

Breaking into Tech



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Communitech was founded in 1997 by a group of entrepreneurs committed to making Waterloo Region a global innovation leader. At the time it was crazy talk, but somehow this community managed to pull it off. Today, Communitech is a public-private innovation hub that supports a community of more than 1400 companies — from startups to scale-ups to large global players.

Communitech helps tech companies start, grow and succeed in three distinct ways.

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Executive Summary

As Canada's innovation-driven economy grows so does its tech sector. With this, technology-enabled roles become more prevalent and the skills required for these roles become vital to Canada's economic growth. This means it is increasingly important for organizations supporting the growth of the tech sector as well as organizations supporting workers seeking employment in general to understand the exact nature of the skills valued within these jobs. Technology companies are seeking a continuous pipeline of talent in order to sustain growth. And while many job-seekers want to work for technology companies, there continues to be friction in matching the right worker with the right skills to the right job in the right company.

There are many potential reasons for this type of friction to exist - from companies lacking internal clarity on their skill needs, to inaccurate representations in job descriptions, to a lack of workers with the specific skill and experience to meet the current needs of employers. The purpose of this report is to take a closer look at the talent and skills components of specific in-demand careers inside Waterloo Region tech companies, skills and talent needs of tech companies, as well as the different routes that workers travel to gain entry into - and navigate between - companies.

This report is a joint effort between Communit^{TECH}, a technology innovation hub based in Waterloo Region, and the Brookfield Institute for Innovation + Entrepreneurship, an independent policy and research institute based at Ryerson University. Communit^{TECH} is developing the Communit^{TECH} Academy to support workers and companies coming together to better match their skills with talent needs, and the Brookfield Institute for Innovation + Entrepreneurship is powering the research underpinning this effort. Through collaborating to deliver this project, both organizations hope to offer a clearer picture of how tech companies in the Waterloo region might go about exploiting the untapped talent pools that exist.

To develop this report, we conducted a literature review scanning the most recent reports issued by other research organizations examining the skill needs of the tech sector. We also spoke with research participants representing over 30 tech companies within the Communit^{TECH} network to better understand (i) their need for skilled talent, (ii) the job opportunities that job-seekers take to enter the technology sector, and (iii) the direction those workers take once inside a technology company. Some of our high level findings include:

- 1 There are a number of skill profiles that together comprise of up to seven career fields representing the highest demand areas for talent with tech companies.** These career fields include:
 - a) Software Development
 - b) Data Science
 - c) Artificial Intelligence
 - d) Sales + Marketing
 - e) Product Management
 - f) User Experience
 - g) Technology Business Management
- 2 A 'growth mindset' continues to be cited as one of the most valuable and essential aptitudes an employee can bring to a company** - in many cases being seen as more valuable than certain technical skills and proficiencies.
- 3 The most common way into a technology company is by recruiting through employee referrals and recent graduates, which creates limitations in reaching new talent. As companies scale, they identify a need for more senior talent than they can obtain from jobseekers aiming to make a career transition into tech.**
- 4 Technology companies encourage horizontal movement of employees within a company more so than vertical growth.** There is some professional development infrastructure in place to support employee growth in this respect, however much of it is either ad hoc or externally sourced.

Introduction

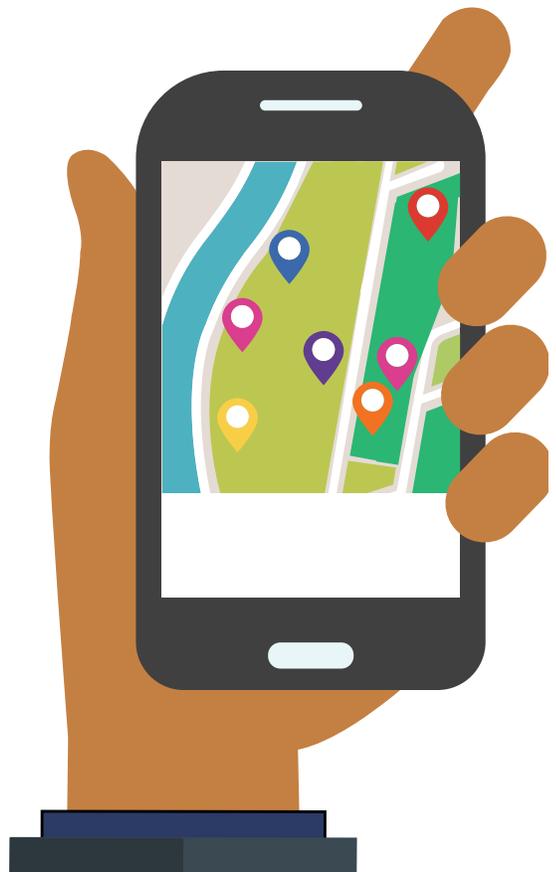
The Canadian technology sector is a fast growing area of the economy and a promising source for employment growth. It is increasingly recognized as a global leader with a vibrant and flourishing tech community, thanks in no small part to the highly skilled and highly educated talent pool readily available in Canada.

According to the Brookfield Institute for Innovation + Entrepreneurship, the technology sector accounts for \$117 billion, or 7.1% of Canada's GDP. It is estimated to employ 864,000 people across Canada and is expected to continue growing.¹ In addition, many technology-intensive jobs are perceived to be highly desirable. According to Indeed.ca, some of the best jobs as measured by salary and employment growth in Canada are in the tech sector, with jobs such as Machine Learning Engineer and Full Stack Developer topping the list.²

In spite of its impressive growth, tech companies still struggle to attract the talent they need to grow. In Ontario alone, 82% of tech firms say that their ability to attract and retain talent is their most pressing need, hindering their ability to scale.³ For many organizations focused on supporting the growth of the tech sector, understanding the challenges that companies face in attracting and retaining talent is an essential part of their work.

For Communittech, understanding how to best support companies in finding and keeping talent is a focal point of their work. Communittech is focused on growing more successful technology companies to support Canada's economic prosperity. Headquartered in Waterloo Region, its mission is to help technology companies start, grow, and succeed; with the objective of creating more companies, more jobs, and more wealth in Canada. Since 2009, Communittech has helped attract \$1.4 billion in equity investment to local tech companies; supported the creation of 2,800+ startups; supported creation of 16,000+ new jobs at existing companies; and helped attract 20 multinational firms to invest in Waterloo Region. Waterloo Region boasts over 23,000 people in tech in the community, accounting for 8.2% of all workers in the region.⁴ This makes it the third largest employer in Waterloo after manufacturing and retail sales.

