SKILLSNEXT

Solving the Skills Puzzle

The Missing Piece is Good Information

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Steven Tobin**

PUBLIC POLICY FORUM

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Future Skills Centre

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The Future Skills Centre is a forward-thinking centre for research and collaboration dedicated to preparing Canadians for employment success. We believe Canadians should feel confident about the skills they have to succeed in a changing workforce. As a pan-Canadian community, we are collaborating to rigorously identify, test, measure and share innovative approaches to assessing and developing the skills Canadians need to thrive in the days and years ahead.

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The Diversity Institute conducts and coordinates multi-disciplinary, multi-stakeholder research to address the needs of diverse Canadians, the changing nature of skills and competencies, and the policies, processes and tools that advance economic inclusion and success. Our action-oriented, evidence-based approach is advancing knowledge of the complex barriers faced by underrepresented groups, leading practices to effect change, and producing concrete results. The Diversity Institute is a research lead for the Future Skills Centre.

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ABOUT THE PROJECT

Canadians' needs for skills training are changing rapidly. Through Skills Next, the Public Policy Forum and the Diversity Institute—in its role as a research lead for the Future Skills Centre—are publishing a series of reports that explore a number of the most important issues currently impacting the skills ecosystem in Canada. Each report focuses on one issue, reviews the existing state of knowledge on this topic, and identifies areas in need of additional research. This strong foundation is intended to help support further research and strengthen policymaking. A diverse set of authors who are engaged in the skills ecosystem through various roles, including through research, activism, and policymaking, have been carefully selected to provide a broad range of perspectives while also foregrounding the Canadian context. Their varied backgrounds, experiences, and expertise have shaped their individual perspectives, their analyses of the current skills ecosystem, and the reports they have authored.

Skills Next includes reports focused on:

- **Global comparison of trends to understand the future of skills**

- **Knowns and unknowns about skills in labour market information**

- **Rethinking the relationship between technology and the future of work**

- **Defining digital skills and the pathways to acquiring them**

- **Barriers to employment for immigrants and racialized people in Canada**

- **Barriers to employment for persons with disabilities**

- **The return on investment of industry leadership in skills and training**

- **Approaches to improving the transitions of university graduates from education to the workforce**

ABOUT THE AUTHORS

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Steven Tobin is the Executive Director of LMIC, whose mandate is to ensure Canadians, stakeholders and policymakers have the necessary information and insights to succeed in a changing, dynamic world of work. Before joining LMIC, Steven held positions at the Organisation for Economic Co-operation and Development and the International Labour Organization, as well as the federal and provincial levels of government.

EXECUTIVE SUMMARY

Every day, Canadians make choices that affect their careers and lives, and businesses make choices that affect their organizations. Accurate, timely and relevant information is needed to ensure these decisions are well informed. However, recent developments (including technological change) have created information gaps in the area of skills and skill requirements for jobs. Even the skill requirements for many traditional jobs are changing and employers report challenges in finding workers with the right skills to fill vacancies—in industries old and new. Similarly, workers struggle to understand the changing skills needed for jobs and often lack the tools and knowledge to meet these new requirements. How do workers and employers make sense of this labour market, which is increasingly driven by supply-and-demand of skills as opposed to the qualifications of graduates?

By most metrics, Canada's economy and labour market are healthy, but to continue to build prosperity and economic opportunity, policymakers and employers will need to identify and better articulate the skills needed in this dynamic world of work. In short, a stronger, more insightful informational architecture around skills is required.

Better clarity of definitions and measurement of skills are needed, as well as easily accessible information about the skills demanded today and expected to be in demand tomorrow. Otherwise, researchers, policymakers and others can't define and measure skills-related issues in the labour market.

Yet a taxonomy alone is inadequate. For workers to thrive and employers to find talent, the skills taxonomy must be connected to occupations through the National Occupation Classification. If skills and jobs can be mapped onto one another this way, it will enable a better understanding of worker and job characteristics.

From there, all possible approaches, including new techniques to harvest big data, should be assessed and used to measure skills needs in the labour market. Employment and Social Development Canada and Statistics Canada should manage this taxonomy and mapping to ensure its credibility, rigour and integrity, as these federal departments have the knowledge and statistical infrastructure to do so.

Canada's continued economic success relies on its ability to improve skills-related policies and programs. In particular, information on the skills and training needs of employers and workers must be improved—which, among other things, will help education and training providers prepare and better support workers in navigating the changing world of work. Good labour market information is what lies at the heart of solving the skills puzzle.

Skills requirements for many jobs are changing, and employers report challenges in finding workers with the right skills. Similarly, workers struggle to understand the changing skills demands of jobs and often lack the tools and knowledge to keep up with new requirements.

WHY WE SHOULD CARE ABOUT LABOUR MARKET INFORMATION

Good Information on Skills is Central to Future Success

Any decision requires weighing various facts and evidence. Every day, Canadians make choices about their education, training, careers, jobs and business activities. These decisions are of vital importance to Canada's economic prosperity, as well as a wide range of individual and social outcomes. The value of labour market information is ultimately derived from the extent to which it helps make these outcomes better for Canadians.

