

PROFESSIONAL, SCIENTIFIC & TECHNICAL SERVICES INDUSTRY

FOCUSING ON COMPUTER SYSTEMS DESIGN & RELATED SERVICES



Professional, Scientific & Technical Services (PST) Industry:

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Table of Contents

Acknowledgements.....	2
Executive Summary.....	3
Data Sources.....	4
Limitations.....	5
Methodology.....	5
Industry Overview.....	7
Economic Overview.....	10
Labour Force, Employment and Unemployment.....	13
Ontario.....	13
Toronto CMA.....	15
Job Openings & Retirements.....	19
Industry.....	20
Business Distribution in Peel & Halton.....	20
Occupations.....	24
Occupational Projection.....	26
Wage.....	27
CSD Industry in Peel & Halton.....	30
Overview and Profile of Survey Respondents.....	30
Survey Findings.....	33
Interview Findings.....	48
Reccomendations.....	49
Promote Entrepreneurship.....	49
Fill Skill Gap.....	50
Increase Training Hours.....	51
Facilitate Hiring Global Talent.....	52
Develop Succession Plan.....	52
Conclusion.....	53

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Executive Summary

This research project is a part of the *Local Employment Planning Council (LEPC)* initiative which is funded by the Ontario Ministry of Advanced Education and Skills Development. The *Peel Halton Workforce Development Group (PHWDG)* was awarded the LEPC project to improve local labour market conditions in the Peel and Halton regions. The purpose of the LEPC initiative is to address local labour market needs through research, education and an integrated network of the following four stakeholder groups:

- The Peel and Halton communities
- Employers
- Employment and training service providers
- Government

As a result, several research studies have been conducted to identify the labour market gaps and challenges in local industries. This report is focused on the professional, scientific and technical services industry, which is one of the dominant industry sectors in Peel and Halton. The purpose of the research is to investigate the local labour market trends, issues, and challenges and to provide possible solutions to improve labour market conditions. Although this research will be shared with the general public in Peel and Halton communities, the intended audiences are employers, employment services providers, educators and governments.

The Professional, Scientific and Technical services (PST) industry is a human capital intensive industry that relies on high skilled expertise in the areas of architecture, engineering, computer systems design (CSD), scientific research and development, etc. This industry plays an important role in the national and provincial economy. There are totally nine subsectors in this industry. Computer systems design and related services, which provides expertise and services in the field of information technology is one of the most significant subsectors in PST in terms of share of GDP, business establishments and total labour force population in Peel and Halton regions. This research will highlight the PST and CSD industry challenges, labour shortages and areas of growth at the provincial, Toronto CMA and the Peel and Halton regional levels.

The key findings of the survey study from Peel and Halton CSD employers are:

- The survey responses revealed that in 13% of the local companies, more than 75% of the staff are temporary which is mainly for the reason that most of their projects are short term, and they need to find the right employee with a particular skill set based on the needs of each project.
- Only 62.2% of small companies (1-20 employees) provide workplace relevant experience (e.g. co-op and internship) due to limited financial and human capital resources. For the employers who offer workplace experience, the primary purpose is finding potential candidates for future hiring.

- 58% of local businesses provide no or less than 30 hours of training per year, which is mainly due to limited financial resources and shortage of time.
- As stated by local employers, in order to support the Canadian CSD industry to absorb and retain talents, it is important to get support from government in the form of financial, advisory and tax incentive programs.
- The most in-demand skills among local employers are technical skills followed by soft skills. However, when it comes to the hiring challenges, soft skills are most lacking among employees. It suggests that efforts need to be taken by employers and educational institutions such as offering relevant courses to better prepare employees for the job requirements.
- The survey results and the interviews with local CSD employers indicated that there is an increasing demand for programming, IT security, database and project management related occupations.

The report has two sections; the first section presents an overview of the Professional, Scientific and Technical services (PST) industry and its subsector, Computer Systems Design and related services (CSD). This section includes analysis of economic performance of the industry, employment and unemployment trends, distribution of firms in the local municipalities, occupational growth and wage rate. The majority of the data presented in this section are at the Toronto CMA or provincial level. The data analysis provides valuable insight into the industry trends, gaps and challenges; however, it does not provide very detailed information about the CSD industry challenges in the Peel and Halton regions.

The second section of the report consist of primary information from local employers, recruitment agencies, employment service providers and job seekers about the industry challenges, shortages and gaps. To acquire local information, a survey was designed for local employers and a series of interviews was conducted with job seekers, employment service providers and recruiters.

Data Sources

For the purpose of this report, primary and secondary sources of data have been utilized to demonstrate the local CSD industry and highlight its challenges and needs. The publically available data sources such as Statistics Canada, Bank of Canada and Government of Canada have been used for the secondary data analysis in the first section of the report. The majority of data were obtained through Labour Force Survey (LFS), Canadian Occupational projection system (COPS) and Canadian Business Counts. Moreover, a number of industry research articles have been reviewed to investigate industry trends and challenges inside Canada and globally.

In addition to secondary data sources, a primary data collection was accomplished through an online survey and interviews with key stakeholders. This source of data, provides invaluable

insight into the CSD industry needs, hiring and retention challenges and skill shortages in local municipalities.

Limitations

The majority of secondary data sources such as Labour Force Survey (LFS), Canadian Occupational projection system (COPS), provide data at the provincial or Toronto CMA level. Although these data provide important information about the overall industry, it cannot picture the industry needs and issues at the regional and municipal levels. Since each region has unique needs based on its demographics, major industries, education level of the residents, geographical situation, etc., lack of granular data causes inaccurate interpretation of local challenges and needs. To address part of this limitation, primary data sources obtained through survey and interviews have been used to validate results of secondary data analysis in local municipalities. It is important to notice that there are also some limitations in primary data collection such as sample selection and survey errors. In the sample selection procedure for interviews, factors such as business size or geography were considered, however the type of business services in CSD (e.g. software development, IT consulting, etc.) was not accounted for. It suggests that it might be an under/over representation of firms with similar business activities and similar challenges. Another example of sample selection bias is related to survey dissemination methodology. The survey was disseminated through Constant Contact and Peel Halton Workforce Development Group's community partners. Since the majority of our partners are local educational institutions, this method might cause improper randomization, which might skew the results of some of the questions (e.g. question about providing workplace experience).

In addition to the sampling errors, there are non-sampling errors such as non-response errors. For most of the questions, the response rate was high and the non-response rate did not affect survey results significantly. The drop rate was higher toward the end of the survey; however, the average response per question remained 78 out of 93 total responses.

Methodology

To address local CSD labour market challenges, qualitative and quantitative research methodologies have been utilized in data collection and data analysis steps. The qualitative research (e.g. interviews with employers and employment service providers) was conducted to gather primary data from local employers. The quantitative research (e.g. statistical data analysis and survey data analysis) was performed to analyze industry trends and labour market challenges. To complement the research, a working group, comprised of local CSD professionals was formed. Various criteria were considered in sourcing the working group members to

represent the diversity of the Peel and Halton regions such as business size, business category (e.g. software design, IT consulting, etc.) and locations². The scope of the project was defined and survey questions were designed based on discussion with working group members.

Additionally, in order to investigate national and provincial industry trends, secondary data was collected through review of industry literature produced by well-known research organizations such as the Conference Board of Canada and ICTC.

² See acknowledgements page for working group detail

Industry Overview

The Professional, Scientific and Technical services (PST) industry is one of the most significant industries in Peel and Halton. Sixteen per cent of the businesses located in Peel and Halton region are PST companies. More importantly, it is one of the main contributors to the local economy. PST is the fourth industry sector after Manufacturing, Retail Trade, and Transportation & Warehousing in terms of size of labour force. Given its important role in the local economy, it was chosen by the Central Planning Table for further study. The objective of this research is to explore the labour market gaps, trends and issues in the PST industry and its subsector Computer Systems Design and related services (CSD) in the Peel and Halton regions. Consequently, the report will provide recommendations to improve labour market outcomes in the local CSD industry and suggest ways to support innovation and entrepreneurship.

PST is a human capital intensive industry and almost all of the production processes are dependent on labour skills. The establishments in this industry sell expertise, so employment is heavily weighted towards high skilled professionals, scientists, engineers, and experts of all types³. There are nine subsectors in this industry (see Table 1), among which, Computer Systems Design and related services (CSD) is identified as the most significant subsector. It is the largest subsector by share of GDP and business establishments. In 2015, nearly 30% of total PST GDP was sourced from CSD. In 2016, 30% of PST establishments in Peel and Halton regions were CSD companies. Considering the importance of CSD, this research is focused on this subsector among all other subsectors in PST.

Table 1. PST Subsectors

Legal services
Accounting, tax preparation, bookkeeping and payroll services
Architectural, engineering and related services
Specialized design services
Computer systems design and related services
Management, scientific and technical consulting services
Scientific research and development services
Advertising, public relations, and related services
Other professional, scientific and technical services

Source: Statistics Canada, North American Industry Classification System (NAICS) Canada 2017

³ Statistics Canada, NAICS 2017

According to Statistics Canada, CSD is composed of establishments engaged in providing expertise and services in the information technology field such as writing, modifying, testing and supporting software, and computer system planning and designing that integrates hardware, software, and communication technologies; on-site management and operation of clients' computer and data processing facilities; and providing advice in the field of information technologies.⁴ Some examples of activities in this subsector are summarized in Table 2.

Table 2. Examples of Activities in CSD Subsector

CAD/CAM systems services
computer consulting services
computer disaster recovery services
computer programs or systems software development, custom
Internet page design services, custom
office automation system design services
custom designing video games

Source: Statistics Canada, North American Industry Classification System (NAICS) Canada 2017

According to conference Board of Canada, the CSD is one of the fastest growing industries in most of the global economies. In Canada, the industry growth has accelerated since 2013, led by technology advancement and value-added activities and it will continue to be backed by strong investment going forward⁵. The CSD industry of Ontario accounts for 47% of the workforce in CSD across Canada⁶. The industry posted a 5.8% growth in output in 2015 and 4.8% in 2016, and it is expected to grow at a similar pace (4.8%) in 2017.⁷ Over the next five years up to 2022, the CSD industry is projected to have approximately 67900 new job openings and a majority (54.5%) of those job openings are a result of industry growth and demand expansion rather than replacement demand.

In recent years, the Canadian Economy has been hit by high uncertainties as a result of low oil prices. Business confidence has been decreasing, leading companies to be cautious when it comes to their investment decisions. Some IT investment that is necessary for daily operation and the success of business is not affected, while some products and services such as the latest

⁴ Statistics Canada, NAICS 2017

⁵ The Conference Board of Canada (2016), Canadian Industry Outlook: Canada's Computer Systems Design Industry

⁶ Immigration, Refugees and Citizenship Canada (2016), Ontario Region: Industry Sectors and Employer Profiles

⁷ Government of Canada, Canadian Occupational Projection System (COPS)

model devices and computers that may enhance productivity but are not vital investments are affected. The demands on those products and services are unlikely to grow until business confidence pick up⁸. The lacklustre macroeconomic environment ⁹ also makes it difficult for IT services to attract new customers, and the companies will be at risk if the existing customers suffer. However, the industry is always changing, innovation opportunities keep the demand for computer products and their design and support services strong¹⁰. This has been seen in the recession in 2009, when Canada GDP fell 2.7%, while CSD investment and output continued to grow due to the high level of new opportunities such as FinTech, Artificial Intelligence and the Internet of Things (IOT). With the depreciation of the Canadian dollar and a resurgent US economy, the demand in the U.S. market for Canadian computer system design is expanding. It is forecasted for 2017 to 2020, that industry exports will grow at an average pace of 3.2%¹¹.

In terms of the labour market, CSD companies are struggling in finding employees with specific skill sets they need, such as a particular software-using skill, knowledge in the field of business, or intensive experience in some emerging IT field such as cloud computing, big data analytics, and data security. The people with hybrid skills such as combinations of solid technical skills and soft skills are also in high demand. The shortage of talent in the CSD industry has two main reasons. (1) New graduates have knowledge but lack experience. The knowledge they obtained from university provides good understanding and technical foundation but not sufficient to fill job requirements. (2) Due to the ever changing and fast growing nature of this industry, the current workforce members need to constantly enhance their knowledge and skills to be able to serve in new and emerging roles. These issues are compounded by demographic shifts, an aging workforce and not enough youth in the supply pipeline¹²

The talent scarcity increases the labour market competition among firms, which results in upward pressure on costs in searching for workers, and industry wage rate increases. Therefore, it is important for local education systems to shift more effort and invest more on computer science and provide more targeted skill training to ensure more young talents fill in the supply pipeline.

⁸ The Conference Board of Canada (2016), Canadian Industry Outlook: Canada's Computer Systems Design Industry

⁹ Lacklustre economy is a period of time when there is a downturn in buying and selling activities and prices do not change much.

¹⁰ The Conference Board of Canada (2016), Canadian Industry Outlook: Canada's Computer Systems Design Industry

¹¹ The Conference Board of Canada (2016), Canadian Industry Outlook: Canada's Computer Systems Design Industry

¹² ICTC (2016), Digital Economy Talent Supply: Immigration Stream

Economic Overview

Gross domestic product (GDP) is one of the most important indicators of economic health and growth in any given geographical area. In brief, GDP is the monetary value of all economic outputs (final goods and services) produced within a region, province or country in a given year. This section will shed light on the historical PST and CSD GDP level, the provincial contribution to total national PST and CSD GDP and the CSD contribution to total PST GDP, to illustrate the importance and the impact of this industry on the overall provincial economy as well as to see the performance and future trends in this industry.

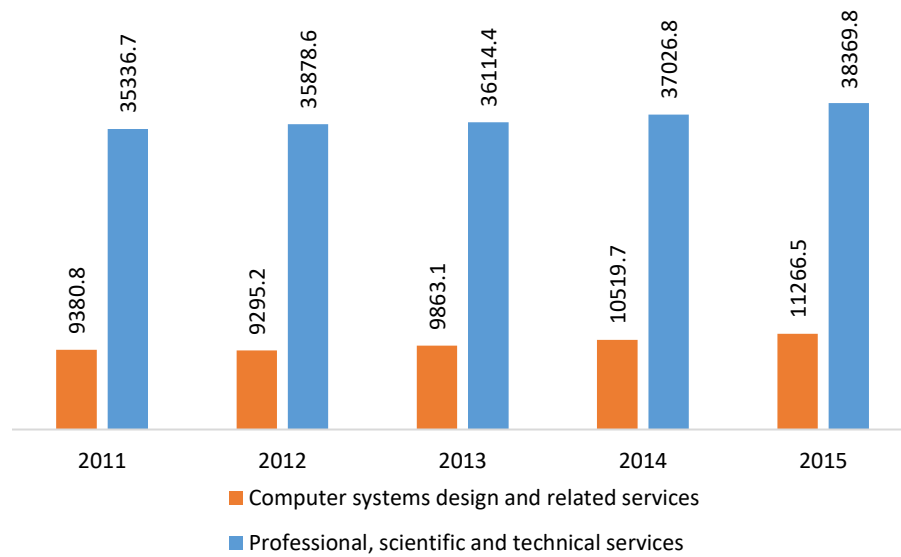
Figure 1 illustrates the GDP for the PST industry and its subsector CSD, over the period 2011 to 2015 in Ontario. As seen, there was a positive trend in the GDP growth for PST and CSD. In the past five years (2011-2015), the Ontario CSD GDP growth was 20.1%, which is 11.5% higher than PST GDP, and 11.9% higher than the Ontario GDP growth by all industries. Over the period of 2011-2012, the CSD GDP growth was negative (-0.9%), which can be a result of economic downturn after the 2008 recession. However, after 2012, the CSD GDP growth surpassed the PST GDP growth by 4.4% on average. The aggressive growth of the CSD industry is possibly due to the technology advancement, and growing innovation opportunities, as well as the rise in mobile usage and internet access rate. These changes in technology and innovation have accelerated as the economy recovered from recession, and have increased as the cost of capital dropped as a result of the decline in interest rates¹³.