Communittech partnered with the Brookfield Institute for Innovation + Entrepreneurship to conduct a study of the skill gaps, directions employee take to enter and move within tech companies, and talent pipelines in the tech sector. These insights will inform the programming design of the Communittech Academy – a learning centre to help people navigate breaking into tech and expanding their skills within it.



Methodology

This report aims to build a knowledge base to support Communittech in understanding the skill needs of their member companies, the career opportunities available for workers and the routes through which employees enter and move within companies. The questions this report seeks to address are:

- 1 What are the skill gaps that tech/tech-enabled companies in Waterloo Region are experiencing?
- 2 How are they currently filling these gaps?
- 3 What are the different directions employees take to enter a company?
- 4 How do employees move within the company once there?
- 5 What are some of the skill gaps or other struggles employees experience in pursuing these job opportunities?

To answer these questions, we relied on a two-pronged research strategy:

- 1) A literature review to understand the existing knowledge base on three interrelated themes:
 - a. evidence of the increasing pervasiveness of technology in the workforce;
 - b. skill needs for technology workers; and
 - c. the routes technology workers take to enter the technology industry.
- 2) Qualitative informational interviews with a wide cross-section of companies that share the following characteristics:
 - a. Research focused on scale-up tech companies, defined as having a minimum of 10 employees and a run rate of at least \$1M per year with a clear path to growth.
 - b. Target companies primarily came from the Communittech network in Waterloo Region.

By speaking with employers, we were able to identify and analyze some of their most important skill needs. In unpacking these needs further, it is instructive to outline a couple potential directions for workers that occupy sectors outside of those identified by this report. One way we approached this task was by making use of the US Bureau of Labor Statistics O*NET database. The O*NET is an occupational classification database of almost 1000 separate occupational groups in the US, with a common language surrounding skills, education, and experience to compare between occupations. We have performed a cross-reference of Canadian data to be able to leverage O*NET to map the underlying knowledge and skills required to perform a designated job. In describing career transition opportunities, we referred to comparable jobs using O*NET and through online job boards to determine definitions for career profiles and related focus areas. Lastly, we used O*NET to identify similar job roles based on the levels of underlying knowledge and skills.

Literature Review

The tech sector is a disruptive, innovative and fast growing area of the economy that poses a tremendous opportunity for the labour market. The impacts of technology are not confined to the tech sector, but are more accurately changing all sectors and industries. These changes are typified by companies adopting new tools to automate and streamline their processes, while looking to use technology to define new ways to increase productivity and efficiency. The end result is that the core skill set required for workers to participate and succeed in this wave involves a fluid and constantly changing set of skills and competencies. Prime examples of sectors that are experiencing these shifts include the Information and Communications Technology (ICT) sector, media sector, professional services and financial services.⁵

The upshot of this technological transformation is that it will introduce a substantial bias towards technology-related skills into the labour market. Specifically, technology will reduce the demand for jobs that comprise of routine tasks and enhance the value of jobs that are comprised of non-routine tasks.⁶ Given the rapid pace of technological change in Canada, we can predict that 42% of jobs are at high risk of being impacted through the increased automation that comes as a result of it.⁷ This in turn will impact the skill needs required for workers to remain competitive. A recent report from RBC suggests that 50% of occupations will require workers to undergo a significant skills overhaul as a result of the rapid pace of technological change across industry.⁸ As such, there is a strong desire among researchers, academia, industry and other organizations to better understand the needs and opportunities posed by the tech sector, and how best to position workers to ensure they have the right skills to benefit from it.

To set the stage for this report, we surveyed some of the most relevant research conducted on talent gaps, skills mismatches and additional issues impacting the tech workforce in Canada. Overall, the literature points to two key themes that we used as our baseline understanding of the current state of the workforce in the tech sector. These themes include the broad base of skill needs from within the technology sector (regardless of whether the job is high-tech, mid-tech or no-tech) and the employment routes of workers entering and moving within the technology sector.

Skill and Aptitude Needs for the Technology Sector

The emergence of new waves of technology has without a doubt impacted the overall needs of employers in the tech sector. In speaking with employers of many technology-based companies we heard continuously that one of the top challenges these companies face is the lack of qualified talent. In unpacking this finding, we discuss three inter-related factors that are often identified by the technology sector as in-demand: 1) digital skills, 2) soft skills to complement digital skills and 3) key aptitudes.

DIGITAL SKILLS

Digital skills are cited as in-demand skills from employers in all sectors, but are especially essential in the technology sector.⁹ By digital skills, we are referring to a worker's ability to use technological tools to solve problems, underpinned by the ability to critically understand digital content and tools. This wider and more flexible definition of digital skills puts forward the suggestion that digital skills are not necessarily restricted to more technical and niche skills.

What this means for aspiring tech workers is that while not everyone will need to learn to code, today's sector will almost certainly require a baseline of digital literacy that extends into the domain of basic problem solving with technology. To break this term down further one can also look at the idea of being 'digitally skilled' as falling into

different levels proficiency: (1) baseline digital skills, (2) workforce digital skills, and (3) professional digital skills.¹⁰ Evidence points to the fact that falling below or outside these categories could prove as a challenge and obstacle for workers looking to enter the tech sector.

The Information Communications and Technology Council (ICTC) estimates that there will be 216,000 vacancies for ICT jobs by 2021 in Canada.¹¹ A Business Council of Canada survey reinforces this pressing need for workers with digital skills, stating that approximately 64% of employees lack the technical digital skills they require.¹² The need for enhanced digital skills is also reflected across industries in the U.S.. From 2002 to 2016, approximately two-thirds of net new jobs created required at least a mid-level understanding of digital skills. These jobs also have an associated wage premium that is attributable to the degree of digital skills a worker has.¹³ Taken together, this evidence clearly points to the increasing importance of digital skills, regardless of industry.

SOFT SKILLS

Accompanying the increased demand for workers with digital skills will likely be an increased need for workers with soft skills. These are skills that enable people to cooperate and coordinate with others in a productive manner, and include strong interpersonal, communication, collaboration and adaptability skills. What this suggests is that there is a duality to what the ideal tech worker can and should possess in terms of dominant skill sets. On the one hand are the digital skills aforementioned, and on the other are soft skills to complement such. It is safe to say that employers in the tech sector are increasingly looking to find workers that possess both skill sets and often express the importance of having both.

