barlow, Mike. Big data culture gap: Technology advancing more quickly than people or processes. O'Reilly, Viewed December 8, 2017 http://radar.oreilly.com/2013/09/big-data-culture-gap-technology-advancing-more-quickly-than-people-and-processes.html