By most metrics, the Canadian economy is doing well. It has experienced almost uninterrupted growth since the global economic crisis of 2008-2009, creating strong and, in some cases, unprecedented employment gains nationally.[1] Despite these positive national figures, there remain important regional and sectoral variations in Canada's economic health.[2] Across the country, for example, rural areas and small towns have unemployment rates far higher than the national average.[3] In addition, specific populations—women, newcomers, racialized minorities, Indigenous people, people with disabilities and others—face particular barriers with higher rates of unemployment, underemployment and wage gaps.[4,5]

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[1] Statistics Canada. (2019). Labour force characteristics by educational degree, monthly, unadjusted for seasonality. Table 14-10-0117-01.

[2] Provinces such as Alberta and Saskatchewan continue to grapple with a slowdown in the oil and gas sector. In other instances, such as Nunavut, the unemployment rate—at nearly 1.5 times the national figure—remains stubbornly high.

[3] Statistics Canada. (2019). Labour force characteristics by educational degree, monthly, unadjusted for seasonality. Table 14-10-0117-01.

[4] Organisation for Economic Co-operation and Development. (2018). Indigenous employment and skills strategies in Canada. OECD Reviews on Local Job Creation. OECD Publishing.

[5] Cukier, W. and Gagnon, W. (2019). The representation of women and racialized minorities as expert sources on-air in Canadian public affairs television. (Manuscript submitted for publication.)

> **Different and contradictory definitions, classifications and measurements of skills coexist.**

Canadians are concerned about the future, even in regions that are experiencing robust job creation. There is anxiety around how the world of work is changing and growing concerns and questions around how an aging population, climate change and the potential rise of gig work will affect the content and amount of work.

In light of this uncertainty and to help Canadians make more informed decisions, new surveys and programs have been introduced in recent years to gather better and more detailed labour market information. While important strides have been made, there is growing recognition that a lack of relevant, reliable labour market information on skills hinders Canada's future success.

Employers are increasingly placing emphasis on skills, rather than education. Finding workers with the right skills is not a challenge unique to those regions or sectors experiencing the strongest employment growth. Workers are also acutely aware of these changes and the increased importance placed on skills (i.e., the actual capacity to be effective in a job) rather than just qualifications (i.e., the document signifying the completion of a course). Indeed, a recent survey conducted by the Labour Market Information Council showed skills requirements as the second single piece of information most wanted by Canadians after wages.[6] Moreover, workers—especially vulnerable ones such as people from low socio-economic backgrounds, Indigenous people and mature workers—could face additional barriers due to these rapid changes in the job market.

There is a disconnect between how employers communicate their needs and how job seekers communicate their skills in relation to those requirements.[7,8,9] Tackling the skills challenge requires improved clarity of definitions and measurement of skills, as well as easily accessible information about the skills demanded today and expected tomorrow.

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[6] Labour Market Information Council (LMIC). (2019). Survey results by demographic groups.

[7] Tyszko, J.A. (2018). Transforming employer signaling in the talent marketplace. Andreason, S., Greene, T., Prince, H. and Van Horn, C.E. (Eds.), Investing in America's Workforce: Investing in Systems for Employment Opportunity, p. 297–312. W.E. Upjohn Institute for Employment Research.

[8] Cappelli, P. (2012). Why good people can't get jobs: The skills gap and what companies can do about it. Wharton Digital Press

[9] Cappelli, P. (2015). Skill gaps, skill shortages, and skill mismatches: Evidence and arguments for the United States. ILR Review. 68(2): 251-290.

Better, Stronger Information about Skills

Canada has been navigating skills programs and initiatives without a common framework to share knowledge and evaluation results. Despite the interest in and importance of skills, labour market information is scarce and incomplete.[10] The result is limited data on the demand and supply of skills in Canada.

Part of the challenge is that much of the current infrastructure around data collection is not built—at least not yet—for capturing information on skills. Various actors, including the private sector, are informing the broader discussion regarding the importance of skills but typically without direct data collection or the use of a common language around skills.[11,12]

Addressing this gap requires clarifying the concepts and terminology used to characterize workers and jobs, as well as the related issues of labour shortages and skills mismatches (see Figure 1).[13,14,15] These efforts are a good first step, but more is needed to meet the challenges of a rapidly changing world of work.

Figure 1: Key Concepts: Labour Shortages, Skills Shortages and Skills Mismatches

Labour shortages, skills shortages and skills mismatches are often used interchangeably, creating confusion and potentially leading to inappropriate or ineffective solutions.	**LABOUR SHORTAGE**	**SKILLS SHORTAGE**	**SKILLS MISMATCH**
	A lack of candidates for a specific job in a specific labour market	A lack of candidates with the skills required by particular employers	A situation in which an employee's current skills are not well suited to their current job

Source: Labour Market Information Council. (2018). What's in a name? Labour shortages, skills shortages, and skills mismatches. LMIC Insights No. 3.

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[10] Drummond, D. and Halliwell, C. (2016). Labour market information: An essential part of Canada's skills agenda. Business Council of Canada.

[11] See, for example, RBC. (2018). Humans wanted: How Canadian youth can thrive in the age of disruption.

[12] See, for example, WorkBC. (2018). British Columbia labour market outlook: 2018 edition.

[13] Carey, D. (2014). Overcoming skills shortages in Canada. OECD Economics Department Working Paper No. 1143. OECD Publishing.

[14] Komarnicki, E. (Ed.). (2013). Labour and skill shortages in Canada: Addressing current and future challenges. The Standing Committee on Human Resources, Skills, Social Development, and the Status of Persons with Disabilities.

[15] Cross, P. (2014). Do labour shortages exist in Canada? Reconciling the views of employers and economists. Fraser Institute. Fraser Institute.