One study notes that, between 1990 to 2012, jobs requiring a high degree of soft skills grew by 12 percentage points as share of the overall US labour force. This was especially true for jobs that required a high degree of technical and soft skills. Technology-intensive jobs with less social interaction shrank by 3.3 percentage points as a share of the overall US labour force over the same period.¹⁴ This suggests that technical skills on their own are insufficient to meet the skill needs of employers.

Employer surveys validate the need for workers with soft skills. According to the Business Council of Canada, the most valued skills that employers look for in both entry-level and mid-level hires are teamwork skills, communication skills and problem-solving skills.¹⁵ Soft skills will only increase in demand for employers, particularly as employers seek workers who can move between human interaction and digital interaction seamlessly.

APTITUDES

In the tech sector, employers are seeing a need for assessments to be able to expand their talent pool beyond people who have formal training to include those with specific aptitudes. Underpinning the rapid changes within the workplace is the desire from employers for employees with a “growth mindset” - that is, employees that are highly adaptable lifelong learners capable of solving a wide variety of problems, and taking initiative. The specific technical skills required by companies are changing so fast that many employers are opting to focus less on the explicit technical skills of an employee (for example, which programming languages they know) and more on their ability to teach themselves new skills quickly.

Survey evidence from Stack Overflow, one of the world’s largest online communities for software developers, suggests self-driven learning is prevalent and expected among software developers.¹⁶ The growth mindset was described by an employer in previous research as: “We present the problem because of where the market is headed, and they’re teaching themselves new technologies [to solve it].”¹⁷ Many of the job roles within the technology sector require individuals to self-teach and evidence suggests that the expectation that employees will have a growth mindset and aptitude for self-teaching is a new baseline for hiring among tech companies.

Employment Opportunities for Workers in the Technology Sector

Workers enter and move within the tech sector in various ways. Our previous research indicates that referral networks and post-secondary work-integrated learning programs are primary talent pools from which employers source employees.¹⁸ This appears to be a common means through which employers source technology talent. A 2017 survey from Stack Overflow found that referral networks are among the most common way in which software developers land their jobs in the technology sector. Approximately 26.8% of developers obtain their jobs through referrals.¹⁹ Furthermore, survey evidence in the Greater Toronto Area suggests that there is a mismatch between how employers are sourcing potential employees and how job-seekers are looking for work in the technology sector. Employers rely on active recruitment methods such as referrals and in-person recruitment. However, the majority of job seekers tend to rely more on passive methods such as online job boards that employers tend not to look to.²⁰ This suggests that is the most effective way to enter the technology sector is through more active means of recruitment.

Within the technology sector, there is an identified need to strongly support lifelong learning opportunities and training. A McKinsey survey found that establishing a culture of lifelong learning was ranked by companies across most sectors as most needed for developing their workforces.²¹

In spite of this need, evidence suggests that there is a chronic underinvestment in workplace training. Between 1990 and 2010, the average amount an organization spent per employee fell by more than 40 percent in Canada. While the trend is reversing direction in the past five years, Canadian companies still lag behind their US peers.²² While evidence points to a lack of training, there appears to be limited research that explores what opportunities for career growth within a technology-based company can look like. This report begins to provide a picture of this internal employee movement in an effort to close such a knowledge gap.

Key Findings

The most important takeaways from this analysis are based on interviews with a cross-section of scale-up and enterprise companies that employ a large number of employees working on technology-based activities. In our interviews, we focused on verifying and further understanding the key themes of: employer skill needs and their application on the job and job routes into and within technology-based companies.

HIGH DEMAND SKILLS

Based on our interviews with employers, we have identified a number of high demand skills that managers from technology-based companies expressed difficulties in sourcing. We aggregated these skill needs into seven distinct career profiles with multiple focus areas within each field. We then applied the O*NET skill database to identify similar occupations to identify the different unique knowledge and skills required to perform the job. The table below provides an overview of the top ranking high demand career fields and the associated focus areas within them.

Career Field	Focus Areas	What Employers Are Saying
Software Development: Software developers write, develop, design and test new and/or existing software using computer science principles. The software can be databases, apps and/or websites.	<ul style="list-style-type: none"> + Back-end Development + Front-end Development + Networking Infrastructure + Dev Ops + Database architecture + Cybersecurity + Cloud computing 	<i>"The need for traditional systems administrator skills is rapidly declining. As the world shifts from physical hardware to the cloud, we need developers who know how to work with cloud-based systems."</i> - KIK
AI: This refers to a specialized subset of software engineering that relies on a variety of methods and techniques to learn and operate. AI mostly refers to Narrow AI that is able to facilitate individual, repetitive tasks by learning from patterns found in data.	<ul style="list-style-type: none"> + Natural Language Processing + Machine Learning + Model Interpretation 	<i>"As much of our data is human structured, interacting through voice is key -- as we started launching our products to be used by Alexa, Siri...we need to ask 'How can we understand context?'"</i> -MANULIFE
Data Science: Data science refers to obtaining insights through analyzing data using a combination of statistical techniques and computer programming.	<ul style="list-style-type: none"> + Data analytics + Business intelligence + Data engineering 	<i>"We're always looking for data to refine algorithms. As a traffic data company, we need data scientists. I'm very bullish about finding more. We need to be involved with directly extracting value from the data on behalf of our customers, as well as building tools for them to do so."</i> - MIOVISION
Sales + Marketing: Sales + Marketing refers to the process of understanding the needs of potential customers, increasing their interest in a service/products to them and then converting them to consumers.	<ul style="list-style-type: none"> + Technical Sales + Enterprise-level sales + Customer Success + Business Development + Account Management + Technical Support/Helpdesk 	<i>"In the early days, sales functions tend to be junior level employees pounding the pavement with cold calls. Eventually you get to bigger enterprise models or bigger contracts/relationships as the startup evolves from its early days and need to scale-up. At this time, you will need deep business experience, combining negotiation, partnership models and international experience."</i> -COMMUNITECH GROWTH COACH

