Workforce Skills Required

Over the Next Decade

July 2012
INTRODUCTION

For over a decade we have been seeing a rapid evolution from the Industrial Age to the Information Age – an age characterized by the ability of individuals to transfer data freely and to have instant access to information. This transition has a tremendous sociological and economic impact affecting how we live, work and play. We must focus on the shifts that are reshaping the workplace and workforce landscape. What are the most likely forces that will impact the future?

This article summarizes information gathered from a number of different sources to offer a glimpse of some of these changes and their impact.

Living Longer – Working Longer

It is estimated that in ten years from now, the number of Canadians over age 60 will increase by 70%. We will begin to see and experience the challenge of an aging population. New understanding of what it means to age, as well as the emerging possibilities for healthy life extension are already beginning to take hold.

Individuals are rearranging their approach to their careers, family life, and education to accommodate this demographic shift. Increasingly, people are working long past 65 in order to have adequate resources for retirement. Multiple careers will be commonplace and lifelong learning to prepare for occupational change will see significant growth.

To take advantage of this well-experienced and still vital workforce, organizations and businesses must rethink the traditional career paths, creating more diverse and flexible work arrangements. Aging individuals will increasingly demand opportunities, products, and medical services to accommodate more healthy and active senior years. Research suggests that as we move toward a world of healthier lifestyles and holistic approaches to what we eat, how we work, and where we live, much of daily life—and the global economy as a whole—will be viewed through the lens of health.

Robots and the Tools of Work

Numerous sources of information, research as well as government programming adjustments confirm that we are entering a period of major transformation in our relationship with technology and our tools of work. Over the next decade, new smart machines will continue to enter offices, factories, and homes in numbers we have never seen before. They will become part of production, teaching, combat, medicine, security, and virtually every domain of our lives. As these machines replace humans in some tasks, and augment them in others, their largest impact may be less obvious: their very presence among us will force us to confront important questions.
What are humans uniquely good at? What is our comparative advantage? And what is our place alongside these machines? We will have to rethink the content of our work, our work processes and essential skills in response.

For example, manufacturing requires fewer people working on the factory floor. Thanks to smarter and more dexterous robots, some lights-out manufacturing is now possible. FANUC, a Japanese producer of industrial robots, has automated some of its production lines to the point where they can run unsupervised for several weeks. Many other factories use processes such as laser cutting and injection molding that operate without any human intervention.

Yet manufacturing will still need people. All these automated machines require someone to service them and tell them what to do. Some machine operators will become machine minders, which often calls for a broader range of skills. And certain tasks, such as assembling components, require too much manual dexterity for robots to do well, which is why assembly is often subcontracted to low-wage countries.

In some areas, a new generation of automated systems will replace humans, freeing us up to do the things we are good at and actually enjoy. In other domains, the machines will become our collaborators, augmenting our own skills and abilities. Smart machines will also establish new expectations and standards of performance. Of course, some routine jobs will be taken over by machines—this has already happened and will continue. But the real power in robotic technologies lies in its ability to augment and extend our own capabilities. We will be entering into a fresh kind of partnership with machines that will build on our mutual strengths, resulting in a new level of collaboration between people and machines.

Data, Simulation and Computation

It is becoming obvious that the diffusion of sensors, communications, and processing power into everyday objects and environments will unleash an unprecedented torrent of data and the opportunity to see patterns and design systems on a scale never before possible. Every object, every interaction, everything we come into contact with will be converted into data. Once we decode the world around us and start seeing it through the lens of data, we will increasingly focus on manipulating the data to achieve desired outcomes. Thus we will usher in an era of “everything is programmable”—an era of thinking about the world in computational, programmable, designable terms.

Agencies will increasingly model macro-level phenomena such as global pandemics to stop their spread across the globe. At a micro level, individuals will be able to simulate things such as their route to the office to avoid traffic congestion based on real-time traffic data.
Micro and macro-scale models will mesh to create models that are unprecedented in their complexity and completeness. As a result, whether it is running a business or managing individual health, our work and personal lives will increasingly demand abilities to interact with data, see patterns in data, make data-based decisions, and use data to design for desired outcomes.

In manufacturing, a number of remarkable technologies are converging: clever software, novel materials, more dexterous robots, new processes, and a whole range of web-based services. It is now much more feasible to create smaller batches of a wider variety, with each product tailored precisely to individual customer’s whims.