Canadians' collective economic, social and individual well-being depends in part on the labour market's ability to match job seekers with job vacancies. Increasingly, that matching process is driven by the supply and demand for skills (as opposed to education). With that in mind, this report summarizes the challenges of defining and measuring skills in Canada and discusses how to develop an improved data infrastructure for monitoring skills. The first section discusses the definitions used to define skills, and some of the problems these definitions create, before presenting a recently created pan-Canadian skills framework. The second section presents the different ways of measuring skills, such as the use of proxy variables and individual testing. Two key opportunities for better observing skills are presented:

1. The increased availability of online job posting data and the establishment of a new Canadian skills classification; and

2. A way to build a data infrastructure to monitor skills is proposed.

THE WEIGHT OF WORDS: THE CHALLENGES IN DEFINING SKILLS

Lost in Translation

The importance of skills has been discussed and debated without a common framework for understanding, measuring and evaluating them. Different and contradictory definitions, classifications and measurements of skills coexist. While the various frameworks each serve a specific purpose or audience, they don't allow for the widespread coherence required for larger systems analysis and impact. The absence of a common framework in Canada has led to the development of multiple classifications by governments and private firms alike.

The best-known framework is Employment and Social Development Canada's (ESDC) Essential Skills Framework,[16] which defines nine essential skills and is broadly used to design and assess various skills development initiatives across the country. ESDC considers essential skills to be the foundation for learning all other skills; they enable people to better prepare for, get and keep a job, and adapt and succeed at work. These skills include literacy (i.e., reading, writing, document use and numeracy), thinking skills, oral communication, computer use/digital skills, working with others and the skills associated with continuous learning. At the provincial level, numerous initiatives identify and organize skills, such as Ontario's framework of global competencies.[17]

Provinces have also come together to create a consensus for common sets of competencies in the Atlantic Canada Framework for Essential Graduation Competencies[18] and, more broadly, for a global competencies' framework through the Council of Ministers of Education.[19] Other organizations have developed tools for their own purposes. For example, EcoCanada and Tourism HR Canada, two sector associations, maintain national occupational standards that lay out, in a harmonized way, the skills in their respective sectors.

The private sector has also been an important actor in this field. LinkedIn collects and organizes its own list of about 50,000 skills based on its database of job postings and profiles. Vicinity Jobs, a private job posting aggregator, identifies some 10,000 specific skills. In other instances, such as the RBC Humans

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[16] Employment and Social Development Canada (ESDC). (2017). The Office of Literacy and Essential Skills. Government of Canada.

[17] Ontario Ministry of Education. (2017). Framework of global competencies. EduGAINS.

[18] Council of Atlantic Ministers of Education and Training. (2015). The Atlantic Canada framework for essential graduation competencies. Council of Atlantic Ministers of Education and Training.

[19] Council of Ministers of Education. (n.d.). Global competencies. Government of Canada.

> Our information system does not have comprehensive and robust data on the demand and supply of skills in Canada. As a country, we have been navigating skills programs and initiatives without a common framework to share understanding, measurement and evaluation of the skills.

Wanted Report (2018), the labour market has been observed through the lens of the United States Occupational Information Network (O*NET), which identifies 35 skills.

While each of these classifications serves an important purpose, having multiple classification systems—which in some cases incorrectly mix knowledge, competencies and skills—has caused confusion. As a result, Canadians must often rely on their own interpretations of what is meant by terms such as "soft skills," and decide for themselves which specific skills they should develop (or, in the case of educators and employers, which types of training they should offer). Such imprecision makes it difficult to address skills challenges in a meaningful way.

Getting the Basics Right

Making meaningful progress toward a coherent skills taxonomy requires a clear and common understanding of what we mean by "skills" in the first place—something that was lacking in Canada until very recently. Defining skills is not easy, with the definition often varying considerably depending on the discipline. Yet other jurisdictions, notably Europe[20] and the United States,[21] have had common definitions for some time.