Career Field	Focus Areas	What Employers Are Saying
<p>Product Management: This refers to supporting the strategic development of product by defining product requirements based on customer feedback, communicating those requirements throughout the rest of the organization and aligning the organization to deliver on the product.</p>	<ul style="list-style-type: none"> + Product Strategy + Agile Project Management + Experience Modelling + Technical Communication 	<p><i>"We tend to have trouble with product management - individuals who work with our customers and identify what is the next stage of our product roadmap and translate that into real actual items to create our engineering team...this has been the most challenging skillset to find globally. It's a unicorn role."</i> - HR LEAD AT SCALE-UP COMPANY</p>
<p>User Experience: This refers to analyzing behaviors of potential customers, building prototypes and testing product features to help make informed business decisions.</p>	<ul style="list-style-type: none"> + User Interface + Customer testing 	
<p>Technology Business Management: This refers to implementing business processes to lead teams and to scale a technology business.</p>	<ul style="list-style-type: none"> + Team Lead + Project Management + Strategic Growth + Organizational Planning + Finance 	<p><i>"There is a need for leadership skills broadly speaking - skills in leading and developing people, across all functions and levels in the business structure."</i> - COMMUNITETECH GROWTH COACHES</p>

TRENDS ACROSS CAREER FIELDS

Across all these career fields, we can identify some common trends. First, it was clear from employer interviews that assessing a potential employee's aptitude for a growth mindset continues to be a baseline for predicting success in the technology sector, regardless of career field.²³ Looking at software developers, again many employers indicated that while they have a preference for them to be familiar with certain programming languages, it was far more important for workers to demonstrate an aptitude for quick learning given how fast technology changes. This indicates that any training program should both assess for key aptitudes and train for hard and soft skills.

Furthermore, as we examined the top knowledge and skill requirements for these career fields (see Appendix A), we identified many common elements shared across fields. For example, critical thinking was a skill needed in almost all career fields. This suggests that certain skills have a high degree of transferability across career fields. Further research shows that many of these skills can be transferable not only within tech careers, but across sectors, supporting the potential for certain workers to more easily transition into roles within tech companies.

"We are really focusing on the 70% (experiential development opportunities) now...how we can leverage experiential opportunities for workers in support of their growth. We use these as an opportunity to supplement an individual's capability, and deepen experiences. We are focused on purposeful development through these engagements, and look for opportunities across the organization to provide [them]."

- TD

Job Routes and Opportunities

To grow the talent pool available for tech companies to draw from, we not only needed to understand the skills most in demand, but also the directions technology employees take to, (1) enter technology-based companies, (2) move within technology-based companies; and (3) tap into the professional development infrastructure that exists to support employees to grow within their company.

WAYS INTO TECHNOLOGY COMPANIES

1) Employee Referrals

The vast majority of employers we spoke with have an employee referral program in place. This is consistent with preliminary evidence from previous interviews with scale-ups and survey results which suggest that referrals are a common way that technology-based employers bring talent into their company.²⁴ Many companies have financial incentives to encourage existing employees to refer prospective employees into the company in the form of a referral bonus in the event the candidate is successful.²⁵

There are two implications of this. One is that it suggests that exposing job-seekers to networks within the technology sector is a key means by which they can transition into it. Workers without a peer network aligned with the tech sector will struggle to learn of job openings that may otherwise go unposted, or to succeed in their applications without an internal referral to vouch as support. Second, it has the unintended consequence of sourcing talent that can be extremely homogeneous, both from a racial and cultural standpoint, but also in mindset, perspective and lived experience. This kind of homogeneity can result in critical blind spots for a company that has the potential to lead to unforeseen challenges with their products or business model. As technology companies look to diversify their talent pool, it is key that they expand their hiring practices beyond referral networks.



“ *An employer referral program is a good way to find talent but can reinforce hiring trends of finding people that are too like-minded. This can harm goals of meeting diversity and inclusion goals. We are trying to rethink our program to better meet these goals.* ”

- VIDYARD

2) Recent Graduates

The vast majority of employers we spoke with rely heavily on recruiting from a pool of recent graduates, particularly from the University of Waterloo and Wilfrid Laurier University. Specifically, employers pointed to their heavy reliance on the co-op programs from these post-secondary institutions to form their pipeline of recent graduate hires. Employers indicated that it was extremely common for them to hire co-op students into full-time roles and many of the companies we spoke to took pride in their high co-op to employee conversion rates.

They typically rely on computer science and engineering graduates for technical roles and they tend to get streamed into a “software development” career field. For business-related roles, employers rely heavily on business graduates where they will be streamed into the “sales + marketing” career field. Companies find that recent graduates are well-suited for entry-level roles, which is partly why so few companies highlight a challenge finding junior developers. They are also generally well-suited to rely on during a company’s early growth stage, but not surprisingly, employers often state that as they begin to scale their co-op pipelines are insufficient to find the leadership and management experience they need.

“ *Almost 80% of students that come in [to our company] co-op become full time. The path to get in as a new graduate is for us to try before you buy.* ”

- HR LEAD AT SCALE-UP COMPANY

3) Career Transitions from Adjacent Industries

As companies scale, they experience an increased need for employees with more industry-specific experience as well as employees with more overall career experience. In order to gain such talent, employers often resort to either luring talent away from competitor companies or relying on people from adjacent industries relevant to their business that are looking to make a career transition.

“ *There are many people in smaller companies that have a misperception that people from larger enterprises cannot adjust to the culture of a smaller company. They think, “people who like structure won’t make the transition,” but in reality, more individuals attracted to a culture that supports transparency and trust are making the jump into smaller tech companies. They realize they no longer fit the big enterprise culture.* ”