The applications of 3D printing are especially mind-boggling. Using this technology, a product can now be designed on a computer and “printed” on a 3D printer, which creates a solid object by building up successive micro-thin layers of material. The digital design can be tweaked with a few mouse clicks. The 3D printer can run unattended, produce products customized to each individual purchaser’s specific requirements, and can make many things which are too complex for a traditional factory to handle.

**Communication and Collaboration**

New multimedia technologies are bringing about a transformation in the way we communicate. As technologies for video production, digital animation, augmented reality, gaming, and media editing, become ever more sophisticated and widespread, a new ecosystem will take shape around these areas. We are literally developing a new vernacular, a new language, for communication. Already, the text-based Internet is transforming to privilege video, animation, and other more visual communication media. At the same time, virtual networks are being integrated more and more seamlessly into our environment and lives, channeling new media into our daily experience. The millions of users generating and viewing this multimedia content from their laptops and other mobile devices are already exerting enormous influence on culture.

Regular television is already history. New media is enabling new platforms for creating online identity while at the same time requiring people to engage in activities such as online personal reputation and identity management. It is enabling new ways for groups to come together and collaborate, bringing in new levels of transparency to our work and personal lives. At the same time, our sensibility toward reality and truth is likely to be radically altered by the new media ecology. We must learn to approach content with more skepticism and the realization that what you see today may be different tomorrow. Not only are we going to have multiple interpretations of recorded events, but with capture and surveillance, events are already being seen from multiple angles and perspectives, each possibly telling a different story of individual events.
Taking advantage of the rapid transfer of data and ideas, prototyping product design facilities are emerging creating what might be called “social manufacturing”. With the help of a growing online community, users submit an idea and if enough people like it (as on Facebook), the design firm's product-development team makes a prototype. Users review this online and can contribute towards its final design, packaging and marketing, and help set a price for it. Once perfected, a manufacturer is sought. The design firm handles patents and standards approvals and gives a 30% share of the revenue from direct sales to the inventors and others who have helped.

New technologies and social media platforms are driving an unprecedented reorganization of how we produce and create value. In other words, we can do things outside of traditional organizational boundaries.

**Organizations and Economies without Borders**

Many organizations we are familiar with today, including educational institutions and corporations, are products of centuries-old scientific knowledge and technologies. Today we see this organizational landscape being disrupted. In health, organizations are allowing people to aggregate their personal health information to allow for clinical trials and emergence of expertise outside of traditional labs and doctors' offices.

Open education and training platforms are increasingly making content available to anyone who wants to learn. The University of Toronto has now joined Stanford, Princeton, Michigan and a dozen other major universities offering free online courses to anyone anywhere in the world with a computer.

A new generation of organizational concepts and work skills is coming not from traditional management organizational theories but from fields such as game design, neuroscience, and happiness psychology. At its most basic level, globalization is the long-term trend toward greater exchanges and integration across geographic borders.

In our globally connected and interdependent world, North America and Europe no longer hold a monopoly on job creation and innovation. Organizations from markets in developing countries like India, Brazil and China are innovating at a faster pace than those from developed countries in some areas, such as mobile technologies. In fact, a lack of legacy infrastructure is combining with rapidly growing markets to fuel higher rates of growth in developing countries.

As markets in China, India, and other developing countries grow, it is increasingly difficult for the headquarters to develop products that can suit the needs of a whole different category of consumers. Presence in areas where new competitors are popping up is critical to survival, but it is not enough. The key is not just to employ people in these locales but also to effectively integrate these local employees and local business processes into the infrastructure of organizations in order to remain competitive.
WHAT DOES IT MEAN TO OUR WORKFORCE?

Many people will look at the digital future and shudder. Most jobs will not be on the factory floor but in the offices nearby, which will be full of designers, engineers, information technology specialists, logistics experts, marketing staff and other professionals. Equally in-demand will be those interacting directly with other human beings performing non-repetitive tasks in sectors like food service, personal care and protective service occupations.

Middle-skill occupations, often performed by workers with moderate education (secondary school diploma but little post-secondary) have been most significantly impacted by a decline in employment opportunities and wages. Routine tasks are characteristic of activities such as bookkeeping, clerical work and repetitive production and machining jobs and the core tasks of these occupations in many cases follow precise, well-understood procedures. Consequently, as computer and communication technologies improve in quality and decline in price, these routine tasks are increasingly codified in computer software and performed by machines or, alternatively, sent electronically to foreign worksites to be performed by low-wage workers.