For our purposes, "skill" is understood as the application of one's knowledge to the execution of a specific task or job function. In other words, a skill sits at the nexus of ability, knowledge and performance. Skills are learned, linked to a specific
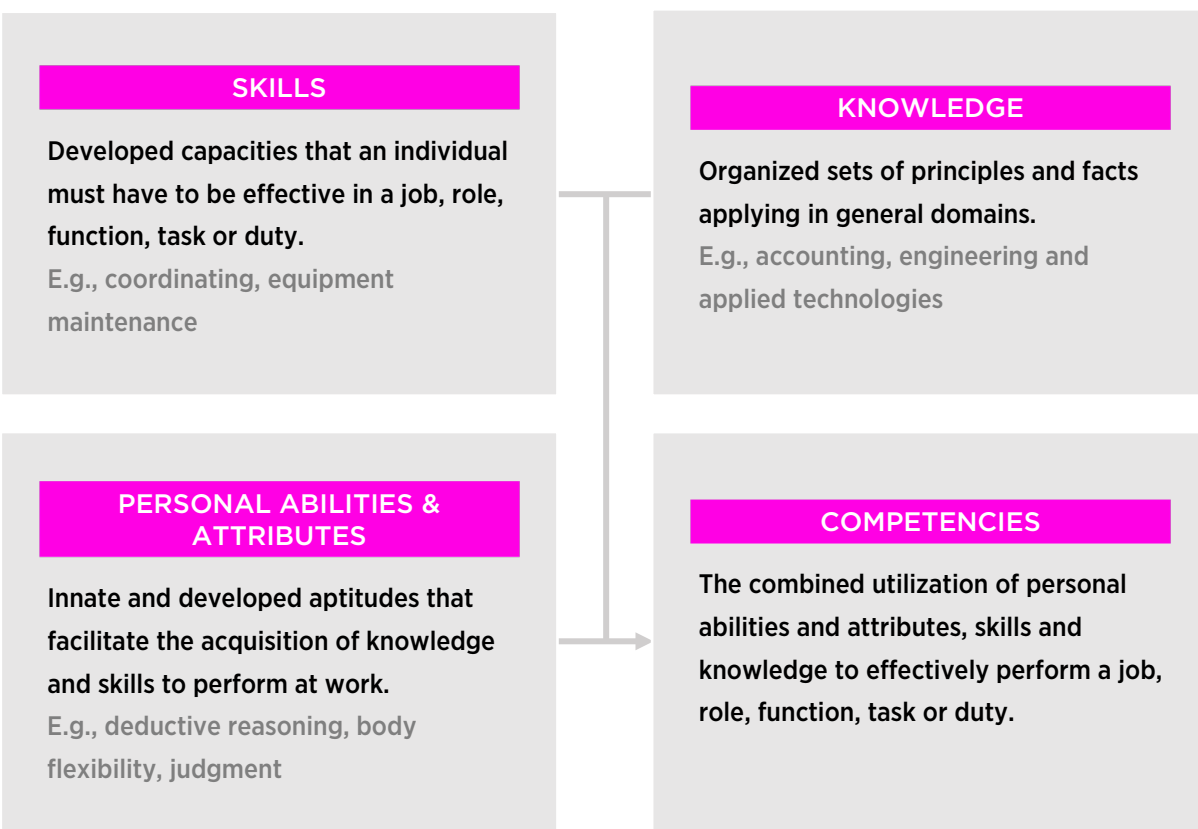
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[20] European Skills/Competences, Qualifications and Occupations. (2018). Skill. European Commission.

[21] Occupational Information Network [O*NET]. (2019). The O*NET® content model. O*NET Center.

task in a particular context, and can be refined and developed.

To add clarity to the issue, ESDC recently adopted a definition aligned with international standards. Specifically, ESDC has defined skills as developed capacities that an individual must have in order to be effective in a job, role, function, task or duty (Figure 2). This definition emerged from an in-depth international review and aligns with the definitions used by the International Labour Organization.[22] It also builds upon the definition used by O*NET, a widely recognized resource.[23] This definition highlights the important distinction between skills and related concepts such as knowledge, personal abilities, attributes and competencies.

Figure 2: A New Framework for Skills in Canada

SKILLS

Developed capacities that an individual must have to be effective in a job, role, function, task or duty.
E.g., coordinating, equipment maintenance

KNOWLEDGE

Organized sets of principles and facts applying in general domains.
E.g., accounting, engineering and applied technologies

PERSONAL ABILITIES & ATTRIBUTES

Innate and developed aptitudes that facilitate the acquisition of knowledge and skills to perform at work.
E.g., deductive reasoning, body flexibility, judgment

COMPETENCIES

The combined utilization of personal abilities and attributes, skills and knowledge to effectively perform a job, role, function, task or duty.

Source: Labour Market Information Council, Employment and Social Development Canada and Statistics Canada. 2019. Bridging the Gap between Skills and Occupations: A Concept Note to Identify the Skills Associated with National Occupational Classification (NOC) categories.

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[22] International Labour Organization (ILO). (2004). ISCO International Standard Classification of Occupations Conceptual Framework.

[23] The ILO defines skills as "the ability to carry out the tasks and duties of a given job". See International Labour Organization (ILO). (n.d.). Conceptual framework. The United States O*NET system defines skills as the "developed capacities that facilitate learning or the more rapid acquisition of knowledge". See O*NET Online. (n.d.). Skills. O*NET.

This pan-Canadian framework is a new development. While distinctions among skills, knowledge, abilities and so on may seem like hair splitting, confusion concerning these terms has real-world implications. For example, some employers have pointed to candidates' lack of "soft skills" as the source of recruiting challenges and have called for a policy response. But it is important to understand what a "lack of 'soft' skills" is before rushing to design solutions. Similarly, when educators consult with employers as they seek to design curricula that align with labour market demands, both sides need a shared understanding in order to bridge the gap in an effective manner.

It cannot be overstated how important it is to ensure that all actors and agents involved in the skills conversation, including education and training policymakers, employers and career development experts, share a common understanding of skills. If Canada is to succeed in addressing today's challenges, a shared understanding of the problem is a necessary first step towards developing solutions.

THE MEASURING TAPE: DIFFERENT OPTIONS TO MEASURE SKILLS

The Old Way Won't Cut It Anymore

It is challenging to measure something if it is difficult to define. Most current Canadian analyses of skill supply-and-demand (skills held by individuals vs. skills desired by employers) measure skills indirectly. That is to say, skills are measured through the use of proxies, the most common of which are educational attainment, occupation and field of study.[24] This is partly because education[25], occupation[26] and field of study[27] are well defined across statistical reporting agencies and are easily measured.

Occupations are classified according to the National Occupational Classification (NOC) maintained by Statistics Canada and ESDC. The classification groups occupations according to "skill level" and "skill type." Note, however, that these criteria do not refer to actual skills but to educational attainment and the type of work typically performed, respectively.