- TEXTNOW

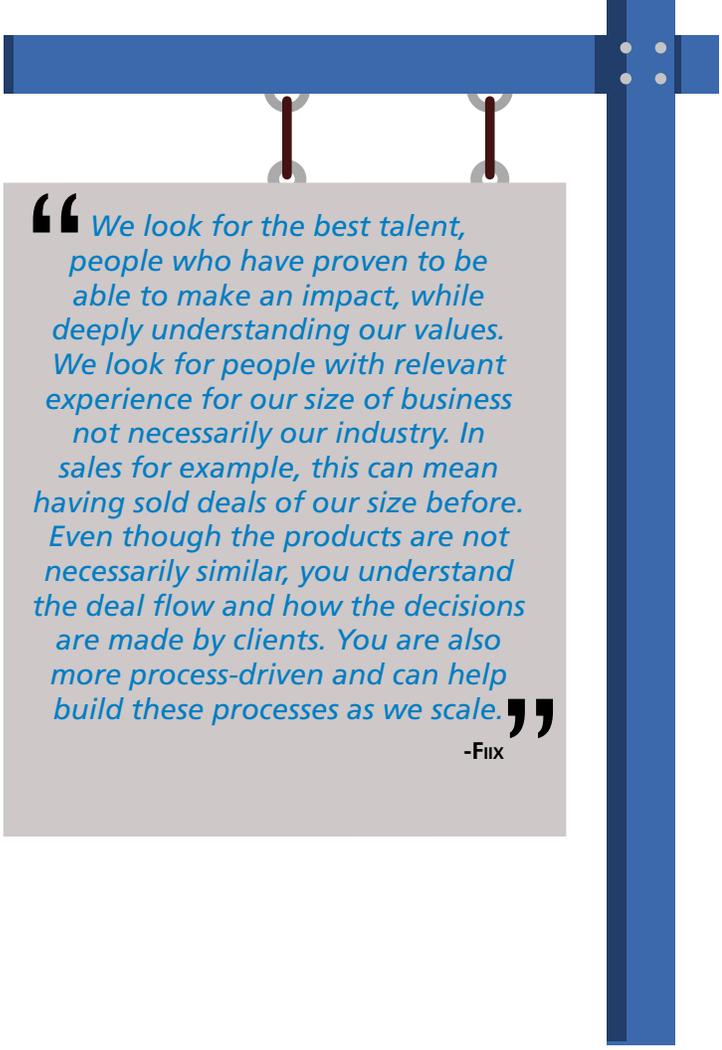
As business grows, the types of skills the company values also shift. When a company is early stage, it will often look for generalists. As a company begins to scale and its product and the business become established, they begin to seek out workers with more specialized skills or experience unique to the needs of the company. Adaptability and a growth mindset are still important, but it is increasingly clear that employers are beginning to place a higher value on specific technical skills integral to the specific product or service the company is delivering. With more specialized products, scale-ups will more heavily rely on mid-career workers transitioning from adjacent industries. In our interviews this included, for example, hardware companies referencing the need for workers who have experience in the manufacturing sector. Another example includes a scale-up assessing mid-career workers looking to transition based on whether they have worked at a previous company in a similar stage of growth, even though it may have been in an entirely different sector.

These findings make it clear that hiring mid-career workers who are embarking on a career transition is an under-utilized opportunity for employers. Generally, when these kinds of workers are considered for roles, it is to engage people with industry experience that can serve in more senior-level roles. This presents an opportunity for employers in the tech-sector to further explore how to leverage those making career transitions, and find new ways to tap into this unexploited talent pool.



““ *We are now regularly hiring for candidates who have over 3+ years of relevant and transferable work experience. It ultimately depends on the skillset but for certain roles, previous experience in a manufacturing environment is what we need.*””

-CLEARPATH



““ *We look for the best talent, people who have proven to be able to make an impact, while deeply understanding our values. We look for people with relevant experience for our size of business not necessarily our industry. In sales for example, this can mean having sold deals of our size before. Even though the products are not necessarily similar, you understand the deal flow and how the decisions are made by clients. You are also more process-driven and can help build these processes as we scale.*””

-FIX

WAYS TO MOVE INSIDE TECHNOLOGY COMPANIES

1) Vertical Growth

One of the central challenges with respect to talent management that a scale-up must overcome is the need to balance between having opportunities for employee growth within an organization while maintaining a relatively flat organization. As such, while some scale-ups have put thought into career development planning for employees, few have a clear processes in place for employees to grow vertically within an organization. The challenge this creates is that employees may not envision a long-term future within a company. Part of this challenge emanates from the nature of working at a small but fast growing company. Companies will only create new senior roles as they are needed by the organization and make sense for the business. However, the timelines for this role creation may not align with an employee's personal career goals for job growth. In these cases, there is very little a company can do to satisfy an employee's desire for an enhanced role or job title if the timing for the employee does not align with the timing for the business.

“

We're a relatively flat organization and [we] take an agile approach to career development which is centred around building your skills and capabilities through key experiences, new projects, tougher challenges and increased scope of responsibility and autonomy. The challenge is that some people are used to having very clear paths from one role to another...and so they may think if I don't get a new title, am I really growing in the organization?

”

- THALMIC LABS

When companies do have opportunities for vertical growth, they tend to have two things in place to support vertical trajectories. The first is that they have clear, identifiable metrics to measure job performance. The second is that many scale-ups are adopting individual contributor tracks as well as management tracks to have career growth opportunities for people that want to advance within an organization but may not necessarily want to be a manager. Nonetheless, scale-ups have less opportunities to support opportunities for vertical growth within an organization generally than a more established enterprise company.

"We have a management track vs. individual contributor track to support development of people who are valuable to [the] company but are not interested in management."

- TULIP RETAIL

2) Horizontal Growth

In spite of limited opportunities for vertical growth, many employers have options for horizontal movement between different roles. The two most commonly cited reasons for this include 1) talent retention and 2) organizational learning so that employees will have a more holistic view of the company through working at different business functions. As such, horizontal movement serves as a means to get employees learning on the job. Many employers referred to the fact that the best way for an employee to increase their value to the company is by expanding their skills and abilities, and gaining a more dynamic understanding of the different roles and responsibilities within the company.

Employees will often move into skill-adjacent positions. What this means in practice is that employees occupying business-oriented roles will transition into other business-oriented roles. Employees that occupy a technical role will transition into other technical roles in different projects across the company. For example, a technical salesperson will transition into a business development role and vice-versa.

Some roles, such as product management or overall business management roles will require employees to grasp both the business-oriented and technically-oriented sides of the company. Horizontal rotations can serve as a means to train people into these kinds of roles. Contrary to popular belief, some of the most sought after skills were not exclusively technical in nature, but were found in workers who could straddle the divide within their company between technically-oriented roles and business-oriented roles, and serve as a translator between the two.

In spite of horizontal movement opportunities for employees to take advantage of, employers cite some friction contributing to lower than expected uptake rates. They cite three reasons for this: (1) a lack of awareness about opportunities to move horizontally to a different job, (2) a lack of understanding of transferable skill-sets and (3) a misperception that moving onto a different job role will be frowned upon.

“ *[Product management] is often an afterthought in planning the overall structure and key roles in the company. Creating a product management function might mean taking a great marketing manager, teaching them enough of the technical and product side of business, and then have them coordinate an internal, cross-functional team to develop product roadmaps, launch plans, etc.* ”

- COMMUNIT**E**TECH GROWTH COACHES

PROFESSIONAL DEVELOPMENT INFRASTRUCTURE

1) Onboarding

Almost all scale-ups have some form of an onboarding program for new hires. This serves as training where employees obtain firm-specific technical skills. These refer to skills that are narrowly scoped and tend to be specific to a firm such as learning about a company's products. In some instances, there is dedicated staff to design onboarding programs. However, onboarding programs can differ dramatically from company to company, ranging in length and formality, with some lasting no more than a day and others involving formal training over several weeks.