Over the next five years (2017-2021), it is projected the Ontario CSD GDP will grow by 19.4%. It is 7.4% point higher than PST GDP growth and 10.9% higher than that of all industries¹⁴.

¹³ Bank of Canada, Canadian Interest Rates and Monetary Policy Variables: 10-Year Lookup, <http://www.bankofcanada.ca/rates/interest-rates/canadian-interest-rates/>

¹⁴ Government of Canada, Canadian Occupation Projection (COPS)

Figure 1. Real GDP in PST and CSD, Ontario, 2011-2015, (Values in Millions of Canadian Chained Dollars (2007))



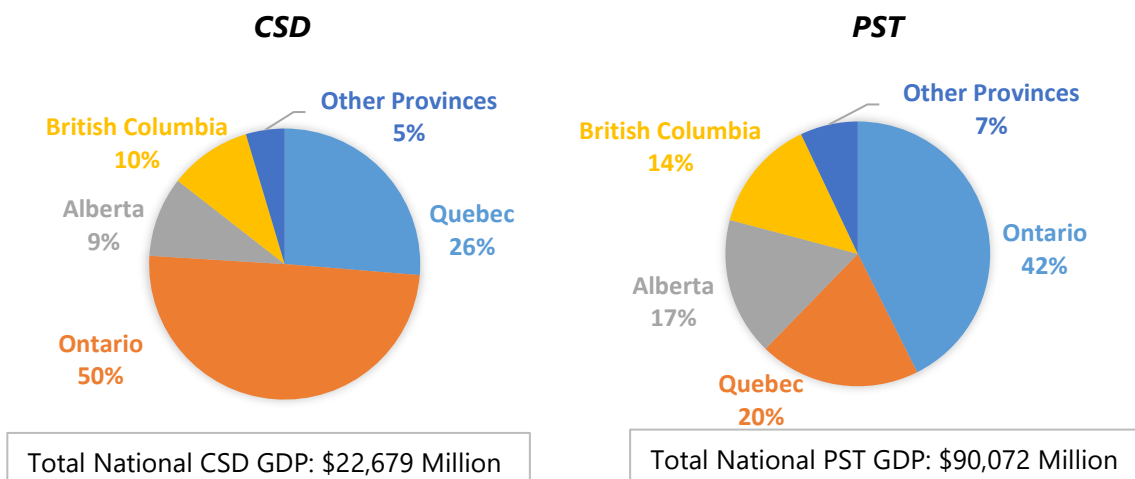
Source: Statistics Canada, Table 379-0030 Gross Domestic Product (GDP) at Basic Prices

In 2011, the PST industry contributed 5.4% to Canada's total GDP and the CSD alone contributed 1.2%. In 2015, the portion of PST GDP and CSD GDP increased to 5.5% and 1.4% respectively with total amount of contribution of \$90.072 billion and \$22.680 billion.

The provincial PST and CSD GDP contributions to total national PST and CSD GDP are varying across regions but remained stable across the last five years for a given region (Figure 2). In 2015, Ontario PST made the largest contribution (42.6%) to the entire national PST GDP. Quebec PST made the second largest contribution (19.7%). The Ontario CSD also made the largest contribution (49.7%) to the national CSD GDP historically and currently. This was followed by Quebec (26.3%).

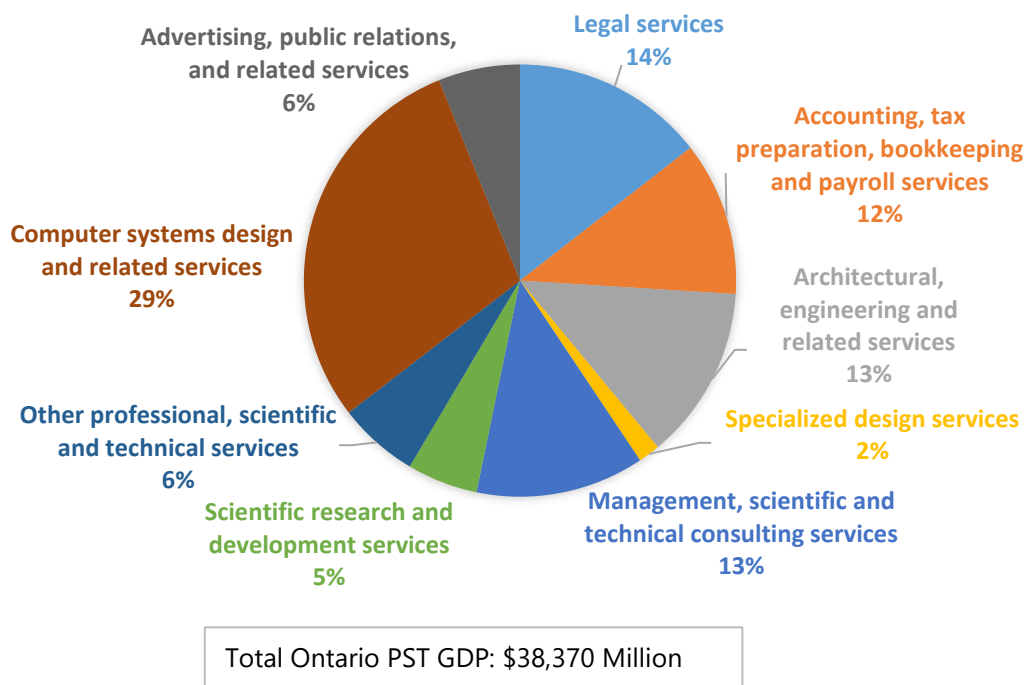
In Ontario, CSD is the dominant subsector in PST historically and currently. The proportion of CSD GDP to total PST GDP continuously increased since 2013. In 2015, it accounted for 29.4% of total PST GDP (Figure 3).

Figure 2. Provincial Contribution to the National PST & CSD GDP, 2015



Source: Statistics Canada, Table 379-0030 Gross Domestic Product (GDP) at Basic Prices

Figure 3. PST Subsector Contributions to Total Ontario PST GDP, 2015



Source: Statistics Canada, Table 379-0030 Gross Domestic Product (GDP) at Basic Prices

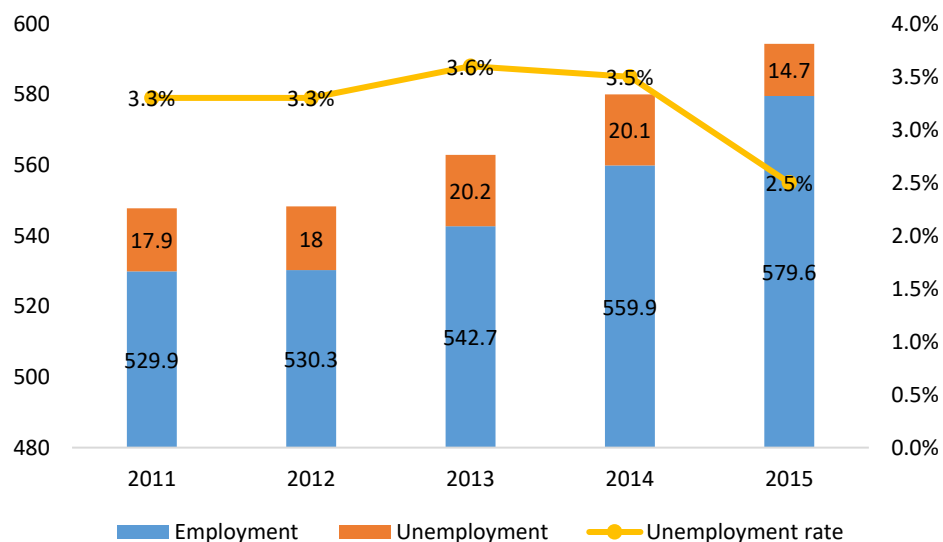
Labour Force, Employment and Unemployment

The labour force is defined as the people who are either employed or unemployed but looking for an employment opportunity. This section provides detailed information about employment and unemployment among PST and CSD labour forces in both Ontario and the Toronto CMA.

Ontario

Figure 4 illustrates the size of employed and unemployed labour force as well as the unemployment rate in the PST industry in Ontario. In the past five years, overall, the labour force population has grown by 8.5%. The proportion of employed to unemployed labour force decreased over 2011 to 2013, however, it increased afterwards and it reached a maximum in 2015. This trend could be seen in the unemployment rate in the graph below. The unemployment rate increased to 3.6% in 2013 and it decreased to 2.5% in 2015. The decline in unemployment rate suggests there is a prospective growing demand for labour in the PST industry as a result of industry expansion. Many industry sectors such as financial services, logistics, manufacturing, natural resources and health care will be continuously reshaped by smart technologies such as IoT and Artificial Intelligence.

Figure 4. Employed and Unemployed in PST Industry, Ontario, 2011-2015 (Values in Thousands of People)

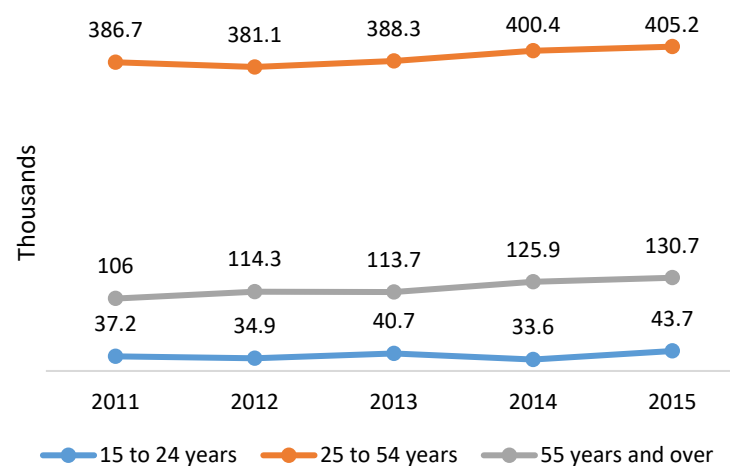


Source: Statistics Canada, Table 282-0008 Labour Force Survey Estimates (LFS)

Notes: Employed and Unemployed Constitute the Labour Force

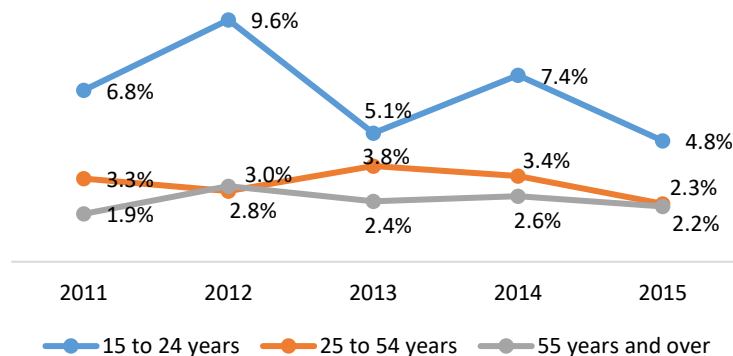
Figure 5 and Figure 6 illustrate employment numbers and unemployment rate in the PST industry by age group. Overall, the highest employment level is for the population aged 25-54 and the lowest is for the youth aged 15-24. On the other hand, the unemployment rate is highest for the population aged 15 -24 years and lowest for those aged 55 years and over. That is because the PST industry strongly relies on labour's working experience and skills, which are normally possessed by senior employees. The unemployment rate for youth aged 15-24 had great fluctuations, but overall, it decreased 2%. The unemployment rate for the population aged 25-54 had declined by 1% over 2011 to 2015. The unemployment rate for the population aged 55 and over remained low and stable in the same period.

Figure 5. Employment in PST Industry by Age, Ontario, 2011-2015 (Values in Thousands of Employees)



Source: Statistics Canada, Table 282-0008 Labour Force Survey Estimates (LFS)

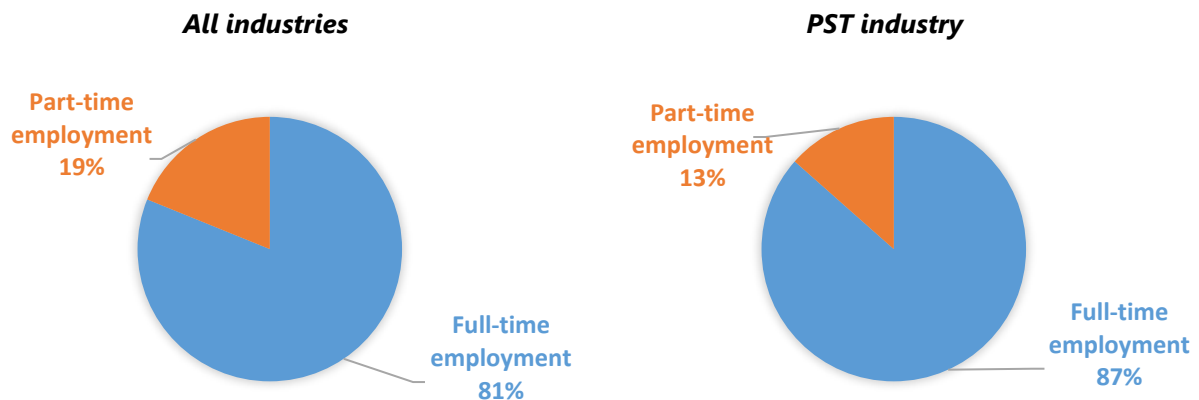
Figure 6. Unemployment Rate in PST Industry by Age, Ontario, 2011-2015



Source: Statistics Canada, Table 282-0008 Labour Force Survey Estimates (LFS)

Figure 7 illustrates the full-time and part-time employment across the PST industry in 2015. As seen, in Ontario, the majority of jobs in PST are full time and the minority are part-time. Compared with the total for all industries, full time employment in the PST industry accounted for the larger portion in 2015.