Proxies are used because of the availability of accessible, reliable and timely data in these areas. The Labour Force Survey and the census provide a great deal of information on the Canadian population, organized according to the occupation they hold or have held in the past as well as information on educational attainment.

However, these proxies do not necessarily provide accurate and useful information. Below, we used two of the key skills proxies—occupation and educational attainment—to estimate the proportion of workers whose education and training match what is required for their jobs. The number of employed workers by highest educational attainment and occupation was used to conduct a simple analysis of over- and underqualification in Canada. Each four-digit NOC code is associated with a skill level (A to D) describing the typical educational and training requirements for the occupation. Classification of highest educational attainment was recoded to align with the educational and training requirement of skill level.

As is demonstrated in Figure 3, a sizable proportion of workers are overskilled (at least according to the proxy of education). Looking at workers whose educational attainment is higher than their occupation

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[24] Educational attainment is usually measured with respect to the highest education program successfully completed, which is typically certified by a recognized qualification. This is why educational attainment and qualification are sometimes used interchangeably.

[25] Statistics Canada. (2019). Educational attainment of person.

[26] Statistics Canada. (2019). National Occupational Classifications.

[27] Statistics Canada. (2019). Classification of instructional programs (CIP) Canada 2011.

(e.g., holding an occupation associated with skill level D with an educational attainment A), this analysis shows that 36% of workers are overqualified (blue) and 16% are underqualified (pink).

Unfortunately, this finding provides no insight into the actual skill-related elements that need to be improved—a precondition for investing in specific skills initiatives.

Figure 3: Educational Attainment by Occupation
Percentage of workers by educational attainment and skill level associated with occupation, 2018

		Educational Attainment of Employed Canadians			
		A	B	C	D
Skill Level Associated with Occupation	A	17%	5%	1%	0%
	B	8%	21%	7%	1%
	C	5%	14%	8%	2%
	D	1%	4%	4%	2%

Source: Statistics Canada. Authors' calculations

On the employer side, the Job Vacancy and Wage Survey, also administered by Statistics Canada, is a quarterly survey of about 100,000 businesses that collects information on job vacancies by occupation. This survey provides valuable information on unmet labour demand and potential shortages by occupation. The information organized by occupation allows us to observe skill level (and type)

requirements of vacancies. But this approach is not perfect. Notably, skill types and levels are too broad to distinguish between labour shortages, skills shortages and skills mismatches.[28]

Testing Skills: Accurate but at What Cost?

Testing people is the most direct approach to measuring their skills, and psychology researchers and employers have used this method for a long time. Different testing and assessment options offer trade-offs in quality and practicality (see Figure 4). Psychometric tests, which offer good quality and accuracy, are sometimes used in recruitment to evaluate general aptitude and behaviour. Other tests measure specific abilities in the context of a job or a task. Applicants for software development jobs, for instance, may have to pass a programming test in the recruitment process.

Such tools are effective for gaining a detailed understanding of the skills held by workers but are difficult to apply in ways that produce population-wide indicators, making them of limited use in policy design. A notable exception is the Organisation for Economic Co-operation and Development's (OECD) Programme for the International Assessment of Adult Competencies (PIAAC) Survey of Adult Skills.[29] This international survey is conducted in over 40 countries and tests adults' proficiency in literacy, numeracy and problem solving.[30] The survey also collects information on workers' perception of their skills in comparison to their positions' requirements, which can be used to estimate self-reported skills mismatches.[31]

Because PIAAC was designed for international benchmarking and not to inform national policies and programs, it suffers from several limitations. First, it does not capture the full spectrum of skills that are becoming important in the world of work. Second, the survey focuses on the supply of skills only. It does not provide any information about current and future demands for skills. Finally, the data-gathering process is costly, which means the survey can only be conducted every few years, which limits the timeliness of the information.

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[28] Labour Market Information Council. (2018). What's in a name? Labour shortages, skills shortages, and skills mismatches. LMIC Insights No. 3.

[29] Organisation for Economic Co-operation and Development (OECD). (2012). About the Survey of Adult Skills (PIAAC). OECD Publishing.

[30] In Canada, PIAAC was conducted by Statistics Canada on behalf of the Council of Ministers of Education, Canada, Employment and Social Development Canada and other partners between November 2011 and June 2012. The next cycle of PIAAC data collection is scheduled for 2021.

[31] Mahboubi, P. (2019). Bad fits: The causes, extent and costs of job skills mismatch in Canada. C.D. Howe Institute, Commentary No 552. C.D. Howe Institute.

Figure 4: Testing Skills: Approaches and Limitations

Type of test	Example(s)	Limitations
Employer Surveys **Employers are asked directly about skills requirements and to identify shortages thereof.**	▪ Extent, Causes and Implications of Skills Deficiencies Survey ▪ UK Commission for Employment and Skills' Employer Skills Survey ▪ 3. European Centre for the Development of Vocational Training's European Employer Survey	1. Currently no Canadian employer surveys at the federal level.[32] 2. Reporting bias: firms might over- (e.g., to increase foreign labour quotas) or under-report (e.g., to leverage contract negotiations) to advance an agenda. [33]
Psychometric tests—Personality Profiling tests **Capture general aptitude and behaviour characteristics.**	Caliper Profile Myers-Briggs Type Indicator SHL Occupational Personality Questionnaire	1. Social desirability bias—test takers may answer based on what they think employer wants to hear. 2. People are not necessarily good at accurately estimating their own behaviour: people tend to overestimate certain tendencies while underestimating others. 3. The link between personality and skills is not well defined. 4. Practice can improve a test taker's score irrespective of their actual ability; tests are vulnerable to racial and ethnic differences. 5. Tests can be quite costly to develop and administer; they must be tailored to the various positions in the company in order to reflect the different skills needed by each.
Psychometric tests— **Aptitude/cognitive tests** **Capture general aptitude and behaviour characteristics.**	PIAAC GATB Wonderlic Test	1. There is evidence to suggest cognitive tests may create lower levels of minority representation in the workplace.[34] 2. The physical, social and emotional environment under which the test is taken is often different from the actual environment in which the skills are to be executed, thus reducing the predictive value of the test.
Skills Tests **Measure applicants' technical competencies.**	A software developer being given a programming test, for example.	These types of tests are not standardized and differ from one employer to the next. As such, they are very narrow in scope and cross-comparison is not easily achieved.