Automation, digitization and off-shoring raise demand for non-routine tasks which can be divided into two major categories – abstract and manual. Abstract tasks require problem-solving, intuition and persuasion. Workers performing these functions tend to have high levels of education and analytical capability, are in high demand and are well compensated. Manual tasks, by contrast, require situational adaptability, visual and language recognition, and in-person interactions. Examples of workers engaged in these tasks include home health aides, construction labourers, janitors, childcare security personnel and motor vehicle operators. While these occupations demand workers who are physically adept and, in some cases, able to communicate fluently in spoken language, most require little in the way of formal education. At some point robots will be able to fulfill these roles, but there’s little incentive to roboticize these tasks at the moment, as there’s a large supply of humans who are willing to do them for low wages.

Most recently, it appears that the trend to off-shore some tasks may be abating. As the demand for innovative products rapidly escalates, companies are turning to in-house innovation while labour costs are becoming less and less important. For example, a $499 first-generation iPad included only about $33 of manufacturing labour, of which the final assembly in China accounted for just $8. Companies now want to be closer to their customers so that they can respond more quickly to changes in demand. And some products are so sophisticated that it helps to have the people who design them and the people who make them in the same place.
General Motors Inc. is the most topical example of a U.S. corporation deciding to move away from outsourcing. The company now outsources 90% of their information technology services. They plan to flip that percentage in about three years to 90% GM staff causing it to go on a hiring binge for software developers, project managers, database experts, and business analysts. The company plans on creating three new software development centres, consolidating data centres and applications, centralizing IT planning and execution and getting a better real-time understanding of GM’s customer and production data. This transformation emphasizes attaining more and quicker value from information technology rather than cost savings.

TEN SKILLS FOR FUTURE JOBS

Sense-making

Definition: *ability to determine the deeper meaning or significance of what is being expressed*

As smart machines take over routine manufacturing and services jobs, there is an increasing demand for the kinds of skills machines are not good at. These are higher level thinking skills that cannot be codified. Sense-making skills are skills that help us create unique insights critical to decision making. A computer may be able to beat a human in a game of chess or Jeopardy by sheer force of its computational abilities, but if you ask it whether it wants to play pool, it won’t be able to tell whether you are talking about swimming, financial portfolios, or billiards. As we renegotiate the human/machine division of labor in the next decade, critical thinking or sense-making will emerge as a skill workers increasingly need to capitalize on.

Social intelligence

Definition: *ability to connect to others in a deep and direct way, to sense and stimulate reactions and desired interactions*

While we are seeing early prototypes of robots in various research labs today, the range of social skills and emotions that they can display so far is very limited. Robots we are building are not feeling machines yet. Socially intelligent employees are able to quickly assess the emotions of those around them and adapt their words, tone and gestures accordingly. This has always been a key skill for workers who need to collaborate and build relationships of trust, but it is even more important as we are called on to collaborate with larger groups of people in different settings.
**Novel & adaptive thinking**

**Definition:** proficiency at thinking and coming up with solutions and responses beyond that which is rule-based

The latest economic downturn has been such that job opportunities have declined in middle-skill white and blue collar jobs, largely due to a combination of the automation of routine work and work being completed in other countries. It is also a fact that job opportunities are increasingly concentrated in high skill, high-wage professional, technical and management occupations and in low-skill, low-wage occupations such as food service, manufacturing, distribution and personal care. These skills will be at a premium in the next decade, particularly as automation and export of jobs continue.

**Cross-cultural competency**

**Definition:** ability to operate in different cultural settings

In a truly globally connected world, a worker’s skill set could see them posted in any number of locations—they need to be able to operate in whatever environment they find themselves. This demands specific content, like linguistic skills, but also adaptability to changing circumstances and an ability to sense and respond to new contexts. Cross-cultural competency will become an important skill for all workers, not just those who have to operate in diverse geographical environments. Research now tells us that what makes a group truly intelligent and innovative is the combination of different ages, skills, disciplines, and working and thinking styles that members bring to the table. Diversity will become a core competency for organizations over the next decade. Employment growth in Canada, Ontario and more specifically in the Counties of SD&G and P-R is already focused mostly on both high skill and low skill jobs, both of which require capacity for innovative thinking.