Figure 7. Part-time and Full-time Employment in the PST Industry and all Industries, Ontario, 2015

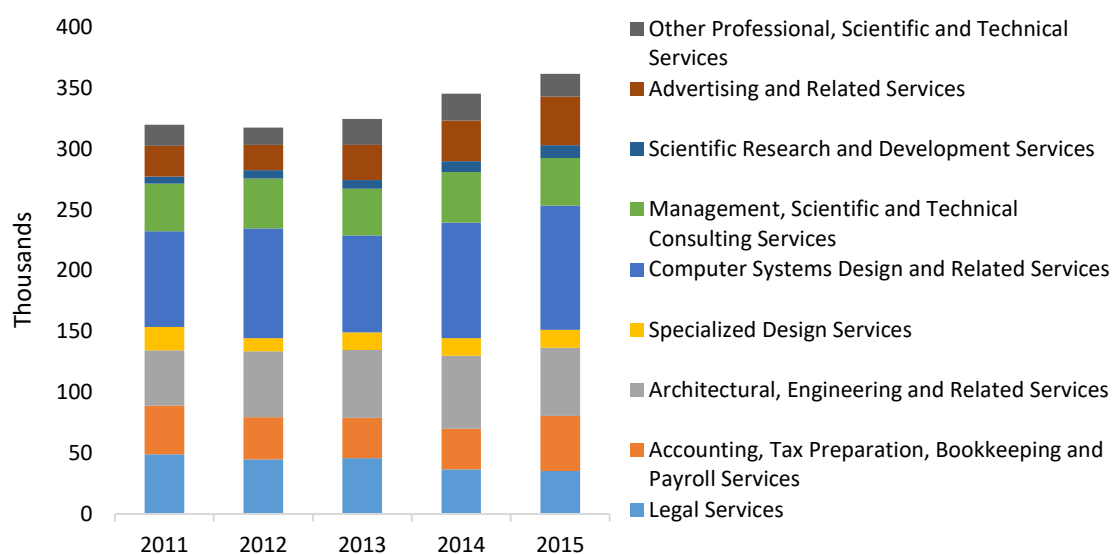


Source: Statistics Canada, Table 282-0008 Labour Force Survey Estimates (LFS)

Toronto CMA

Figure 8 illustrates the size of the labour force in PST subsectors in Toronto CMA. Generally, over the 5-year period (2011-2015), the aggregate labour force size has increased by 13%. Among all subsectors, CSD accounted for the largest portion historically and currently (24.6% in 2011 and 28.2% in 2015), which is 12.7% higher than the second largest subsector, Architectural, Engineering and Related Services. The CSD labour force grew dramatically in 2014, by 19.1%. Overall, the labour force growth in PST and CSD in Toronto CMA are consistent with that in Ontario.

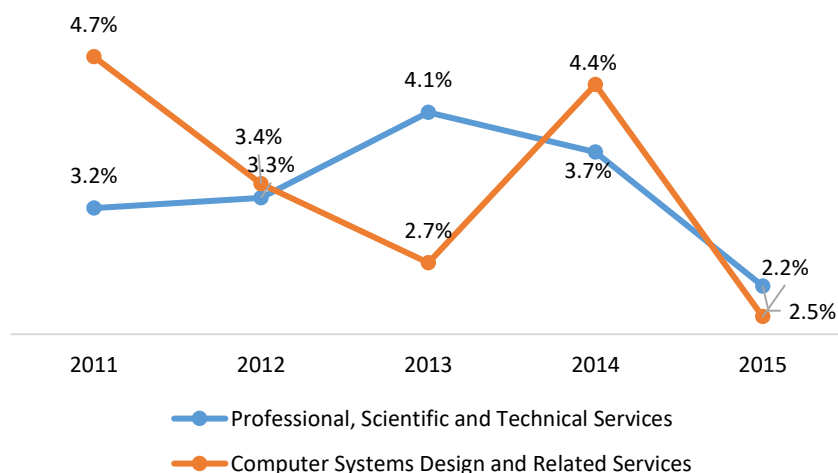
Figure 8. Labour Force in PST Industry by Subsectors, Toronto CMA, 2011-2015 (Values in Thousands of people)



Source: Customized Labour Force Survey Data Obtained through Economic Data Centre, City of Toronto

Figure 9 shows the movements of unemployment rate in PST and CSD over 2011-2015. Similar to Ontario, in Toronto CMA the highest level of unemployment rate in PST happened in 2013 with a dramatic decline afterward. On the contrary, CSD had the lowest level of unemployment rate in 2013 followed by a considerable growth in 2014. The sudden increase in CSD labour force population (19.1%) in 2014, caused a huge change in the unemployment rate during the same year.

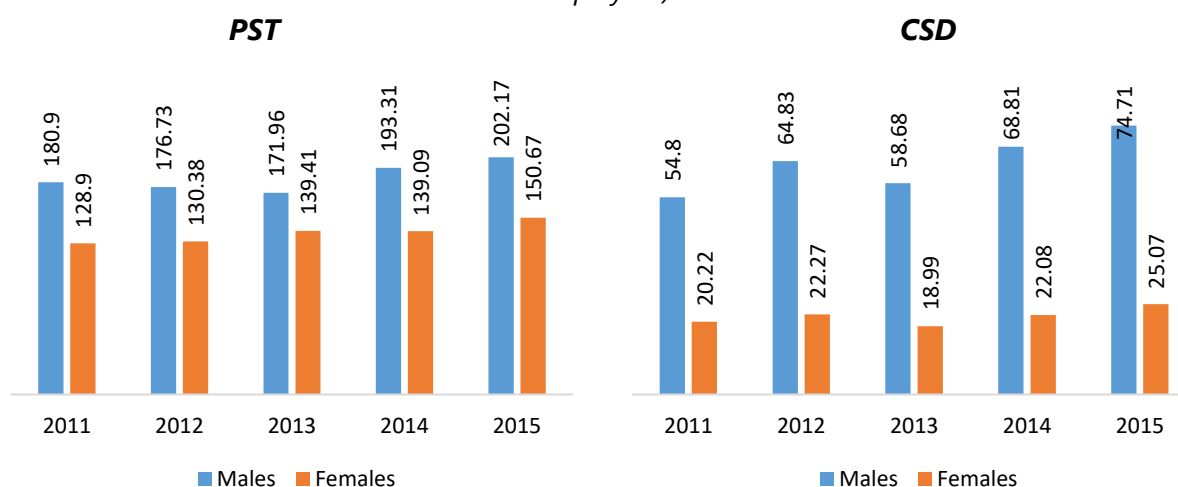
Figure 9. Unemployment Rate in PST and CSD, Toronto CMA, 2011-2015



Source: Calculated Based on Customized Labour Force Survey Data Obtained through Economic Data Centre, City of Toronto

Figure 10 illustrates employment by gender in PST and CSD. In comparison, the number of employees have greater disparities in CSD than the overall PST industry currently and historically. The proportion of women in overall PST employees remains moderate and slightly increased over the five-year period (41.6% in 2011 and 42.7% in 2015). The proportion of women in CSD employees remained low and was declining over the five-year period (36.9% in 2011 and 33.6% in 2015). The under representation of females in CSD suggests there are some barriers and challenges for attracting and integrating women into this industry.

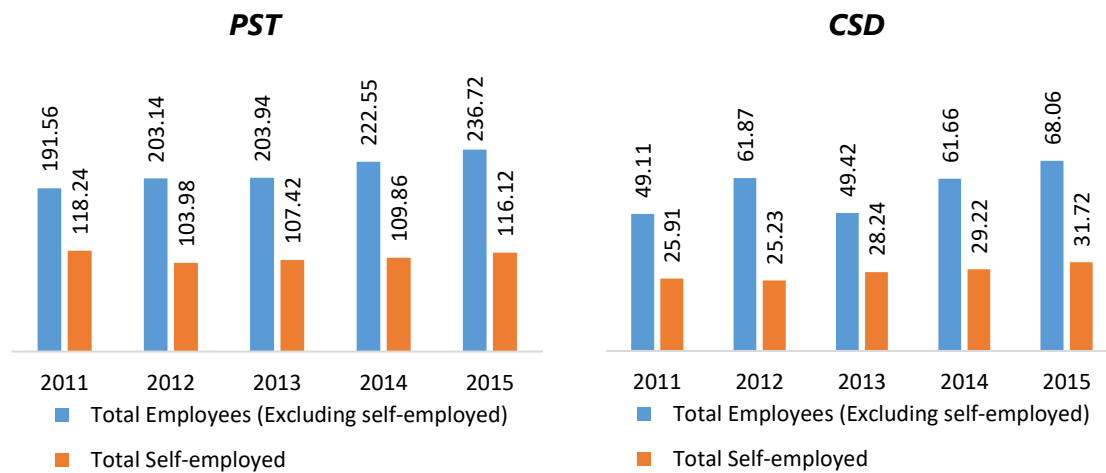
Figure 10. Employment in PST and CSD by Gender, Toronto CMA, 2011-2015 (Values in Thousands of Employees)



Source: Customized Labour Force Survey Data Obtained through Economic Data Centre, City of Toronto

Figure 11 shows the distribution of total employees (excluding self-employed) and self-employed people in the PST industry and its CSD subsector in Toronto CMA in 2015. For both PST and CSD, self-employed accounted for a significant portion of total workers. In 2015, 32.9% of PST employees and 31.8% of CSD employees were self-employed; this may be due to the benefits of self-employment in terms of earnings flexibility and tax savings.

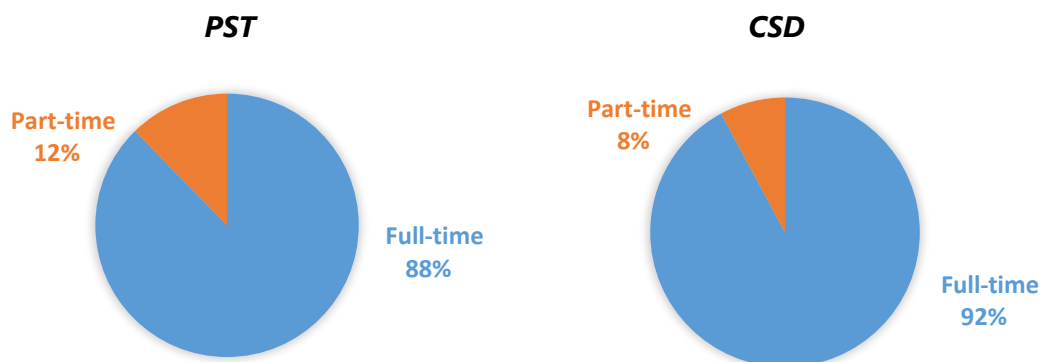
Figure 11. Total Employees (Excluding Self-employed) and Self-employed in PST & CSD, Toronto CMA, 2011-2015 (Values in Thousands of Employees)



Source: Customized Labour Force Survey Data Obtained through Economic Data Centre, City of Toronto

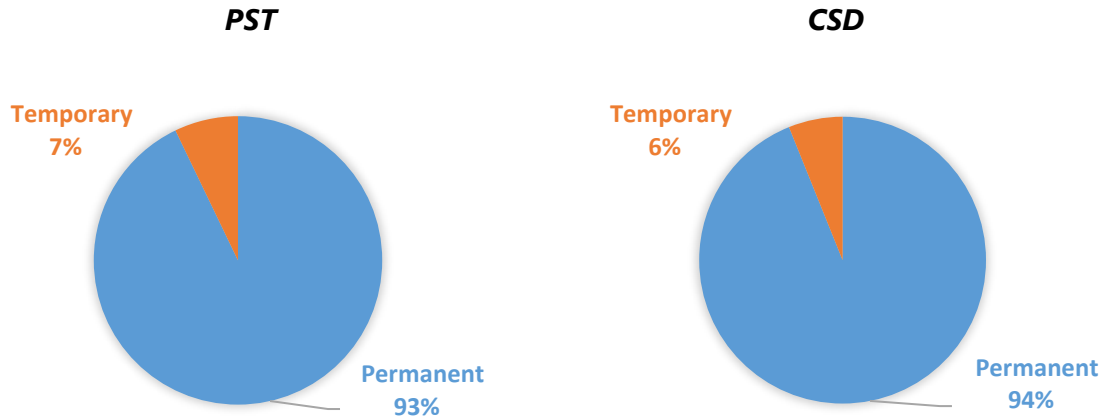
Figure 12 & 13 show the proportion of full-time and part-time employees as well as the proportion of permanent and temporary employees in PST and CSD in Toronto CMA in 2015. In comparison, there was a smaller proportion of part-time employees in the CSD subsector than the overall PST industry. Temporary employees accounted for almost the same proportion in the CSD subsector as in the overall PST industry. The reason is that PST and CSD jobs are similar in nature. The majority of PST and CSD jobs are project based which requires a long-term dedication and commitment to the work.

Figure 12. Part-time and Full-time Employment in PST and CSD, Toronto CMA, 2015



Source: Customized Labour Force Survey Data Obtained through Economic Data Centre, City of Toronto

Figure 13. Permanent and Temporary Employment in PST and CSD, Toronto CMA, 2015



Source: Customized Labour Force Survey Data Obtained through Economic Data Centre, City of Toronto

Note: Temporary job includes seasonal, term/contract, and casual

Job Openings & Retirements

Based on Table 3 employment projection in the CSD subsector, over the next five years (2018-2022), 44,400 new jobs will be created due to the industry expansion and 36,200 employees will be retired. There would be great foreseeable demand for new jobs in 2018, and 2022. The number of replacing jobs will also increase over the next five years. It is very important that companies and businesses that face retirement challenges start planning in advance and foster qualified candidates to take over the roles of retired employees.