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[32] Some surveys do exist at the provincial level, however. The Manitoba Federation of Non-Profit Organizations conducts the Voluntary and Non-Profit Workforce Skill Survey, and Emploi-Québec runs the Survey on Recruitment, Employment and Training Needs of Quebec Businesses (EREFQ).

[33] Barnow, B., Trutko, J. and Piatak, J. (2013). Conceptual basis for identifying and measuring occupational labor shortages. In Occupational Labor Shortages: Concepts, Causes, Consequences, and Curses, p. 1–34. W.E. Upjohn Institute for Employment Research.
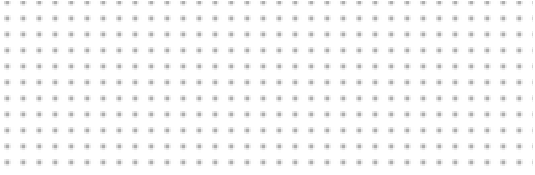
[34] Ng, E. and J. Sears. (2008). Walking the talk on diversity: CEO beliefs, moral values, and the implementation of workplace diversity practices. Journal of Business Ethics: 1-14.
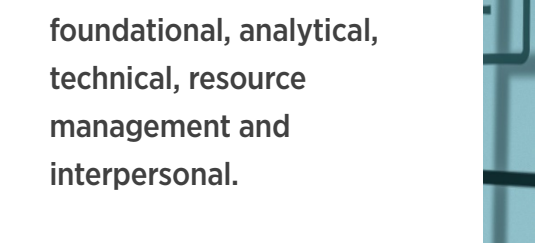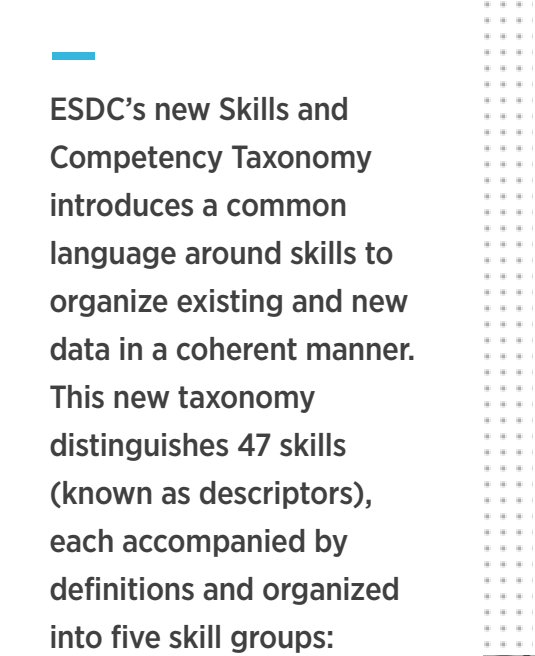
Going Digital

Because of the limitations associated with testing and proxy-based approaches, there are efforts to mine self-reported skills data, which can be aggregated from anonymized job seeker profiles (supply of skills) and employer job postings (demand for skills) on platforms such as LinkedIn. The availability of online job posting and resumé data, as well as of the broader use of machine learning and data mining techniques, have opened new approaches to documenting skills.

Datasets with millions of self-reported skills supplied and demanded are available from firms specializing in web and database scraping[35] such as Vicinity Jobs Technologies, or directly from job portals such as Magnet. After compiling information from job postings and job seeker profiles, these firms clean the data and use natural language processing techniques to identify skills requirements (from job postings) and the stock of skills supplied (from resumés). Finally, they organize and categorize skills in a consistent and coherent manner. No commonly accepted classification, such as NOC, exists to organize the information. As a result, the organizing of skills into predefined categories and hierarchies is done differently by each firm processing the raw data. This results in different classifications coexisting, which makes comparison across data sources difficult if not impossible.

Several recent publications use such data to draw conclusions about the supply of and demand for skills in the Canadian labour market. For example, the Labour Market Information Council identified the top skills demanded within LinkedIn Premium job postings

ESDC's new Skills and Competency Taxonomy introduces a common language around skills to organize existing and new data in a coherent manner. This new taxonomy distinguishes 47 skills (known as descriptors), each accompanied by definitions and organized into five skill groups: foundational, analytical, technical, resource management and interpersonal.