2) Professional Development

Many scale-ups do not have formal in-house professional development programs. Where they do have internal development programs, these often take the form of peer-to-peer learning, such as organized lunch and learns or TED-style talks. Some companies referenced setting aside time for employees to work on specific projects outside of their usual workload, or organizing staff hackathons, where employees can create cross-functional teams to develop new product solutions. These kinds of development activities both provide workers the opportunity to get outside of their comfort zone and learn from peers, as well as provide the company with new ideas or product solutions they may otherwise not have considered.

Companies will often rely on external professional development programs to fill in the gaps of their in-house programs. This could range from taking an online course to a short or longer term in-person program. Most companies also cover the costs for their employees to attend conferences or gain job related skill certifications. Often employees must make a case on the value of the training opportunity; and managers administer a professional development budget for employees to learn a skill through formal training programs.

“ *We need a more entrepreneurial workforce that can search out things and also stop the things that are not working. No one knows the future of media. It is a lot better to explore possibilities and test the ideas. So we have Kickbox. This is a two-stage in-house innovation program to upskill our staff and develop an innovation mindset.* ”

- GLOBE AND MAIL

3) Mentorship Programs

Almost all scale-ups have a mentorship component that functions like a buddy program. These programs pair new hires with senior-level employees to help get new hires up to speed. This is particularly important for technical teams where senior software developers will get new software developers up to speed on a team's legacy code base. A buddy program is a low-resource way to provide mentorship within an organization. However, it is not a substitute for coaching and mentorship that can be provided by senior leadership. A small number of scale-ups are able to offer a more formal mentorship program, though some cited challenges in matching mentors, ensuring ongoing engagement and ramping up programming.

“ *We think about development much more broadly than formal training courses and most of our learning happens on the job. If there is a business case for external training that is relevant we find a way to accommodate it, but internally there are countless opportunities to work on new things with experts who are the best in their field.* ”

- THALMIC LABS

“ *Every new hire is set up with a 'buddy' to help them get situated,, [and to give them a] company and product overview.* ”

- D2L

An Opportunity to Leverage Job Similarities

Through all of our conversations with employers, one message was very clear - there is a need to continuously grow the talent pool of available skilled workers for the tech sector. One opportunity to do this is by identifying and exploring transferable skills for job adjacencies - that is, figuring out what kind of workers in other industries have jobs that are closest in skill profile to the skill needs of the tech sector. Better understanding this will help to target job seekers making career transitions as well as better equip employees to make horizontal moves within an organization. One method to achieve this relies on using the O*NET skill database. Given an identified job role, it also publishes a list of similar occupations, based on similarity between two occupations on the grounds of skills, knowledge, work activities, education and training, as well as a host of other dimensions. We hypothesize that these similar jobs are jobs that one can easily transition into with minimal retraining given that the existing skill set is there.

For the purpose of this report, we decided to test this approach within the Waterloo Region labour market, picking one area of work that tech companies cite as being high demand and studying it in depth for its skill alignment with the Waterloo Region workforce more broadly. For this example, we identified technical salesperson as a role needed by almost every employer we spoke to. We matched the description to the corresponding National Occupational Classification for this occupation, which is Technical Salesperson - Wholesale. The adjacent job roles are the jobs in Waterloo Region that most closely align with Technical Salesperson. Using O*NET, we were able to generate this job similarity table. The skill overlap column names all of the skills identified through O*NET that the adjacent role shares with the skills required for Technical Salesperson. The employment in Waterloo Region column provides the number of workers in the region currently employed in these roles based on the 2016 census.



NON-TECH SECTORS FILLED WITH TECH TALENT IN WATERLOO REGION

Adjacent Job Roles	Knowledge and Skill Overlap Based On O*NET	Employment in Waterloo Region
Advertising, marketing and public relations manager	Economics and Accounting, Computers and Electronics, Law and Government, Telecommunications, Evaluating Information to Determine Compliance with Standards, Selling or Influencing Others, Active Listening, Persuasion	1,100
Corporate sales manager	Production and Processing, Psychology, Geography, Monitor Processes, Materials, or Surroundings, Evaluating Information to Determine Compliance with Standards, Active Listening, Speaking	1,400
Business development officers and marketing researchers and consultants	Economics and Accounting, Psychology, Assisting and Caring for Others, Resolving Conflicts and Negotiating with Others, Active Listening, Critical Thinking, Active Learning, Coordination, Instructing, Management of Financial Resources, Management of Material Resources	1,100
Authors and Writers	Clerical, Computers and Electronics, Psychology, Monitor Processes, Materials, or Surroundings, Judging the Qualities of Things, Services, or People, Processing Information, Communicating with Supervisors, Peers, or Subordinates, Developing and Building Teams, Coaching and Developing Others, Performing Administrative Activities, Critical Thinking, Active Learning, Learning Strategies, Monitoring, Complex Problem Solving, Operations Analysis, Judgment and Decision Making, Time Management	500
Insurance Agents and Brokers	Administration and Management, Sales and Marketing, Computers and Electronics, Communications and Media, Inspecting Equipment, Structures, or Material, Thinking Creatively, Coordinating the Work and Activities of Others, Training and Teaching Others, Coaching and Developing Others, Reading Comprehension, Active Listening, Critical Thinking, Active Learning, Learning Strategies, Monitoring, Instructing, Service Orientation, Complex Problem Solving, Operations Analysis, Judgment and Decision Making, Systems Analysis, Systems Evaluation, Management of Personnel Resources	1,500
Financial Sales Representative	Customer and Personal Service, Personnel and Human Resources, Education and Training, English Language, Organizing, Planning, and Prioritizing Work, Coordinating the Work and Activities of Others, Training and Teaching Others, Active Listening, Writing, Speaking, Active Learning, Monitoring, Social Perceptiveness, Instructing, Complex Problem Solving, Operations Analysis, Systems Analysis, Time Management, Management of Financial Resources, Management of Personnel Resources	800

Conclusion

The Canadian technology sector continues to grow and is likely to continue doing so. Communities like Waterloo Region represent the engine of much of the innovation that is fueling that growth in Ontario, and in Canada more broadly. In order to ensure the tech sector succeeds in delivering on the promise of job creation and economic prosperity, it is essential to ensure that barriers to growth are removed. As acknowledged earlier in the paper, 82% of tech companies identified the challenge of recruiting and retaining talent as a major barrier to growth.