Table 3. Employment and Retirement Changes in CSD, Canada, 2018-2022

	2018	2019	2020	2021	2022
Employment projection	358300	365300	371800	379000	387000
New Jobs (Demand Expansion)	8400	6900	6600	7100	8000
Retirement	5600	6000	6200	6500	6600

Source: Government of Canada, Canadian Occupational Projection System (COPS)

Industry

Business Distribution in Peel and Halton

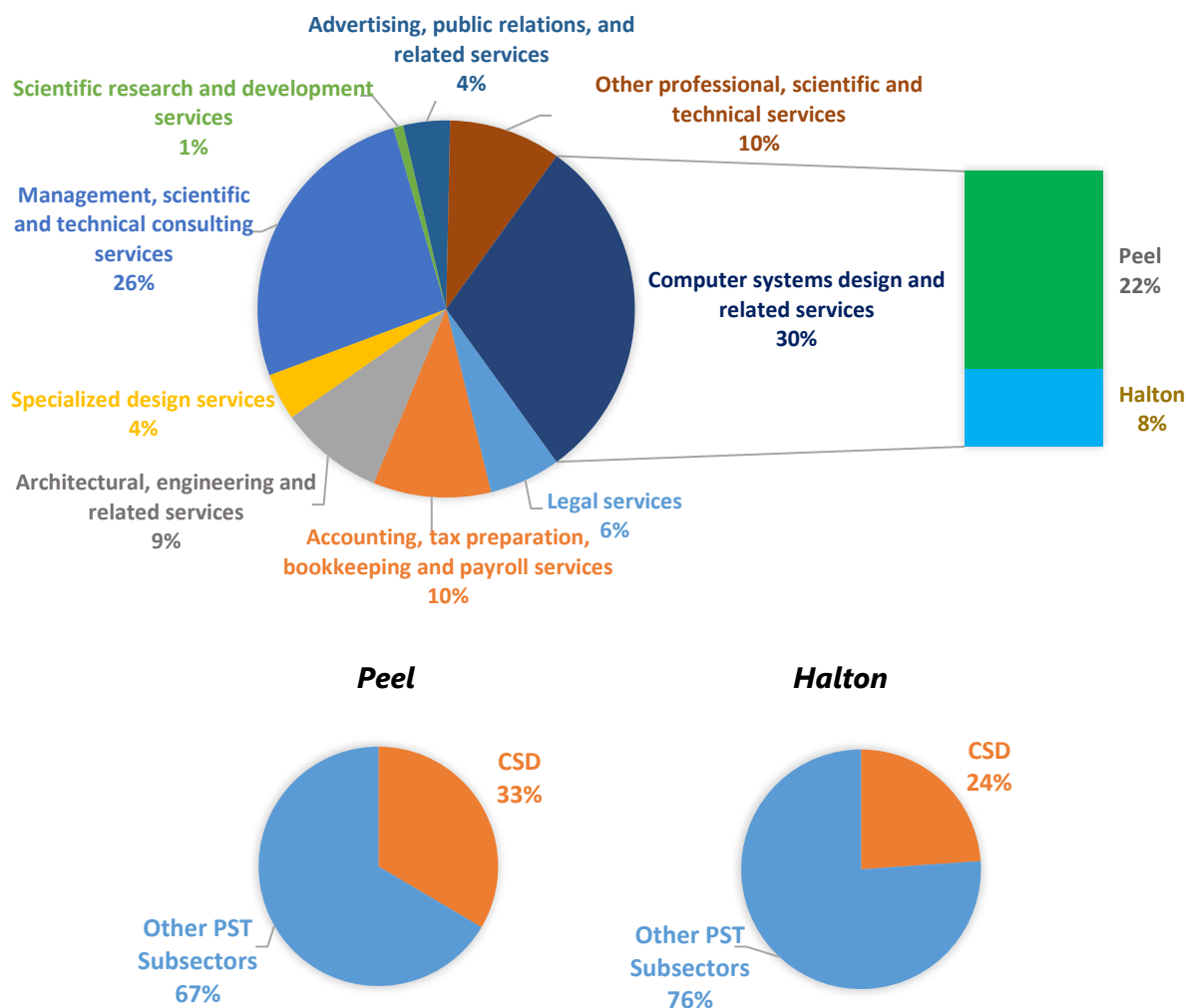
PST is one of the dominant industries in Ontario and in Peel and Halton regions in terms of the number of establishments. In June 2016, 14.45 per cent of business establishments (self-employed and with employees) in Ontario were in the PST industry. It was 3.9 per cent lower than the Real Estate and Rental Leasing industry which is the largest industry by number of establishments. However, in Ontario, the PST industry accounted for the largest portion of establishments with employees only, which is 14.05 per cent, 2.3 per cent higher than the second largest industry, Retail Trade.

In June 2016, the PST industry was the largest in Peel and Halton regions as it accounted for the largest portion (16.31 per cent) of establishments, self-employed and with employees. It is 1.4 per cent higher than the Transportation and Warehousing industry which is the second largest industry by number of establishments. The majority of the PST establishments in Peel and Halton regions are self-employed (accounting for 2/3), given that PST is more dependent on labour skill than labour volume.

As can be seen from Figure 14 in Peel and Halton regions, the proportion of establishments (self-employed and with employees) in CSD is the largest among all nine subsectors in PST (30 per cent), four per cent higher than management, scientific and technical consulting services and three times higher than accounting, tax preparation, bookkeeping and payroll. Out of all CSD companies located in Peel and Halton regions (30 per cent as shown in figure below), 22 per cent are located in Peel and 8 per cent in Halton. The majority (66.35 per cent) of CSD companies in Peel are located in Mississauga.

Additionally, compared to other subsectors in PST, CSD is important in both Peel and Halton. On a regional basis, the CSD establishments accounted for 33 per cent of total PST establishments in Peel and 24 per cent in Halton.

Figure 14. PST Establishments (With employees and Self-employed) in Peel and Halton, June 2016



Source: Statistics Canada, Canadian Business Counts

In addition to distribution pattern, it is also important to understand the business sizes. Tables 4 and 5 present the number of PST business establishments within the Peel and Halton municipalities by company size. By and large, most of the establishments in PST in Peel and Halton are small businesses and self-employed. This trend is typical in the CSD subsector, 57.32 per cent of businesses are self-employed professionals, and 41.42 per cent of businesses are small size (1-19 employees). They together accounted for 98.74 per cent of total CSD businesses in Peel and Halton regions. This is due to the high-skilled nature of CSD.

In both Peel and Halton, CSD is the subsector with the largest number of total establishments. In Peel, Mississauga has the highest number of PST and CSD businesses. In Halton, Oakville has the highest number of PST and CSD businesses. The total number of PST and CSD businesses in Mississauga are 2.6 and 3.6 times as high as the number of businesses in Oakville.

Table 4. Number of PST Establishments (Self-employed and with Employees), Peel Census Subdivisions, June 2016

	Mississauga				Brampton				Caledon			
	Self-employed	Small	Medium	Large	Self-employed	Small	Medium	Large	Self-employed	Small	Medium	Large
Legal services	509	280	7	0	302	170	2	0	29	16	0	0
Accounting, tax preparation, bookkeeping and payroll services	930	421	13	4	447	193	0	0	77	25	0	0
Architectural, engineering and related services	787	381	57	12	278	136	7	2	52	35	3	0
Specialized design services	373	120	4	1	139	33	0	0	49	14	1	0
Computer systems design and related services	2572	1805	64	16	1198	879	5	0	110	68	0	0
Management, scientific and technical consulting services	2460	759	23	4	831	239	3	0	266	67	0	0
Scientific research and development services	59	49	13	4	19	10	0	0	4	3	2	0
Advertising, public relations, and related services	345	141	25	6	144	43	1	0	27	12	0	0
Other professional, scientific and technical services	918	276	16	4	383	150	3	0	92	28	0	0
Total Professional, scientific and technical services	8953	4232	222	51	3741	1853	21	2	706	268	6	0

Source: Statistics Canada, Canadian Business Counts

Notes: Small (1-19 employees), Medium (20-99 employees), Large (100+ employees)

Table 5. Number of PST Establishments (Self-employed and with Employees), Halton Census Subdivisions, June 2016

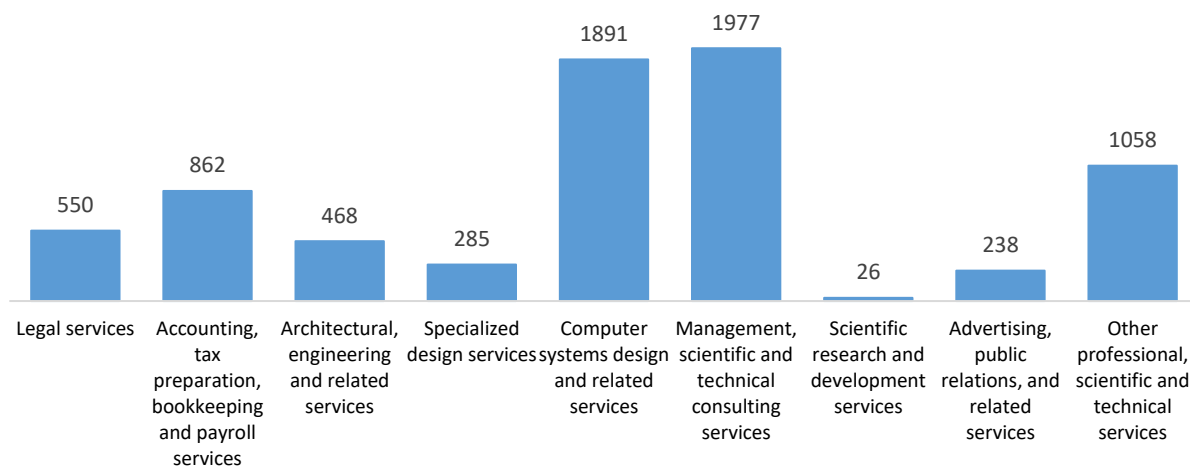
	Oakville				Burlington				Milton				Halton Hills			
	Self-employed	Small	Medium	Large	Self-employed	Small	Medium	Large	Self-employed	Small	Medium	Large	Self-employed	Small	Medium	Large
Legal services	197	111	3	1	94	74	4	0	45	18	0	0	31	13	0	0
Accounting, tax preparation, bookkeeping and payroll services	319	116	3	0	246	76	3	0	116	36	1	0	84	32	0	0
Architectural, engineering and related services	313	171	11	3	197	114	21	2	77	48	2	0	57	27	1	0
Specialized design services	188	58	4	0	128	29	0	0	58	10	0	0	35	9	0	0
Computer systems design and related services	675	539	11	1	371	242	15	2	349	286	2	0	88	56	2	0
Management, scientific and technical consulting services	1376	394	10	0	855	190	5	1	296	101	1	0	201	58	1	0
Scientific research and development services	36	14	2	0	28	11	2	0	5	1	0	0	2	1	0	0
Advertising, public relations, and related services	163	57	2	1	116	42	4	1	51	18	0	0	35	9	0	0
Other professional, scientific and technical services	363	109	5	1	292	73	5	1	130	60	1	0	58	23	0	0
Total Professional, scientific and technical services	3630	1569	51	7	2327	851	59	7	1127	578	7	0	591	228	4	0

Source: Statistics Canada, Canadian Business Counts

Notes: Small (1-19 employees), Medium (20-99 employees), Large (100+ employees)

Figure 15 presents the change in business establishments over the period of June 2013-June 2016. All of the subsectors in PST have grown, as more businesses established in Peel and Halton. Within the three years, CSD was the second fastest growing subsector in terms of incremental number of businesses. Eighteen hundred and ninety one new businesses have established since 2013 in Peel and Halton, which stands for 25.3% growth. Management, scientific and technical consulting services was the fastest growing subsector in terms of number of new businesses with 86 more business openings than CSD during same period.

Figure 15. Change in Number of Business Establishments, Peel & Halton Regions, June 2013-June 2016



Source: Statistics Canada, Canadian Business Counts

Occupations

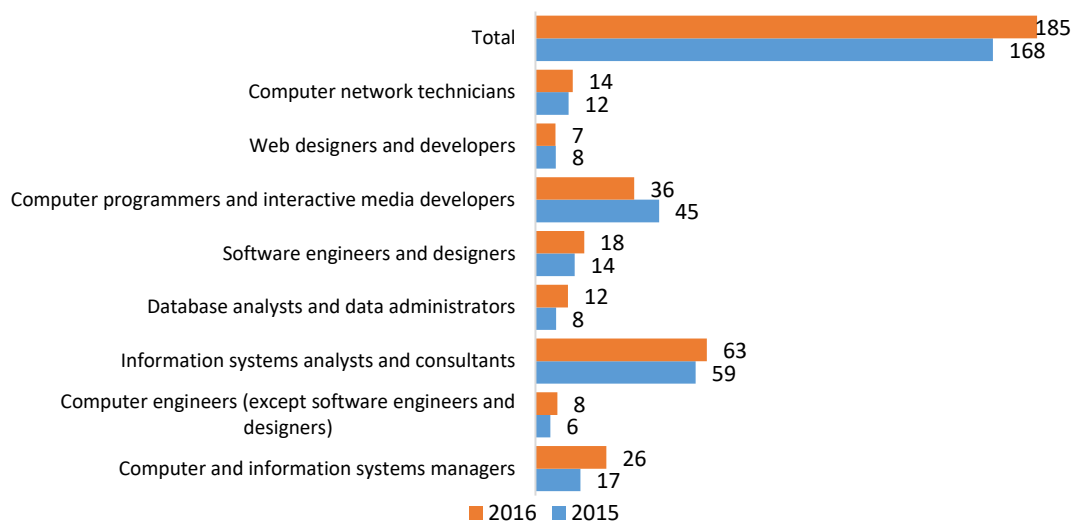
In the National Occupational Classification (NOC), the majority of CSD occupations are categorized under natural and applied sciences and related occupations. There are mainly eight occupations directly relating to the CSD subsector as presented in figure 16. In 2016, in Toronto CMA, there were totally 185 thousand people working in those eight occupations, which has increased by 9.6% since 2015. Among all the eight occupations, information systems analysts and consultants has the most and web designers and developers has the least number of employees.

Over 2015 to 2016, employment has increased in almost all CSD occupations except for computer programmers and interactive media developers. In this occupation, the labour force population decreased by 9,633 individuals (20.6%), the employment rate slightly increased (97% in 2015 to 97.7% in 2016) and the unemployment rate dropped by 0.7%, in the one year period. The significant decline in labour force changed the proportion of employed and unemployed population which resulted in changed employment and unemployment rates. The dramatic decline in labour force over the one year period might be due to movement of labour to other

regions/countries or other occupations for better employment opportunities. It is important to note that a part of this dramatic change might be due to survey error.

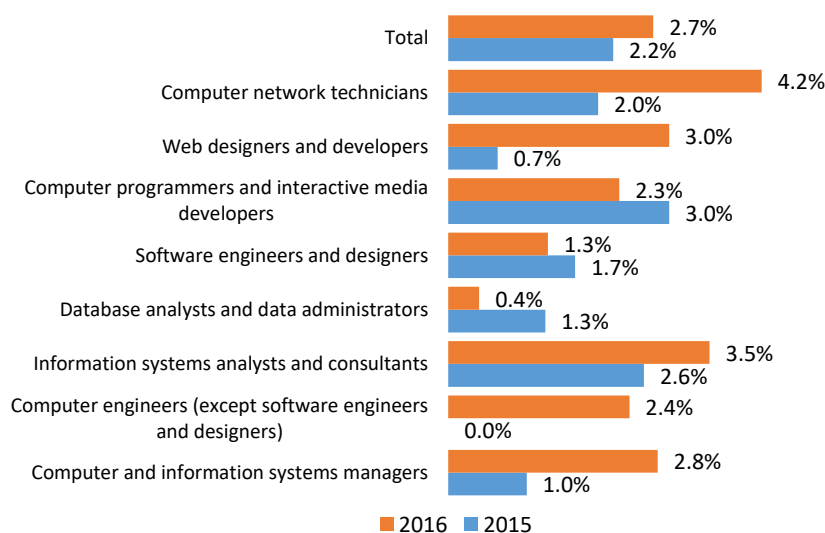
The occupations that have lower unemployment rates in 2016 as compared to 2015 (computer programmers, software engineers and database analysts) are the ones that are in high demand as stated by employers (Figure 17).

Figure 16. Employment by Occupation, Toronto CMA, 2015-2016 (Values in Thousands of Employees)



Sources: Customized Labour Force Survey (LFS) Data Obtained through Information and Communications Technology Council (ICTC)

Figure 17. Unemployment Rate by Occupation, Toronto CMA, 2015-2016



Sources: Customized Labour Force Survey (LFS) Data Obtained through Information and Communications Technology Council (ICTC)

Occupational Projection

Canadian occupational projection system (COPS) is a set of economic models that is developed to forecast labour market conditions on an industrial and occupational basis¹⁵. The COPS projections are reported only at the national level. Despite this limitation, it is worthwhile to look through the national lens and learn about employment and retirement trends in CSD occupations in the near future.