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[35] Web scraping is the automated extraction of data from websites.

in the 10 largest Canadian cities in 2018.[36] Similarly, the Brookfield Institute for Innovation + Entrepreneurship looked at the most in-demand skills in Ontario for selected industries using information gathered by Burning Glass Technologies.[37]

These new data sources present immense opportunities to understand the supply and demand for labour and skills in a timely manner—thousands of new postings are added to job boards and scraped daily— and at a local, granular level. However, this approach requires some caution. First, both resumés and profiles are promotional content where employers and job seekers can exaggerate or incorrectly describe their needs and skills. Also, in organizing and categorizing skills, web scrapers sometime pick up other descriptors (e.g., qualifications) that are not proper skills.

Moreover, online data is not as robust as traditional statistics. For example, it is difficult to determine if the observed number and characteristics of job postings and résumés are representative of the wider job market.

There is evidence that employers in certain fields (e.g., information technology and health) are more likely than others to post vacancies online, leading to an overrepresentation of these employers' needs. Smaller businesses and certain occupations, like construction, are likely underrepresented.[38]

Online sources present new data-quality challenges, including correctly classifying information and suppressing duplicate postings. In addition, most of this information is privately owned, requiring ongoing purchasing agreements with private organizations. While web scraping offers one potential way of overcoming the obstacles presented by private ownership of this data, the legality of web scraping varies across the world. In Canada, web scraping is legal at a general level, but it may be against the terms of use of some websites that implement processes to detect and deny access to web scrapers.

These challenges are significant but not unique to labour market analysis. Indeed, data collected through scraping and other novel methods is at the forefront of modern data analytics. The caveats mentioned above are mainly a concern if one tries to measure the exact number of vacancies and job seekers. But online data remain helpful in providing insights on labour market trends. Moreover, data is collected daily and is generally provided at the individual job posting level. This offers information that is more timely

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[36] Labour Market Information Council. (2019). Insights into skills and jobs advertised on LinkedIn in 2018. LMIC Insights No. 10. LMIC.
[37] Brookfield Institute for Innovation + Entrepreneurship. (2018). Better, faster, stronger: maximizing the benefits of automation for Ontario's firms and people.
[38] Maher and Maher. (2014). Real-time labour market information. U.S. Department of Labour.

and granular in terms of geography (firm's exact location) and other characteristics (occupation, qualifications, etc.) than traditional statistics.

Even traditional government statistical agencies like Statistics Canada are considering these new sources of data to reduce costs and response burdens associated with surveys and are developing ways of addressing the concerns about the quality of this data.[39] Such efforts to determine online data's accuracy and usefulness should continue. In the meantime, the known limitations should not, by themselves, stop researchers from using this data so long as users understand these limitations and make allowances for them.

Wanted: Data Seeking Classification

Until recently, a limitation in Canada on the use of web-scraped data was the absence of a recognized skill classification or taxonomy. ESDC's new Skills and Competency Taxonomy[40] introduces a common language around skills to organize existing and new data in a coherent manner. This taxonomy distinguishes 47 skills (known as descriptors), each accompanied by definitions and organized into five skill groups: foundational, analytical, technical, resource management and interpersonal (Figure 5). This new tool presents a unique opportunity to make better use of existing data and develop skills-specific insights on the Canadian labour market.

At the same time, it is important to recognize that this taxonomy complements the other initiatives that categorize skills. Different methods have been developed for specific analysis and monitoring purposes. The Skills and Competency Taxonomy won't be the only tool used by everyone—nor should it be. Rather, it can provide a framework that enables different actors (educators, employers, etc.) to speak the same language.

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[39] Statistics Canada. (2019). Web scraping.

[40] LMIC, ESDC and Statistics Canada. (2019). Bridging the gap between skills and occupations: A concept note to identify the skills associated with NOC. LMIC Insights No. 16.

Figure 5: Skills Subcategories in the Skills and Competency Taxonomy
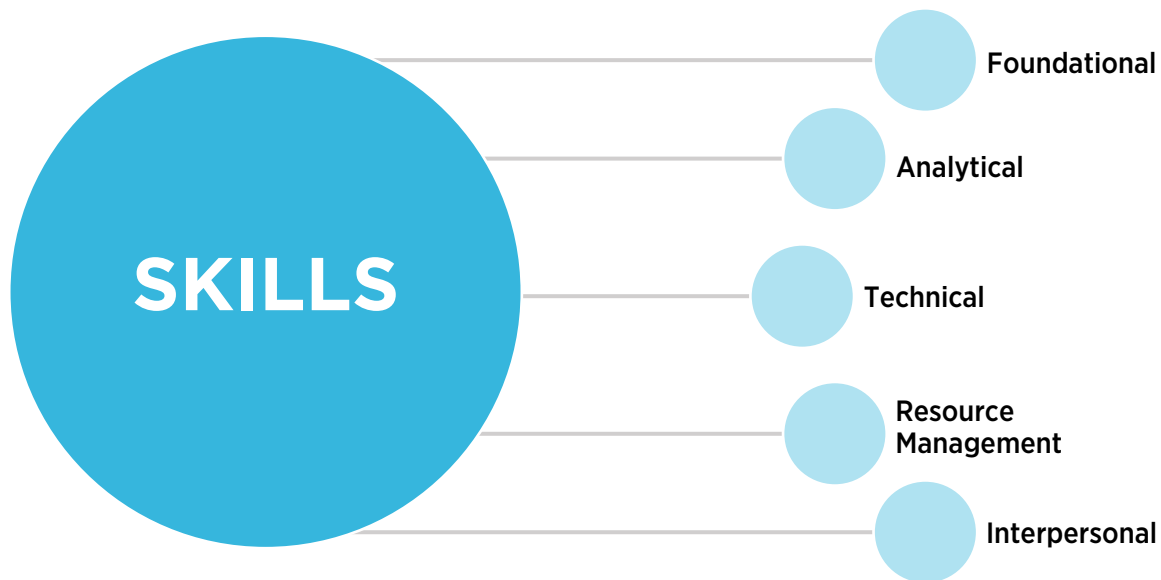
Source: Labour Market Information Council, Employment and Social Development Canada and Statistics Canada. (2019). bridging the gap between skills and occupations: A concept note to identify the skills associated with National Occupational Classification (NOC) categories.