Understanding the specific skills needed by the tech community is only the first step to ensuring that there is a robust and active talent pool available for companies to draw from. It is also essential to understand how companies source talent, the pipelines into the sector that exist and the opportunities within companies to move and grow once a worker is inside. Any product, service or program that seeks to support both workers and companies will need to factor all of these components into their work in order to convert potential into impact.

This paper has also demonstrated that there are novel ways to grow the available talent pool for tech companies beyond the traditional approach of increasing STEM graduates. Mid-career workers from adjacent industries with high skill overlaps are well suited to transition into the tech sector with targeted training requirements necessary to succeed. Programs targeting these workers may not require as much focus on digital or human skill development, but may require an effort to develop and expand a workers' growth mindset in order to be well suited to make the career transition successfully.

The technology sector poses tremendous promise for continued economic growth and labour market engagement. The better we can understand how to support its continued growth through talent, while creating new opportunities for workers, the greater the benefit to the Canadian economy.

Appendices

APPENDIX A: TAXONOMY OF HIGH DEMAND SKILLS

Software Development

Career Field	
Software Development + Software developers write, develop, design and test new and/or existing software using computer science principles. The software can be databases, apps and/or website.	
Focus Areas	
Focus Area Name	Description
Full Stack Development	Developing both the front-end and back-ends of software applications.
Back-end Development	Developing the back-end infrastructure for software applications. This includes APIs, database servers and data validation
Front-end development	Developing the front-end user interfaces for software applications.
DevOps	Designing and testing automation processes between software development and IT teams for the purposes of building, testing and releasing software more rapidly.
Database Administration and Architecture	Designing and maintaining database systems, including setting and the implementation of standards for operations, programming, and security.
Cybersecurity	Designing and implementing security measures to protect computer networks and information.
Computer Network Architecture	Designing and implementing computing and information network systems.
Knowledge and Skill Areas	
<ul style="list-style-type: none"> + Computers and Electronics - Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming. + Engineering and Technology - Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services. + Mathematics - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications. + Programming — Writing computer programs for various purposes. + Systems Analysis — Determining how a system should work and how changes in conditions, operations, and the environment will affect outcomes. + Complex Problem Solving — Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions. + Reading Comprehension — Understanding written sentences and paragraphs in work related documents. + Critical Thinking — Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems. 	

Data Science

Career Field

Data Science

+ Data science refers to obtaining insights through analyzing data using a combination of statistical techniques and computer programming.

Focus Areas

Focus Area Name	Description
Data Analytics	Formulating research questions and analyzing data to answer them.
Business Intelligence	Developing and analyzing data to support making business-oriented decisions.
Data Engineering	Developing the back-end infrastructure to support the analysis of data; a specialized subset of back-end development.

Knowledge and Skill Areas

- + **Computers and Electronics** - Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
- + **Sales and Marketing** - Knowledge of principles and methods for showing, promoting, and selling products or services. This includes marketing strategy and tactics, product demonstration, sales techniques, and sales control systems.
- + **Mathematics** - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- + **Reading Comprehension** - Understanding written sentences and paragraphs in work-related documents.
- + **Active Learning** - Understanding the implications of new information for both current and future problem-solving and decision-making.
- + **Judgment and Decision Making** - Considering the relative costs and benefits of potential actions to choose the most appropriate one.
- + **Mathematics** - Using mathematics to solve problems.
- + **Critical Thinking** - Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.

Artificial Intelligence

Career Field

Artificial Intelligence

+ This refers to a specialized subset of software engineering that relies variety of methods and techniques to learn and operate. AI mostly refers to Narrow AI that is able to facilitate individual, repetitive tasks by learning from patterns found in data.

Focus Areas

Focus Area Name	Description
Machine Learning	Designing algorithms that enable computer systems to learn and make predictions based on historical data using methods of data analysis and analytical modelling.
Natural Language Processing	Refers to functionality that enables machines to process, understand, and / or generate audio and textual speech.
Model Interpretation	Interpreting the artificial intelligence model and its results. This is accompanied by communicating this to a broader audience.

Knowledge and Skill Areas

- + **Computers and Electronics** - Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
- + **Engineering and Technology** - Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.
- + **Mathematics** - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- + **Reading Comprehension** - Understanding written sentences and paragraphs in work-related documents.
- + **Active Learning** - Understanding the implications of new information for both current and future problem-solving and decision-making.
- + **Complex Problem Solving** - Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.
- + **Mathematics** - Using mathematics to solve problems.
- + **Critical Thinking** - Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.

Sales + Marketing

Career Field	
<p>Sales + Marketing + Sales + Marketing refers to the process of understanding the needs of potential customers, increasing their interest in a service/products to them and then converting their interest into a sale.</p>	
Focus Areas	
Focus Area Name	Description
Technical Sales	Selling highly technical products typically to business customers.
Enterprise-level Sales	Selling highly technical products that involve multiple stakeholders with a lengthy sales cycle.
Customer Success	Developing long-term relationships with customers and clients to advocate for their needs.
Business Development	Developing leads with potential customer and clients.
Account Management	Managing customer and client accounts to maintain sales renewals and leads.
Technical Support/Helpdesk	Assisting customers and clients to use technical products effectively.
Knowledge and Skill Areas	
<ul style="list-style-type: none"> + Customer and Personal Service - Knowledge of principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction. + Sales and Marketing - Knowledge of principles and methods for showing, promoting, and selling products or services. This includes marketing strategy and tactics, product demonstration, sales techniques, and sales control systems. + Computers and Electronics - Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming. + Persuasion - Persuading others to change their minds or behavior. + Speaking - Talking to others to convey information effectively. + Active Listening - Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times. + Reading Comprehension - Understanding written sentences and paragraphs in work related documents. + Social Perceptiveness - Being aware of others' reactions and understanding why they react as they do. 	