According to COPS data, over the next five years, the employment will grow on average by 6.9 per cent among CSD occupations (Table 6). Database analysts and data administrators will be the fastest growing occupation (9.8 per cent) over the next five years and computer network technicians will be the least growing occupation (4.3 per cent). This trend is consistent with employers' view in Peel & Halton regions. According to the interview with local employers, occupations such as database management, big data analysts, data scientist and machine learning are expected to have the greatest demand in near future.

As seen in the table, among the eight major CSD occupations, information systems analysts and consultants accounted for the largest portion of employment (30.5 per cent in 2018 and 30.7 per cent in 2022), which is around 5 per cent higher than the second largest occupation, computer programmers and interactive media developers.

Table 6. Employment Projection by Occupation in CSD, Canada, 2018-2022

Occupation Name	2018	2020	2022	% Change (2018-22)
Computer and information systems managers	61,500	64,000	65,900	7.2%
Computer engineers (except software engineers and designers)	24,500	25,400	26,400	7.8%
Information systems analysts and consultants	190,200	197,200	204,400	7.5%
Database analysts and data administrators	32,800	34,400	36,000	9.8%
Software engineers and designers	52,400	54,200	56,000	6.9%
Computer programmers and interactive media developers	161,300	165,300	169,500	5.1%
Web designers and developers	32,200	33,300	34,500	7.1%
Computer network technician	69,600	71,100	72,600	4.3%

Source: Government of Canada, Canadian Occupational Projection System (COPS)

¹⁵ Government of Canada, COPS glossary (<http://occupations.esdc.gc.ca/sppc-cops/gl.4ss.1ry@-eng.jsp>)

Retirement in the CSD industry is quite a big challenge since all services in this industry are strongly tied to experience and expertise. In industries such as CSD or healthcare that are highly dependent on a skilled labour force, retirement has significant impact on overall performance of companies. As a result, an appropriate program should be put in place in advance to plan and prepare a platform for knowledge transfer from experienced employees to employees with lower experience levels.

According to Table 7, over the next five years, information systems analysts and consultants, and computer programmers and interactive media developers will be the two occupations that have the greatest retirement. In terms of retirement growth rate, database analysts and data administrators, and web designers and developers have the highest growth rate (25%).

Table 7. Retirement Projection by Occupation, Canada, 2018-2022

Occupation Name	2018	2020	2022	% Change (2018-22)
Computer and information systems managers	1,500	1,600	1,700	13.3%
Computer engineers (except software engineers and designers)	500	500	500	0.0%
Information systems analysts and consultants	2,400	2,700	2,900	20.8%
Database analysts and data administrators	400	500	500	25.0%
Software engineers and designers	700	700	800	14.3%
Computer programmers and interactive media developers	2,000	2,300	2,400	20.0%
Web designers and developers	400	500	500	25.0%
Computer network technician	1,100	1,300	1,300	18.2%

Source: Government of Canada, Canadian Occupational Projection System (COPS)

Wage

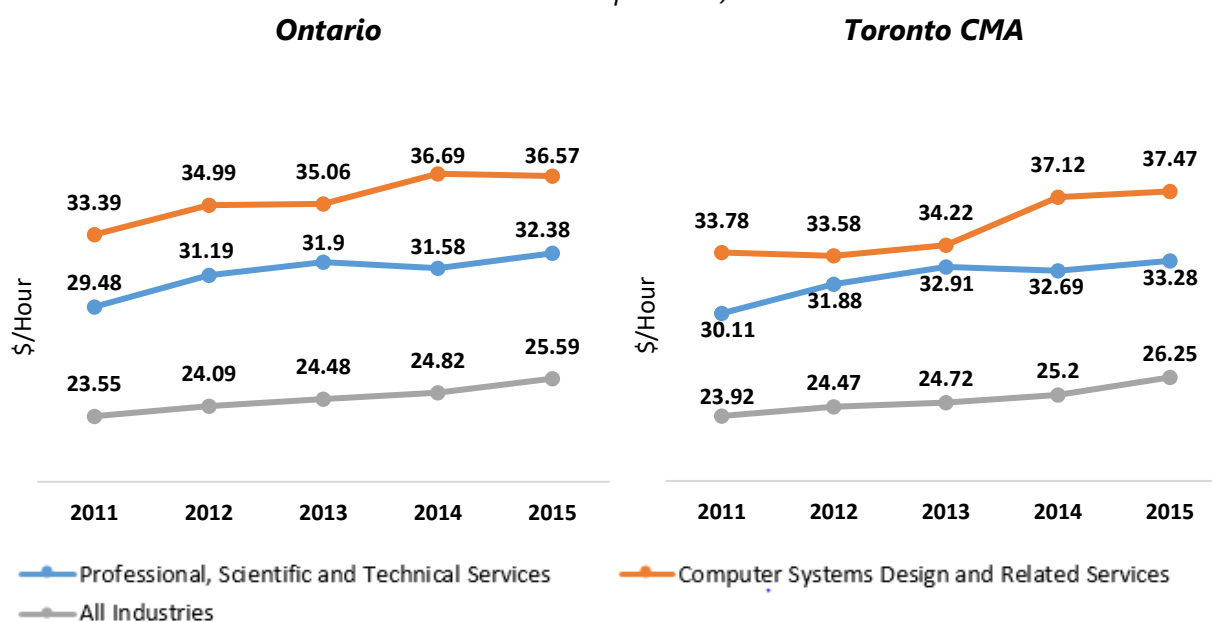
Globally, Canadian CSD professionals earn higher salaries; one reason is that the Canada technology market is relatively mature. However, the salaries in Canada are lower than the U.S since the U.S. technology market is more mature and has more well developed technology clusters such as Silicon Valley and Seattle to attract technology talents globally. In 2016, the average annual wage rate for software engineers in the San Francisco Bay Area was US\$134K, compare to US\$74K in Toronto. However, adjusting for the living costs in San Francisco, Toronto becomes more appealing with adjusted wage of US\$149K, which is higher than San Francisco (US\$134K). In other words, earning US\$74K (CAD\$97K) in Toronto is relatively equivalent to earning US\$149K in San Francisco. Overall, in North America, the software engineer average

annual salary adjusted for cost of living is highest in Austin, Texas (US\$198K) and second highest in Denver, Colorado (US\$181K)¹⁶.

Figure 18 presents the average hourly wage rate by industry in Ontario and Toronto CMA for the period of 2011 to 2015. In both graphs, the average hourly wage rate in the CSD subsector is higher than the wage in the PST industry and all industries.

Overall, the wage rate in Ontario and Toronto CMA are very close and they are following relatively the same pattern of change over time. In both areas, the CSD wage rate dramatically increased after 2013. This pattern is consistent with the historical trends in GDP and the unemployment rate. To elaborate, after 2013, economic activities in the CSD industry have accelerated and increased which resulted in GDP growth and unemployment rate drop.

Figure 18. Average Hourly Wage Rate by Industry, Ontario and Toronto CMA 2011-2015 (Values in Dollars per Hour)



Source: Customized Labour Force Survey Data Obtained through Economic Data Centre, City of Toronto

Tables 8 & 9 indicate the average hourly wage rate by education and occupation in Toronto CMA. Education is one of the key determinants of wage rate. In general, earning has a positive correlation with the level of education; the higher the education level, the more salary one can obtain. As seen, employees with same education level could earn more in the CSD subsector as compared to PST in both 2013 and 2015. It is interesting to note that during same period, the increase in wage rate of employees with post-secondary certificates or diplomas in CSD was not

¹⁶ Hired (2017), 2017 State of Global Tech Salaries
Page | 28

only higher than in the PST industry (25% vs 11.5%), but also was higher than the increase in wage rate of university degree holders in the same industry (25% vs 4.7%). The two groups that made less in 2015 as compared to 2013 are CSD high school graduates (-8.9%), and PST university graduates (-3%).

As seen in Table 9, software engineers and designers is the highest paid occupation and user support technicians is the lowest paid occupation among eight CSD occupational categories. The wage rates for Information systems analysts and consultants and Computer network technicians were more stable throughout the period, whereas, Database analysts and data administrators as well as Information systems testing technicians face greater a wage fluctuation over the period of 2015 to 2016.

Table 8. Average Hourly Wage Rate by Education, Toronto CMA, 2013, 2015

	PST			CSD		
	2013	2015	% Change	2013	2015	% Change
Graduate from high school	25.39	26.84	5.7%	31.35	28.56	-8.9%
Post-secondary certificate or diploma	28.57	31.85	11.5%	29.55	36.94	25.0%
University degree	36.4	35.29	-3.0%	36.69	38.42	4.7%

Source: Customized Labour Force Survey Data Obtained through Economic Data Centre, City of Toronto

Table 9. Average Hourly Wage Offered in CSD Occupations, Toronto CMA, Second Quarter of 2015 to Second Quarter of 2016

National Occupational Classification (NOC)	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016
Information systems analysts and consultants	34.45	33.4	32.45	33.7	34.45
Database analysts and data administrators	33.35	33.1	30.25	50.5	30.4
Software engineers and designers	38.95	40.95	40.9	42.5	40.55
Computer programmers and interactive media developers	36.6	33.5	36.2	38.15	35.5
Web designers and developers	33.55	29.45	27.6	32.15	32.3
Computer network technicians	25.8	-	28.5	27.95	27.15
User support technicians	19.4	23.2	25.25	24.35	24.05
Information systems testing technicians	45.55	-	28.7	37.1	29.5

Source: Statistics Canada, Table 285-0003 Job Vacancy and Wage Survey (JVWS)

CSD Industry in Peel and Halton:

This section of the report aims to shed light on CSD employment challenges, worker shortages and industry needs in Peel and Halton regions. The prior sections provide insight into various aspects of both PST and CSD industries such as industry performance, employment, occupations and wage in Ontario and Toronto CMA. However, the lack of granular data at the local level, prevent a detailed description of the CSD industry in Peel and Halton regions. In order to obtain a better sense of local issues and challenges, primary research, including survey development for local CSD employers and a series of interviews with industry professionals, was conducted. In the following, the qualitative and quantitative findings of this study are presented.

Overview and Profile of Survey Respondents

The purpose of both survey and interviews was to highlight and investigate the labour market challenges, needs, gaps and shortages in the Peel and Halton's CSD industry. In order to obtain insight into the local CSD issues, a working group comprised of five employers¹⁷ was developed. Recruitment of working group members was targeted to represent different business sizes and business activities. With the consultation and guidance of working group members, the scope of the project was defined and survey questions were developed.

The survey was administered electronically through various channels such as Constant Contact, social media (e.g., LinkedIn, Twitter), our company website, email campaigns and PHWDG's community partners (e.g. Sheridan College) to increase participation rate. Although the dissemination strategy was to include almost all the local CSD companies and employers, the majority of results were obtained through our partners' links. Since the partners who helped in survey dissemination were mostly local educational institutions, the results might be skewed in a few questions. Additionally, as mentioned, the survey was disseminated widely into internet, social media, etc. with no specific target for the proportion of respondents originating from companies of a specific size, in a specific geographical area or engaged in a specific business activity.

There were 98 survey responses, which were reduced to 93 after cleaning up the dataset. The average response rate was 78 per question; the reason for the lower response rate per question as compared to the total of 93 responses is that the drop-off rate in participants increases through the length of the survey.

In order to better interpret and clarify the survey responses, 16 follow-up interviews with local employers and 4 interviews with job seekers were planned and conducted¹⁸. The interview

¹⁷ List of working group members is provided in the acknowledgment

¹⁸ List of interview participants is provided in the acknowledgment

participants were selected through PHWDG organizational outreach to local communities. A diverse sample of CSD businesses was defined to capture the voices of SMEs and large corporations as well as businesses from different geographical areas. However, the business activities (e.g. software development, IT consulting, etc.) of the interviewees were not included in the selection criteria. It might cause a sampling error, as some of the companies with similar business activities and similar challenges were over represented compared to other businesses. To elaborate, for both survey and interviews, the CSD professionals from all industries (PST and other industries) have been taken into account; for instance, IT professionals in banking and finance or healthcare have been asked to participate in our research study.

Figure 19 profiles the distribution of employer respondents by CSD subcategories. The seven business categories that were incorporated in this question, would basically cover all areas of CSD activities. The majority of respondents were from IT consulting services (26.9%) and software businesses (24.7%). There was a limited representation of some groups such as hardware businesses or network system design. Generally, the proportion of these businesses in Peel and Halton regions is smaller than IT or software businesses, however, due to the under representation of the participants, the survey results could not reflect their challenges effectively. Additionally, the greatest portion of responses (33.3%) were related to CSD professionals in various industries, not limited to CSD. The list of major industries, which participated in the survey is illustrated in Table 10.

Figure 19. Distribution of Survey Respondents by CSD Subcategories

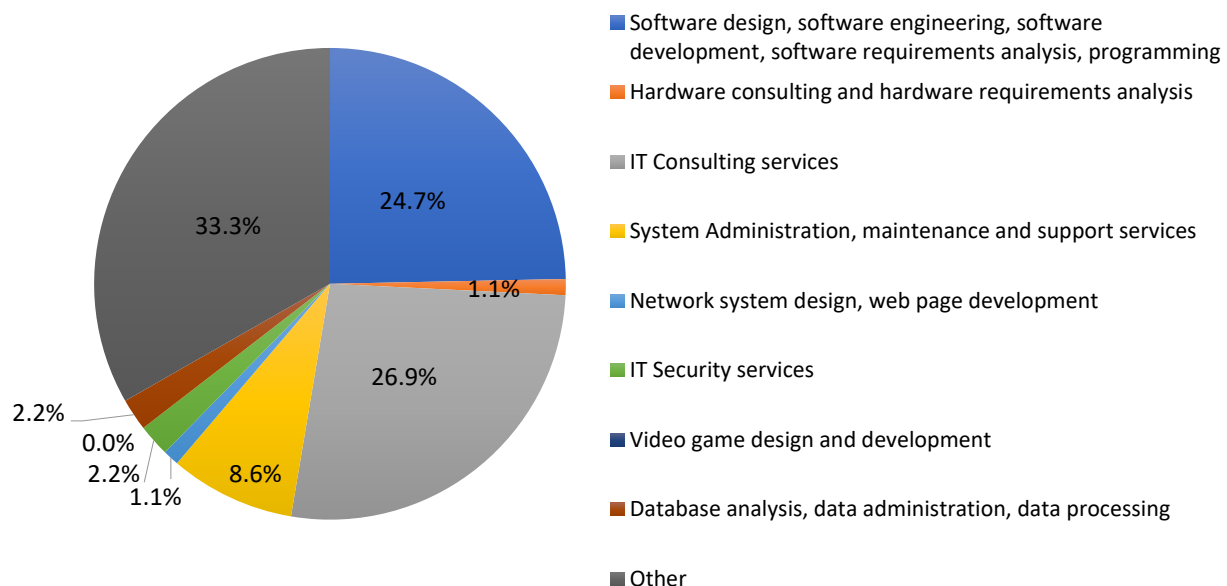


Table 10. Examples of Industries Covered by Survey

Manufacturing
Web design & digital marketing
Education
Utility
Publishing
Transportation
Public Sector
Construction
Mental Health & Addictions

The survey responses also represented a cross section of employers by geography as presented in Figure 20. The majority of responses come from employers in Mississauga, Brampton and Oakville. This corresponds with the actual distribution of businesses in local municipalities as these three cities have the highest proportion of CSD businesses. However, the share of survey respondents and the actual share of employers are not close especially in Oakville and Milton. Additionally, 10.8% of the respondents are either from other locations in the GTA or they serve in multiple locations in Peel and Halton. Although, there are some mismatches between the actual and survey shares, the accuracy and credibility of survey results is not impacted, since employers' needs and challenges are almost consistent in this industry across cities in the GTA.