**Data Analysis thinking**

**Definition:** ability to translate vast amounts of data into abstract concepts and to understand data-based reasoning

As the amount of data that we have at our disposal increases exponentially, many more roles will require computational thinking skills in order to make sense of this information. The use of simulations will become a core expertise as they begin to feature regularly in discourse and decision-making. HR departments that currently value applicants who are familiar with basic applications, such as the Microsoft Office suite, will shift their expectations, seeking out resumes that include statistical analysis and quantitative reasoning skills.
Social media literacy

**Definition:** *ability to critically assess and develop content that uses new media forms*

The explosion in user-friendly media including the videos, blogs, Twitter, Facebook, Skype and podcasts that now dominate our social lives will be fully felt in workplaces in the next decade. Communication tools that break away from the static slide approach of programs such as PowerPoint will become commonplace, and with them expectations of worker ability to produce content using these new forms will rise dramatically. The next generation of workers will need to become fluent in forms such as video, able to critically “read” and assess them in the same way that they currently assess a paper or presentation. They will also need to be comfortable creating and presenting their own visual information. Knowledge of fonts and layouts was once restricted to a small set of print designers and typesetters, until word processing programs brought this within the reach of everyday office workers. As immersive and visually stimulating presentation of information becomes the norm, workers will need more sophisticated skills to use these tools to engage and persuade their audiences.

Cross disciplinary

**Definition:** *literacy in and ability to understand concepts across multiple disciplines*

Many of today’s global problems are just too complex to be solved by one specialized discipline. While throughout the 20th century, ever-greater specialization was encouraged, the next century will see cross disciplinary approaches take center stage. The ideal worker of the next decade will bring deep understanding of at least one field, but have the capacity to converse in the language of a broader range of disciplines. This requires a sense of curiosity and a willingness to go on learning far beyond the years of formal education. As extended life spans promote multiple careers and exposure to more industries and disciplines, it will be particularly important for workers to develop this quality.

Cognitive load management

**Definition:** *ability to discriminate and filter information for importance*

A world rich in information streams in multiple formats and from multiple devices brings the issue of overload to the fore. Organizations and workers will only be able to turn the massive influx of data into an advantage if they can learn to effectively filter and focus on what is important. The next generation of workers will have to develop their own techniques for tackling the problem. Workers will also need to become adept at utilizing new tools to help them deal with the information onslaught.
Virtual collaboration

**Definition:** ability to work productively, drive engagement, and demonstrate presence as a member of a virtual team.

Connective technologies such as Skype and others already make it easier than ever to work, share ideas and be productive despite physical separation. But the virtual work environment also demands a new set of competencies. As a leader of a virtual team, individuals need to develop strategies for engaging and motivating a dispersed group.

Ensuring that collaborative platforms include typical gaming features such as immediate feedback, clear objectives and a staged series of challenges can significantly drive participation and motivation. Members of virtual teams also need to become adept at finding environments that promote productivity and wellbeing. To be successful in the next decade workers in the future will need to be adaptable lifelong learners.

**IMPLICATIONS**

**Educational institutions** at the primary, secondary, and post-secondary levels, are largely a mix of products of older infrastructure and social circumstances of the older generation and put in place by an even older generation. The landscape has changed and educational institutions should consider how to adapt quickly in response. Instead of adding buildings, some directions of change might include:

- Placing additional emphasis on developing skills such as critical thinking, insight, and analysis capabilities
- Integrating social media literacy into education programs
- Including experiential learning that gives prominence to soft skills—such as the ability to collaborate, work in groups, communicate, and respond adaptively
- Broadening the learning period beyond teens and young adults through to a minimum retirement from the workforce age.
- Strengthen communication with both large and small companies, often at the forefront of innovation, ensuring that a broad array of upskilling courses and programs are readily available
- Integrating multi discipline training in a project-based approach allowing students to develop skills and knowledge in a range of subjects
Businesses must also be alert to the changing environment and adapt their workforce planning (at a minimum begin a workforce planning process) and development strategies to ensure alignment with future skill requirements and the needs of a diverse workforce. Strategic human resource professionals must reconsider traditional methods for identifying critical skills, as well as selecting and developing talent. A workforce strategy for sustaining business goals should be one of the most critical outcomes of human resource professionals and should involve collaborating with universities and colleges to address lifelong learning and skill requirements.

Employment Service Providers will need to respond to the changing landscape by taking more of a leadership role and making education and training a priority. If education is not prioritized, we risk compromising our ability to prepare our people for a healthy and sustainable future. For our workforce to be prepared and for our businesses to be competitive, policy makers are considering the full range of skills the future workforce will require, as well as the importance of lifelong learning and constant skill renewal.

Note: The information provided in this document has been gleaned from a number of research documents, materials and community consultations. The report has been reduced in length so as to better reflect what is most important to the area we serve. The Eastern Ontario Training Board has a mandate to champion training and workforce adjustment in the counties of Prescott, Russell, Stormont, Dundas and Glengarry by identifying needs, provide labour market information and facilitating solutions. Should you have questions or comments, please contact the following.

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