Product Management

Career Field	
<p>Product Management</p> <p>+ This refers to supporting the strategic development of product by defining product requirements based on customer feedback, communicating those requirements throughout the rest of the organization and aligning the organization to deliver on the product.</p>	
Focus Areas	
Focus Area Name	Description
Product Strategy	Developing the roadmap of a product that includes outlining product features and its target market to help meet company goals.
Agile Project Management	Managing projects using more flexible project management methods that is becoming industry standard for making technology-based products.
Product Marketing	Bringing the product to market, that includes launching the product, communicating product features to the company and potential customers and driving demand for the product.
Technical Communication	Conveying scientific, engineering or other technical information in an easily understandable manner.
Knowledge and Skill Areas	
<p>+ Computers and Electronics - Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.</p> <p>+ Engineering and Technology - Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.</p> <p>+ Sales and Marketing - Knowledge of principles and methods for showing, promoting, and selling products or services. This includes marketing strategy and tactics, product demonstration, sales techniques, and sales control systems.</p> <p>+ Critical Thinking - Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.</p> <p>+ Speaking - Talking to others to convey information effectively.</p> <p>+ Active Listening - Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.</p> <p>+ Reading Comprehension - Understanding written sentences and paragraphs in work related documents.</p> <p>+ Judgment and Decision Making - Considering the relative costs and benefits of potential actions to choose the most appropriate one.</p>	

User Experience

Career Field	
<p>User Experience + This refers to analyzing behaviors of potential customers, building prototypes and testing product features to help make informed business decisions.</p>	
Focus Areas	
Focus Area Name	Description
User Interface	Designing the visual and graphical elements of a user's interface with a technology product.
Customer Testing	Testing and capturing customer insights as they interact with a product to better refine products to meet customer needs.
Knowledge and Skill Areas	
<ul style="list-style-type: none"> + Psychology - Knowledge of human behavior and performance; individual differences in ability, personality, and interests; learning and motivation; psychological research methods; and the assessment and treatment of behavioral and affective disorders. + Design - Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models. + Communications and Media - Knowledge of media production, communication, and dissemination techniques and methods. This includes alternative ways to inform and entertain via written, oral, and visual media. + Active Listening - Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times. + Speaking - Talking to others to convey information effectively. + Critical Thinking - Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems. + Reading Comprehension - Understanding written sentences and paragraphs in work-related documents. + Social Perceptiveness - Being aware of others' reactions and understanding why they react as they do. 	

Technology Business Management

Career Field	
Technology Business Management + This refers to implementing business processes to lead teams and to scale a technology business.	
Focus Areas	
Focus Area Name	Description
Team Lead	Leading and assembling project-based teams that will also serve as an intermediary to upper-level management.
Project Management	Managing the planning and delivery of project goals within a given set of constraints.
Strategic Growth	Implementing business processes to support scaling the organization in an efficient manner.
Organizational Planning	Identifying around an organization's long-term objectives and allocating resources to meet those goals.
Finance	Implementing back-office financial controls.
Knowledge and Skill Areas	
<ul style="list-style-type: none"> + Administration and Management - Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources. + Education and Training - Knowledge of principles and methods for curriculum and training design, teaching and instruction for individuals and groups, and the measurement of training effects. + Personnel and Human Resources - Knowledge of principles and procedures for personnel recruitment, selection, training, compensation and benefits, labor relations and negotiation, and personnel information systems. + Judgment and Decision Making - Considering the relative costs and benefits of potential actions to choose the most appropriate one. + Speaking - Talking to others to convey information effectively. + Management of Personnel Resources - Motivating, developing, and directing people as they work, identifying the best people for the job. + Reading Comprehension - Understanding written sentences and paragraphs in work-related documents. + Social Perceptiveness - Being aware of others' reactions and understanding why they react as they do. 	

APPENDIX B: INTERVIEW QUESTIONS

- 1) What are the top three skill sets you are hiring for to move your business forward?
 - a. What is the typical background or experience history of someone who possesses these skills?
- 2) As you look at the next 18-24 months:
 - a. What new skill sets do you see being needed?
 - b. What skill sets that employees now have might be redundant in the near future?
- 3) In thinking about the way individuals join your organization (examples: candidates coming out of school, vs. candidates transitioning into tech):
 - a. Are there any specific barriers you see for candidates coming out of school?
 - b. Are there any specific barriers you see for candidates who are making a career transition into tech?
- 4) What do you consider for an employee to advance / move around the company? If we asked your employees:
 - a. What would be the opportunities they would say are available to them to advance / move around within the organization?
 - b. What would they say are some of the challenges (to advance / move...)?
- 5) What development opportunities are available to your employees?
- 6) What are the things in your organization that are dragging the speed in which talent can grow?
 - a. What could accelerate or expedite growth?
- 7) How many employees do you have today? How many do you plan to have by the end of 2018?

APPENDIX C: INTERVIEWEES

Company List
Aeryon
Auvik
Bonfire
Clearpath Robotics
Communit tech Growth Coaches*
D2L
Deloitte
Fiix
Kik
Globe & Mail
Magnet Forensics
Manulife
Miovision
Sortable
TD
TextNow
Thomson Reuters
Thal mic Labs
Tulip Retail
Vidyard

*Communittech Growth coaches based their responses on insights gained while working with 15 fast scaling companies participating in the REV Accelerator program over the past 12 months.

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- ¹¹ ICTC (2017), The Next Talent Wave: Navigating the Digital Shift - Outlook 2021, p. 13
- ¹² Business Council of Canada (2018), "Navigating change: 2018 Business Council Skills Survey," p .
- ¹³ Mark Muro et al. (2017), "Digitization and the American Workforce," p. 15
- ¹⁴ David Deming (2017), "The Growing Importance of Social Skills in the Labour Market"
- ¹⁵ Business Council of Canada (2018), "Navigating Change: 2018 Business Council Skills Survey," p. 10
- ¹⁶ C. Lamb and D. Rubinger , (2017), Stacking Up: A Snapshot of Canada's Developer Talent, p. 45
- ¹⁷ A. Do and AJ Tibando (2018), "Understanding the Talent Gap: Lessons + Opportunities for Canada" p. 7
- ¹⁸ Ibid, p. 8-9
- ¹⁹ Stack Overflow (2017), Developer Survey Results: 2017.
- ²⁰ MaRS (2018), "Talent Fuels Tech: Connecting the GTA's tech sector with top talent," p. 5
- ²¹ McKinsey Global Institute (2018), "Skill Shift: Automation and the Future of the Workforce," p. 41
- ²² Advisory Council on Economic Growth (2017), "Learning Nation: Equipping Canada's Workforce with Skills for the Future," p 14.
- ²³ Career field refers to a category of distinct job roles. For our purposes, we are referring to category of job roles that are found within technology companies.
- ²⁴ A. Do and AJ Tibando (2018), "Understanding the Talent Gap: Lessons + Opportunities for Canada," p. 8.
- ²⁵ Stack Overflow (2017), " Developer Survey Results: 2017."

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