Figure 20. Share of Survey Respondents and Actual Share of Employers by Geography

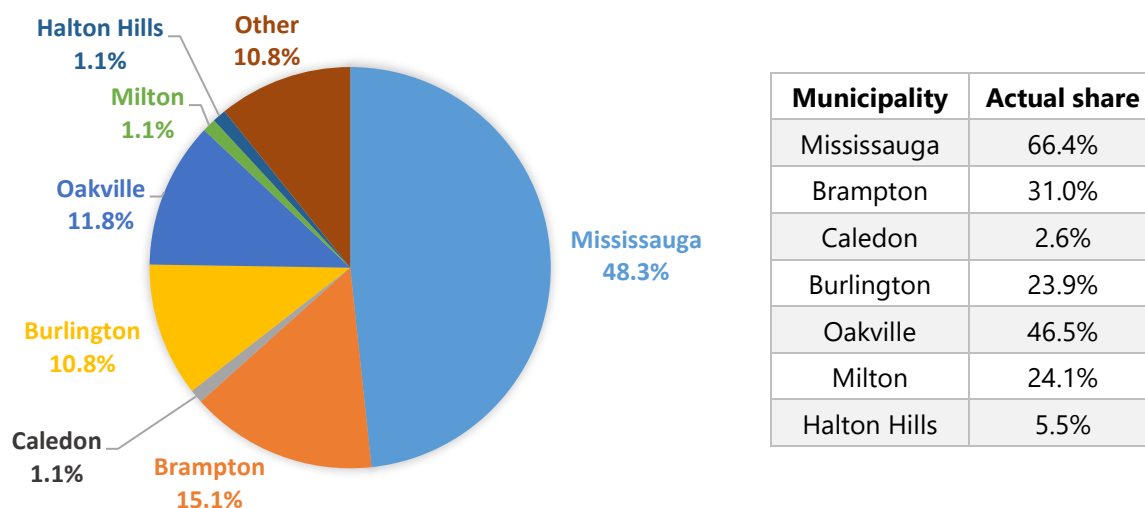


Table 11 presents the share of survey respondents and actual share of employers by business size. Comparison of survey and actual percentages suggests that opinions of small businesses

might be underweighted since they are under represented as compared to their actual share. On the other hand, medium and large businesses had a stronger voice among respondents as opposed to their actual share.

Table 11. Share of Survey Respondents and Actual share of Employers by Business Size

Size of Businesses	Survey Percent	Actual Percent
1 to 20 employees	49.5%	97.0%
21 to 99 employees	24.7%	2.5%
100 to 199 employees	4.3%	0.2%
200+ employees	21.5%	0.3%

Survey Findings

One purpose of the survey was to investigate the type of employment in the local CSD industry. As a result, the next few questions are focused on employment pattern (permanent vs temporary (e.g., term/contract/casual)) and the reasons behind the current pattern in Peel and Halton. Based on the results in Table 12, in a majority (68.9%) of local businesses, more than 75% of employees are permanent and in 13% of businesses, more than 75% of the employees are temporary.

Table 12. Proportion of Permanent and Temporary Employment among Peel and Halton Businesses

Proportion of permanent vs temporary employees	Response Percent
All the employees are permanent	32.3%
25% of the employees are temporary and 75% are permanent	36.6%
50% of the employees are temporary and 50% are permanent	12.9%
75% of the employees are temporary and 25% are permanent	6.5%
All the employees are temporary	6.5%
Other	5.4%

According to survey responses (Figure 21), the employers (58.3%) that offer more temporary jobs as compared to permanent jobs mainly hold the view that most of their projects are short term and they do not need to keep the permanent staff. The secondary reason is to find the right employee with a particular skill set based on the needs of each project. Surprisingly, the cost reduction effect of hiring temporary employees was not the main reason for local employers.

The employers that had other opinions than the ones presented in Figure 21 below specified two reasons:

- Their business model enables employees to work with flexibility
- They tend to hire co-op students to help with help desk/in house projects

Figure 21. Reasons for Hiring more Temporary Employees rather than Permanent Employees

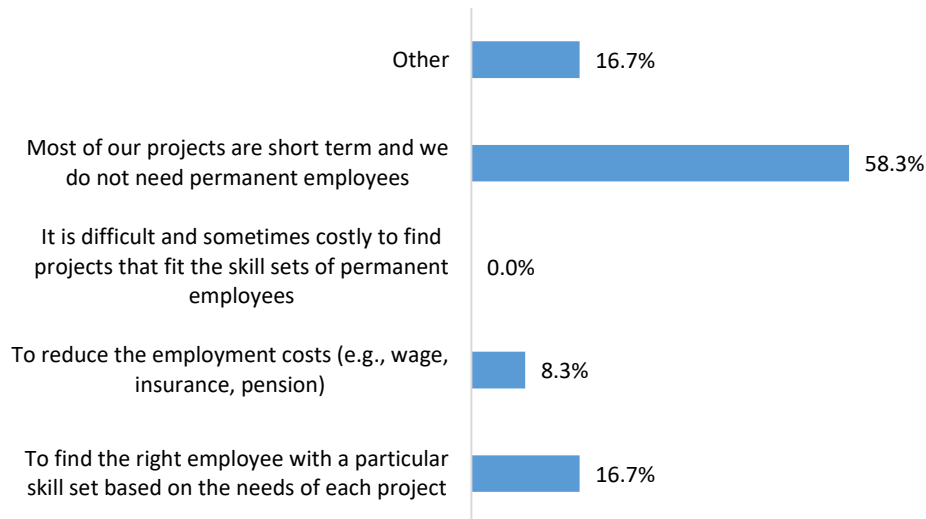
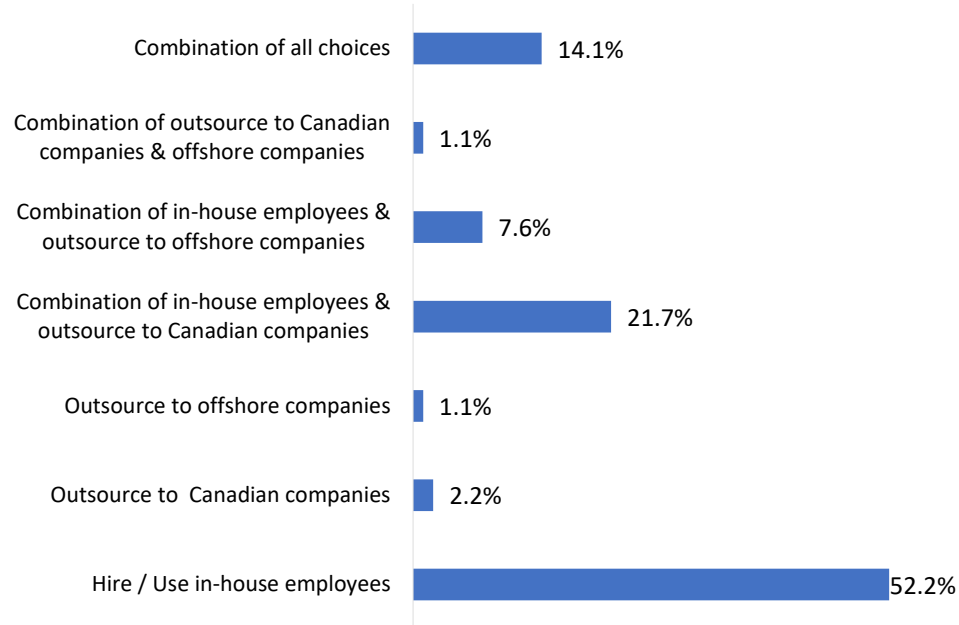


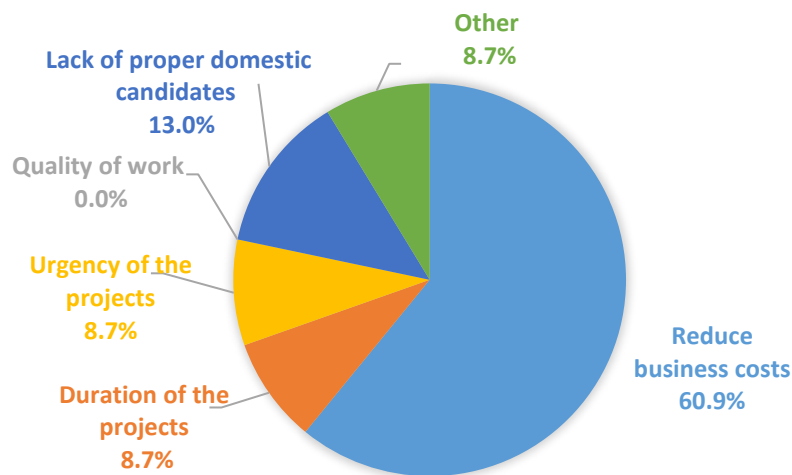
Figure 22 illustrates how local employers source CSD professionals for their projects/works. Based on survey responses, the majority (52.2%) of employers prefer to hire in house employees for their regular works and projects. There is also a considerable portion (21.7%) of employers, who prefer to use a combination of in-house employees and outsource to Canadian companies. Only a small portion (3.3%) of employers outsource solely to Canadian companies or offshore companies.

Figure 22. Source of CSD Employees for the Purpose of Projects/Jobs



As seen from Figure 23, the employers who outsource all or part of their labour force from overseas do so primarily to reduce business costs. According to the interview with local employers, India is one of the key destinations of outsourcing due to its competitive advantages in labour costs, productivity and quality. Due to the limitation of the domestic CSD talent pool, finding and acquiring proper candidates that have specific skill sets is another main reason for offshoring. However, besides cost factor and options listed below, there is another reason raised by employers – support projects in different time zones.

Figure 23. Reasons for Outsourcing All or Part of Labour Force from Overseas



Workplace experience is one of the crucial factors when it comes to hiring new employees, especially for entry-level jobs. Some employers provide experiences such as co-op or internship, which helps candidates to get first hand experience. As illustrated in Figure 24, 72% of local employers provide workplace experience. Among firms with 100+ employees, who participated in the survey, 83.3% offer such experience (Figure 25). In small companies, this percentage is lower (62.2%) due to the limited financial and human capital resources.

It is important to consider that the results of this question might be skewed a bit due to the survey dissemination strategy. The majority of partners that helped us in dissemination are local educational institutions. As a result it is more expected that their industry contacts are employers who are willing to work with colleges and universities and have a positive attitude toward providing workplace experience.

Figure 24. Providing of Workplace Experience (Co-op or Internship) among Local Employers

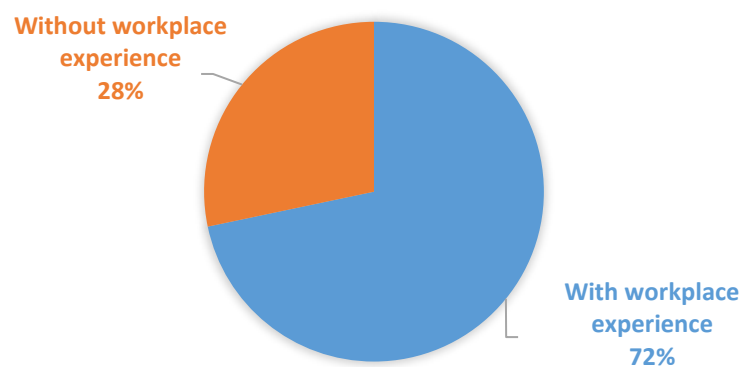


Figure 25. Percentage of Employers Providing Workplace-Relevant Experience, By Size of Firm

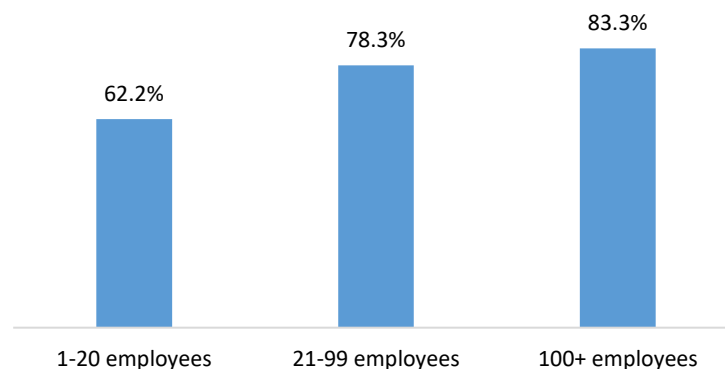
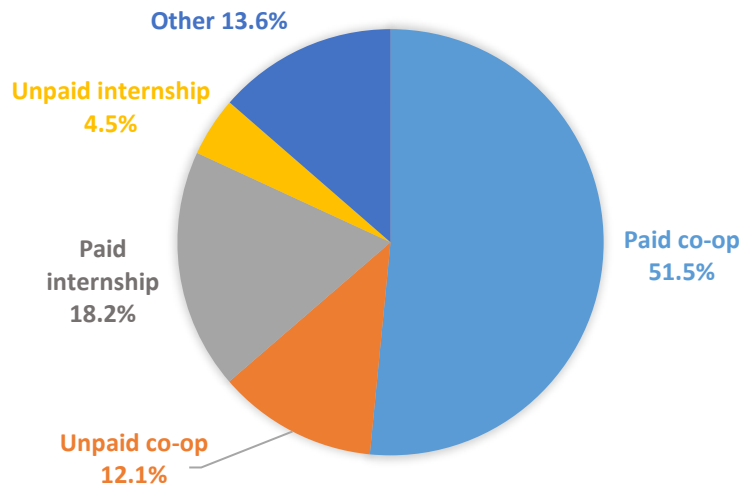


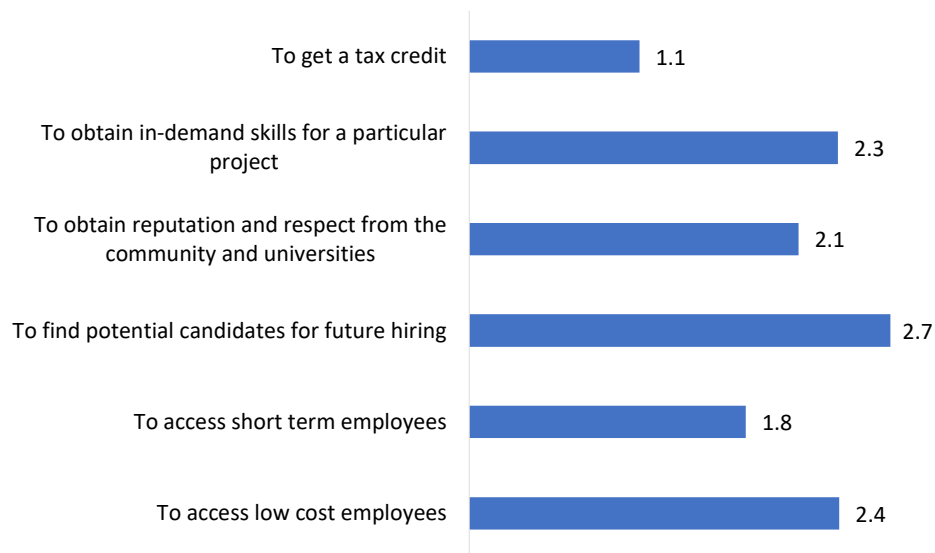
Figure 26 represents the type of workplace experience that local employers offer. Most of the workplace experience is paid co-op, which accounted for over a half. Paid internship accounted for the second largest portion (18.2%) and unpaid programs (co-op and internship) with 16.6% are the third largest portion. Employers who selected the “other” category specified that they provide a combination of internship and co-op programs (paid & unpaid).