Linking Skills to Occupations

A new taxonomy isn't a silver bullet. To be of most use, it should speak to jobs.[41] To achieve this, a taxonomy must connect skills to occupations—in other words, specify the skills that make an occupation. Doing so would allow Canadian researchers and policymakers to leverage the wealth of existing data and to structure and organize skills information to already established systems of occupations.

However, identifying skills and linking them to occupations is a complex process. Different approaches can make this linkage, such as leveraging job analyst expertise, manually assigning skills to occupations and using big data from online job postings and resumés. Each has its advantages and limitations, and there is likely value in a hybrid approach. Consequently, it is important to evaluate each of these methods of understanding skills and jobs against the following criteria (Figure 6).

[41] Evers, F.T., Rush, J.C. and Berdrow, I. (1998). The bases of competence: Skills for lifelong learning and employability. Jossey-Bass Publishers.

Figure 6: Key Criteria for the Success of Any Assessment Framework to Bridge Skills and Occupations

Flexible	Managed and executed in a way that enables it to be modified to respond to changing labour market conditions and emerging skills
Sustainable and cost-effective	Adequate resources to maintain and update the mapping
Representative	Reflects the different ways employers, workers and training providers express skill requirements
Granular	Incorporates greater specificity of skills and occupation-specific data
Responsive	Enables policymakers, career and employment counsellors, curriculum developers and others to make better-informed decisions about skills training and education
Measurable	Allows for the reasonable measurement of skills
Statistically sound	Sound empirical techniques ensure the resulting estimates of skills levels and distributions are representative of Canadian labour markets

THE WAY FORWARD

By most metrics, Canada's economy and job market are doing well, but the world of work is changing. In the face of the many drivers of change, jobs evolve as workplaces innovate and adjust. And while post-secondary education remains a fundamental pillar of Canada's workforce development, labour market information related to skills is essential to ensuring the country's future success. Indeed, employers struggle to find workers with the right skills, and workers are asked to improve their skills on an ongoing basis. Yet the discussion regarding skills is often misleading and conflated with other issues. If Canada is to build upon its healthy labour market, more refined information and insights must be brought into the discussion about skills.

The recently introduced ESDC Skills and Competency Taxonomy is a first step in building a framework for observing and acting on skills priorities in Canada. The next step is to link the taxonomy to occupations in a way that improves our understanding of the skill requirements of jobs, while meeting the criteria for assessing the bridge between skills and occupations.

Moving forward, three actions are necessary to ensure that Canadians have the data and insights they need to make informed decisions regarding skills.

Sharing a Common Language

The Skills and Competency Taxonomy is an important first step towards improving the ability of researchers, policymakers and others to understand each other and to compare analysis of job characteristics and our understanding of workers—all in an open and transparent way. This taxonomy can lay the foundation for a common skills language, which will allow and promote meaningful dialogue and exchange on issues related to skills for improving policy and program design.

Given the pace of changes underway in the world of work, however, this taxonomy cannot be static if it is to remain relevant. Regular and ongoing consultations with different users are needed so that skills included in the taxonomy can be refined and continue to reflect reality as new skills emerge and others disappear. This will entail rigorous maintenance and updating.

Linking the Skills and Competencies Taxonomy to Occupations

Speaking a common language on skills is only the first step towards deepening our knowledge of how job requirements are shifting. To support a better understanding of skill needs for today and tomorrow, the Skills and Competency Taxonomy should be fully integrated in the Canadian statistical system to act as a national skills and competency dictionary. While many argue that the NOC system does not sufficiently keep pace with changes in the labour market, it is the current framework for describing the world of work in Canada. A large volume of labour market information is organized according to NOC, as existing surveys (e.g., Labour Force Survey and the census) collect and classify information on workers and jobs using its system. It is therefore a natural place to begin to structure and organize the new skills information in the Skills and Competency Taxonomy.[42]

Leveraging New Techniques to Improve Information on Skills

New techniques to harvest big data on skills are improving our understanding and monitoring of skills—in near real-time. These techniques offer cost-effective and efficient means by which skills can be linked to jobs. Approaches of this nature, however, come with some limitations and concerns, as have been outlined. When using these techniques, any caveats must be clearly communicated and understood. But perfection should not be the enemy of progress. No approach is without limitations, and these techniques should be used as a complement to other ways of collecting information on skills. Finally, as the world of skills continues to evolve, how skills are measured, defined and assessed in relation to occupations must be constantly revisited.

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[42] ESDC, Statistics Canada and the Labour Market Information Council have committed to work together, with input from other governmental and non-governmental stakeholders, to assess how best to link the skills identified in the Taxonomy to occupational categories.

Canada's continued labour market success will be grounded in its ability to shift skills-related policies and programs. In particular, information on the skills and training needs of employers and workers must be improved, and education and training providers must be provided the information and tools to better support workers in navigating the changing world of work. Good labour market information lies at the heart of solving the skills puzzle.

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