Figure 26. Types of Workplace Experience Offered by Local Employers



The employers who provide workplace experience then were asked to rank from 1 to 3 the top three benefits of providing workplace experience to their businesses, where 3 indicated the highest benefit (Figure 27). The numbers in the figure below represent the average ratings of the responses to each choice. The main benefits are primarily for finding potential candidates for future hiring, and secondarily for obtaining in-demand skills for a particular project, as well as, obtaining low cost labour. Apparently, the financial incentive reason (to get a tax credit) is the least important reason for employers when they provide workplace experience.

Figure 27. Benefits of Providing Workplace Experience to Local Businesses (Numbers are Average Ratings)



Note: 3 indicates the highest rating score and 1 indicates the lowest rating score

Among those employers who indicated that they do not offer a workplace-relevant experience, the main reason was limited resources (Figure 28). This issue mostly can be seen in small sized companies as they do not have enough financial supports and their human capitals are also limited. Another primary reason is that some employers do not need entry-level workers, as their type of work requires a higher level of experience. Overall, CSD is an industry in which sales expertise and senior professionals with extensive work experience are more in demand. There is also a considerable number of employers, who want to start providing such experience, but do not know how to do so.

Figure 28. Reasons of Local Employers for Not Being Engaged in Workplace Experience

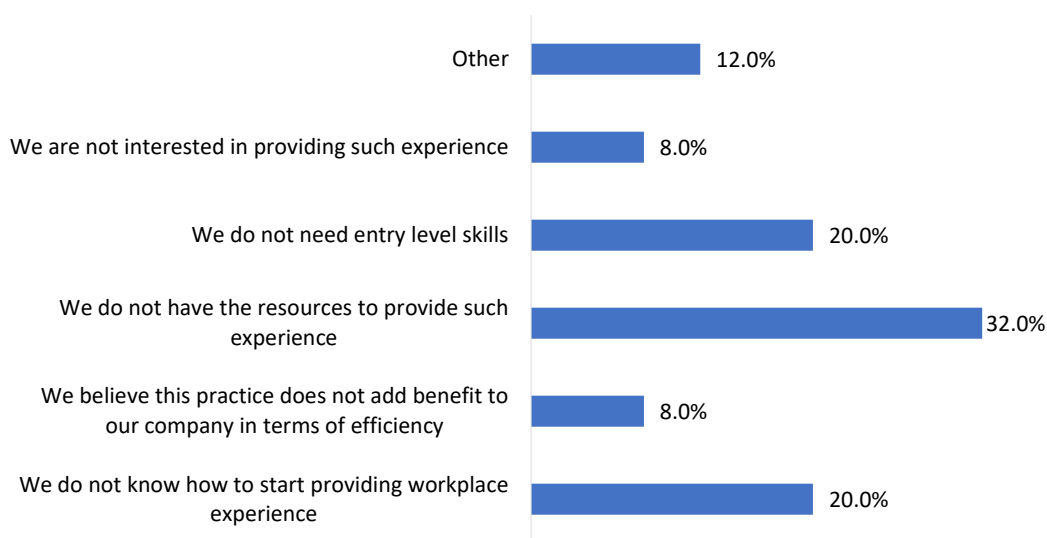


Figure 29 profiles the level of importance employers put in various criteria when hiring new employees. Numbers in the figure represent the number of employers choosing each option. According to employers' responses, the following criteria and skills are top valued:

1. Technical skills
2. Soft skills
3. Passion and strong career goal

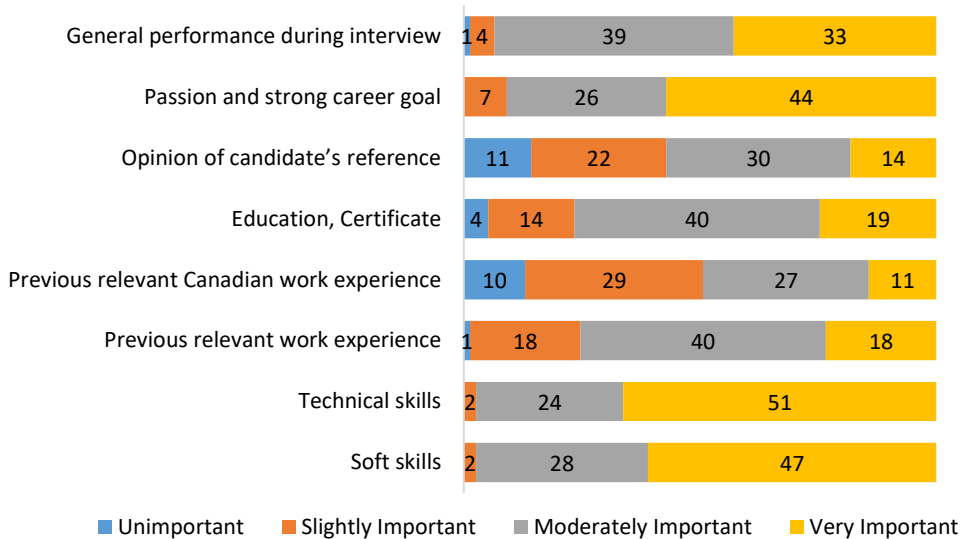
There are some other criteria that are moderately important but not the most important:

1. Education, certificate
2. Previous relevant work experience
3. General performance during interview

Employers that participated in the interviews have also mentioned a number of criteria which were not included in this question such as personality fit, cultural fit, positive attitude, willingness to learn and enthusiasm.

According to the responses, technical skills was the most important hiring criterion. One reason might be the distribution of survey participants. The majority (74.2%) of participants are companies with fewer than 100 employees. Interviews with local employers revealed that small companies prefer to hire individuals with excellent technical skills and good soft skills who can take responsibility for the job as quickly as possible. Additionally, small companies have time and budget constraints on training new employees. While on the other hand, large employers prefer to hire individuals with excellent soft skills and communication expertise to join as team members very quickly.

Figure 29. Importance of Various Criteria When Hiring New Employees



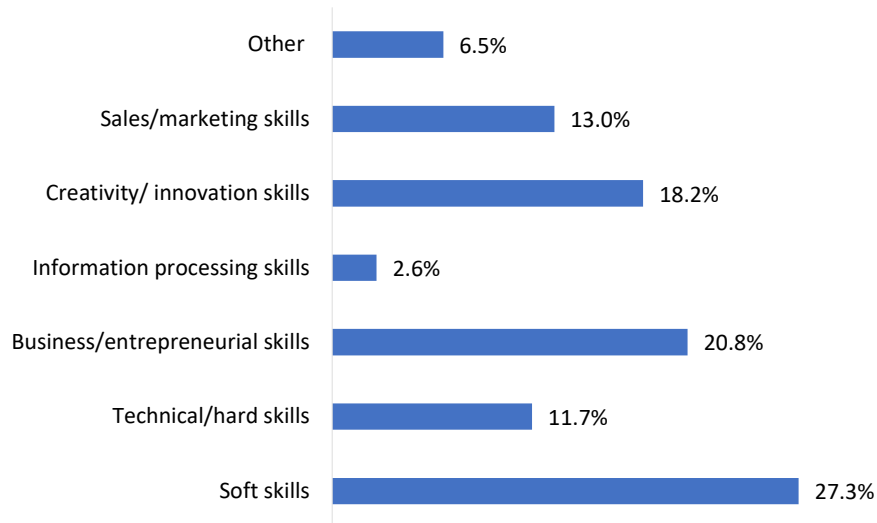
Note: Numbers represent number of employers choosing each option.

In order to figure out the future potential employment issues, employers were asked to choose the skill that was lacking among employees. As presented in Figure 30. The top three skills that were most lacking are:

1. Soft skills
2. Business/ entrepreneurial skills
3. Creativity/innovation skills

The employers, who selected other (6.5%), are mostly from small companies. These employers specified that they require individuals with multidisciplinary skills. Since they are small with limited resources, they need employees to take the responsibility of more than one duty.

Figure 30. Skill Shortages among CSD Employees



One of the objectives of this report is to identify skill gaps and explore possible ways to solve this problem. One way of finding a solution is to consult with employers and industry professionals. Since the lack of soft skills has been one of the key skill shortages for many years and in almost all industries, employers were asked to select the most effective way of solving this issue (Figure 31). The largest portion (36.4%) of employers believe that offering relevant courses at universities and colleges would be very beneficial to improve soft skills among employees. The second largest group (28.6%) hold the view that offering training courses at work would help to solve the problem. A quarter of the respondents hold relatively optimistic views and think the gap will be solved over time at the workplace.

Figure 31. Potential Ways to Improve Soft Skills among Employees

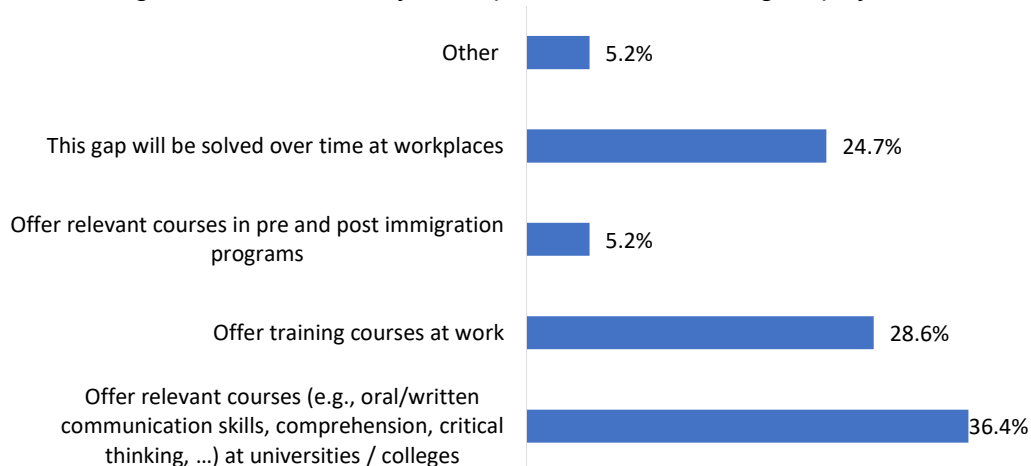
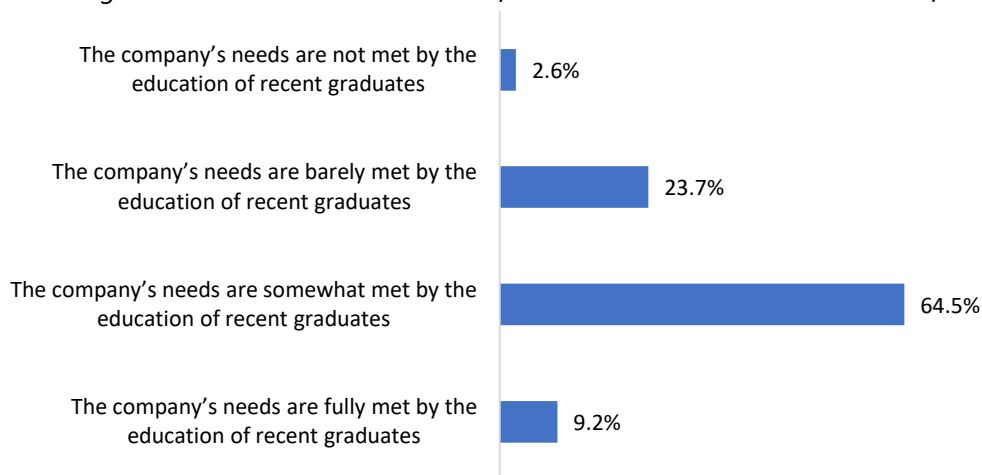


Figure 32 illustrates the alignment between the education of recent graduates and the needs of CSD employers. As seen, less than 10% of the CSD employers believed that education of recent graduates meets their needs. This implies that the CSD related programs offered in colleges and universities need to be reviewed and the needs of employers have to be taken into account when educational institutions start planning for a new program. About 65% of employers believed that their needs are somewhat satisfied and 24% specified that their needs are barely satisfied by the knowledge and education of recent graduates.

Figure 32. Alignment between the Education of Recent Graduates and the Needs of Companies



Employers were asked to rank the top three areas in the CSD industry that are most difficult to fill as shown in Figure 33. The ranking scores do not exhibit great variations. As seen, the areas that have average scores equal to or greater than two are:

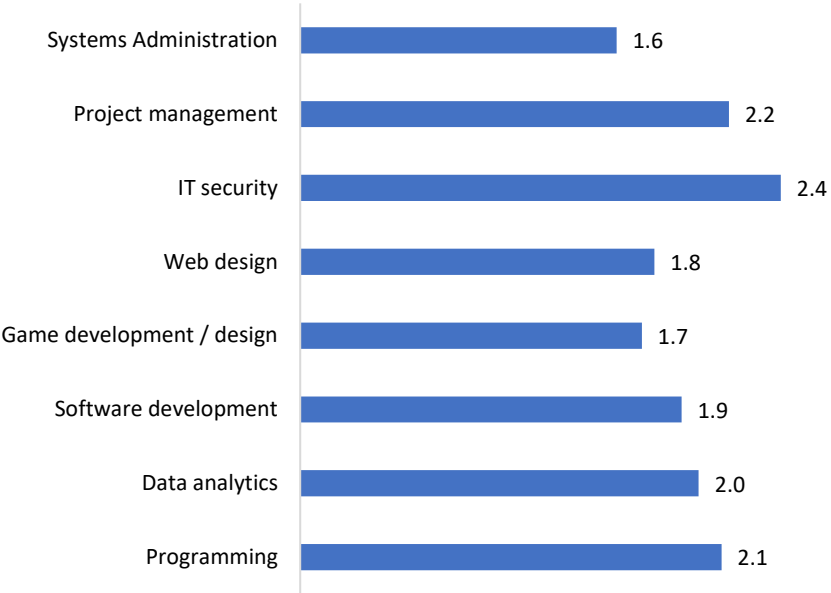
1. IT security
2. Project management
3. Programming
4. Data analytics

These findings are consistent with the interview results from local CSD employers. In addition to these occupations, the interviewees have mentioned the following occupations as the high demand and hard to fill occupations:

1. Data science
2. Sales engineer
3. Content management system analysis
4. Cloud computing architecture
5. DevOps engineer
6. Machine learning

These are emerging occupations, which require specialized skill sets. As a result, it is very challenging for employers to find a candidate with relevant experience and expertise.

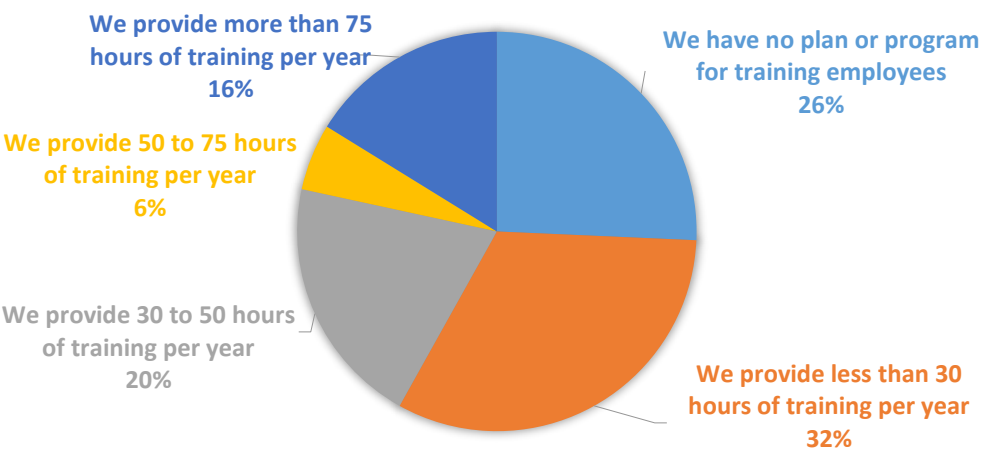
Figure 33. Difficult to Fill CSD Occupations



Training and enhancing knowledge and skills are identified as one of the key elements of success and progress in many occupations, especially in CSD jobs that require high levels of skill and expertise. As a result, employers were asked to determine their current capacity for training employees.

As seen in Figure 34, a considerable portion (74.3%) of companies provide training to employees. In companies that have capacity for training, a majority (52.7%) could provide less than 50 hours of training and a minority (21.6%) provide over 50 hours of training per year.

Figure 34. Employers' Current Capacity for Training Employees



As stated by the interviewees, the main reason for providing training is the fast changing environment of the CSD industry. Innovation is the driving engine at this industry. Companies that are innovative or adopt innovation quickly are the ones that can survive and remain profitable. As a result, to keep employees’ knowledge and skills up to date, the majority of employers provide training.

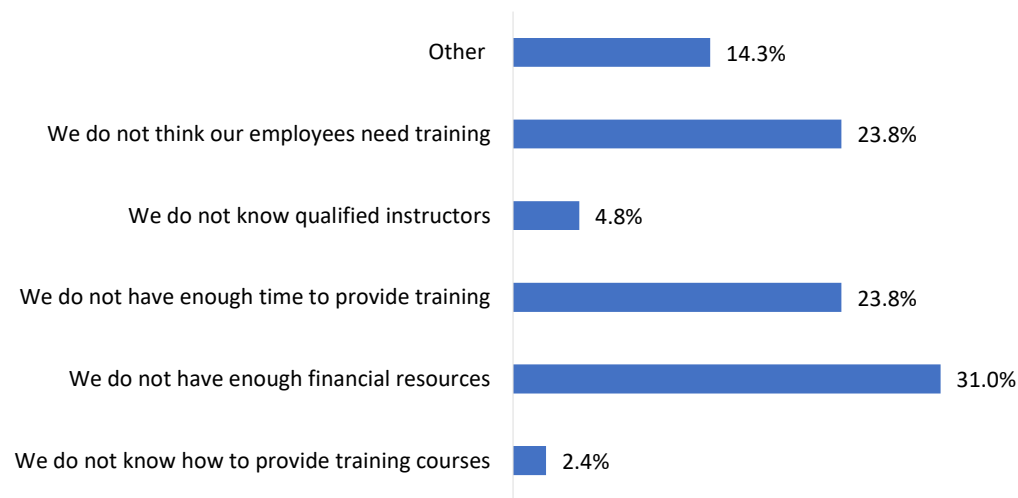
It is important to consider that results of this question might not represent the opinions of local CSD employers very accurately. There is a higher probability that employers obtained through educational partner organizations are more familiar with available support and training programs for businesses offered by these institutions. Those employers obtained by other means may have little or no knowledge of those supports.

The employers who provide 30 hours or less, or no, training then were asked to choose the main reasons for not providing the training (Figure 35). The top three reasons are:

- 1. Scarcity of financial resources
- 2. Shortage of time to provide training
- 3. Lack of need for training

Other reasons specified by employers are mostly related to cost or time for training during working hours and the fact that on the job training is planned as needed based on the different projects.

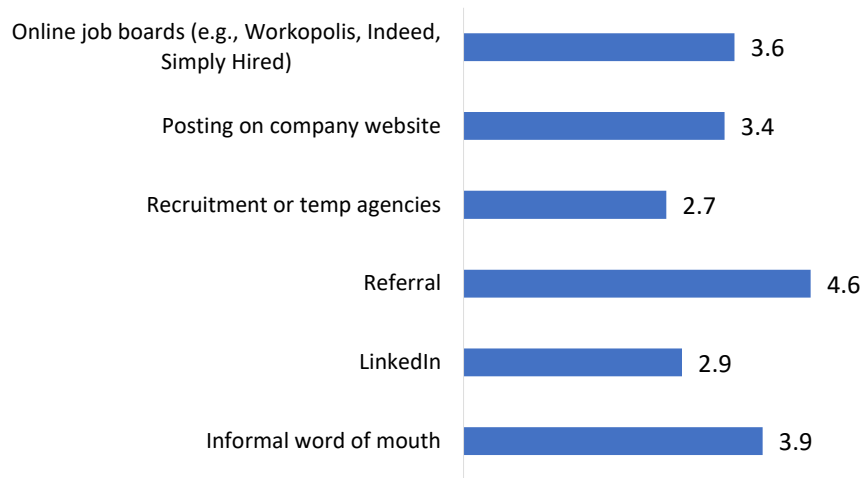
Figure 35. Reasons for Providing No or Less than 30 Hours of Training



In addition to hiring challenges and training needs, sourcing of qualified candidates is another challenge in hiring new employees. Although, there are various methods of advertising a job, some ways are more effective and more popular among local employers. Hence, in this survey, employers were asked to rank from 1 to 6 the sourcing methods for hiring in terms of their preference, where 6 indicated the most preferred and 1 indicated the least preferred method. As

shown in Figure 36, overall, in the CSD industry, referral, informal word of mouth, and online job boards are the most preferred ways for recruiting. For small and medium sized firms, the most preferred methods are referral and informal word of mouth, and for large firms are posting on the company website and referral.

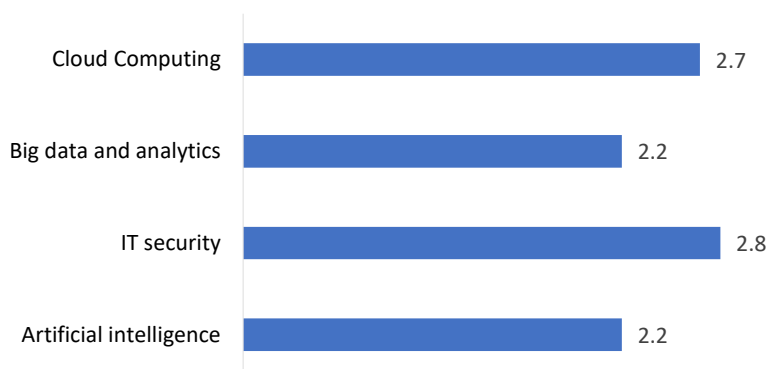
Figure 36. Most Preferred Sourcing Methods for Hiring (Numbers are Average Ratings)



Note: 6 indicates the highest rating score and 1 indicates the lowest rating score

As mentioned earlier, CSD is a growing and fast changing industry and as a result, some of its occupations are expected to become very demanding in the near future. In the consultation with working group members some areas of occupational growth were highlighted. Then, in order to test the findings in a bigger sample size, the survey respondents were asked to rank from 1 to 4 the fastest growing CSD occupations based on their future needs, where 4 indicated the fastest growing occupation. Figure 37 illustrates the fields in the CSD industry that are most expected to grow in the next five years. As was expected, the scores were close, since all of the options were among the fastest growing occupations. Cloud computing and IT security were ranked the highest and big data and analytics and artificial intelligence were ranked the lowest.

Figure 37. CSD Occupations that Are Expected to Grow Over the Next Five Years (Numbers are Average Ratings)



Note: 4 indicates the highest rating score and 1 indicates the lowest rating score

One of the challenges in the CSD industry is employee retention rate. As mentioned by interviewees, there is always a risk of losing a good employee, since there is a variety of employment options available through competitors within or outside the country. For instance, Silicon Valley, which is a hub for CSD and IT professionals, offers a wide range of high paid and high quality employment. As a result, it is very important to invest in the domestic CSD industry and support existing companies to continue their business and retain their employees. It is also important to consider that small and medium sized businesses face more problems regarding employee retention compared to large corporations. The main reason is that they do not have enough financial supports and capabilities to offer high quality employment.

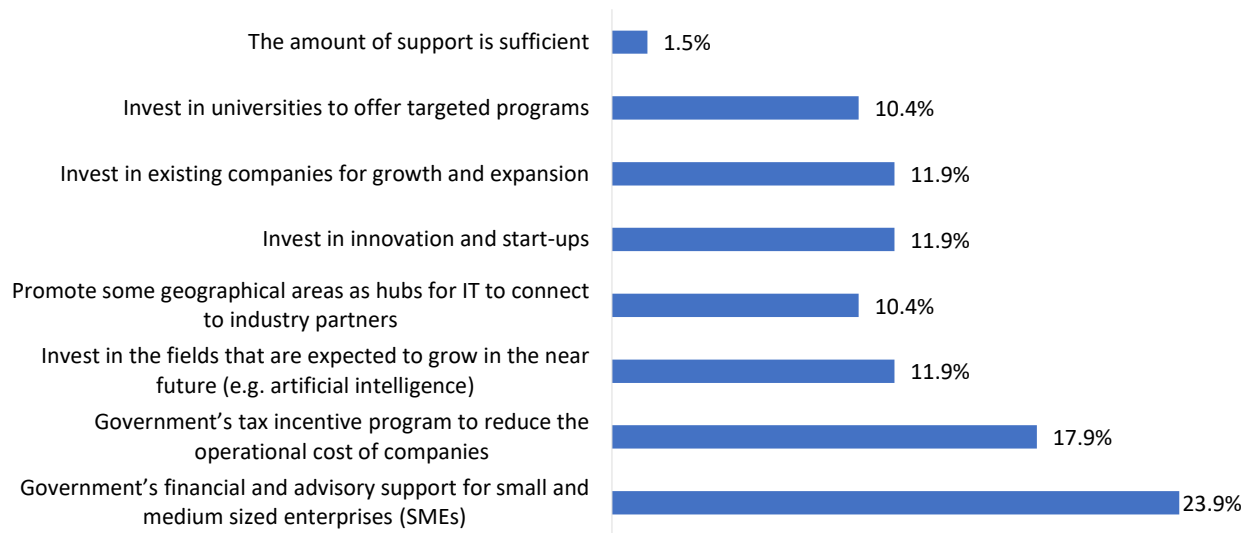
Overall, growth of the CSD industry results in better employment quality and a higher retention rate. This growth will not happen unless the share of private and public investments in innovation and creativity increases. Regarding the retention issue, employers were asked about possible ways to help the Canadian CSD industry absorb and retain CSD professionals and IT talents. Among options listed in Figure 38, the top five areas that were identified as the most effective ways to help the Canadian CSD industry are:

1. Government's financial and advisory support for small and medium sized enterprises (SMEs)
2. Government's tax incentive program to reduce the operation cost of companies
3. Invest in existing companies for growth and expansion
4. Invest in innovation and start-ups
5. Invest in fields that are expected to grow in the near future (e.g. artificial intelligence)

Only 1.5% of respondents believed that the amount of support is sufficient.

One reason that government financial and advisory support for SMEs was chosen as the first option is that the majority (74.2%) of survey respondents are small and medium size companies.

Figure 38. Potential Ways to Support Canadian CSD Industry to Absorb and Retain CSD & IT Talents



It is important to note that around 28% of the respondents did not answer the last two questions. As a result, some caution should be taken in interpreting the results.

Due to the scarcity of appropriate CSD & IT talents in Canada, it is getting more and more important for companies to retain senior CSD & IT professionals in order to remain competitive in the market. In order to get insights on employee retention factors, employers were asked to rank the top three factors that create the most difficulty in retaining employees. Based on the survey results that profiled in Figure 39, the top three factors are:

- 1. Competitive pay or wage rate
- 2. Job dissatisfaction
- 3. Worker poaching

Lack of pension and benefits and the duration of a job are the least important factors affecting employee retention.

Figure 39. Factors that Create the Most Difficulty in Retaining Employees

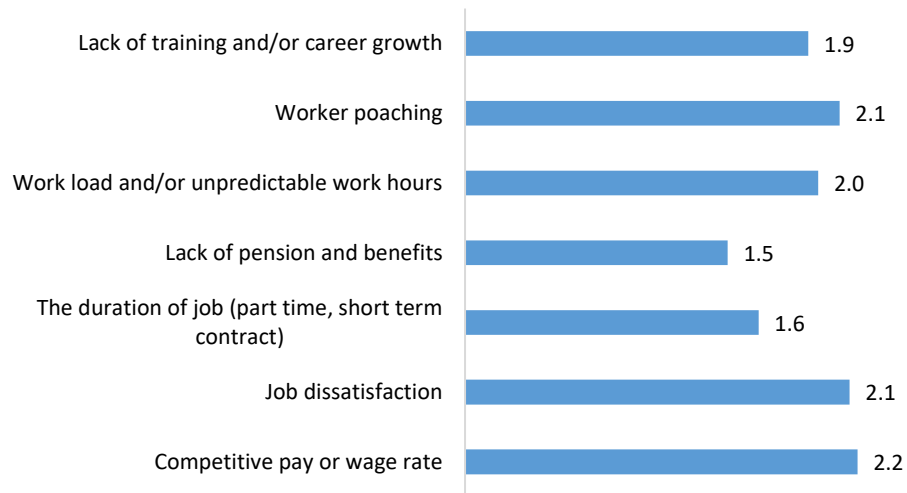
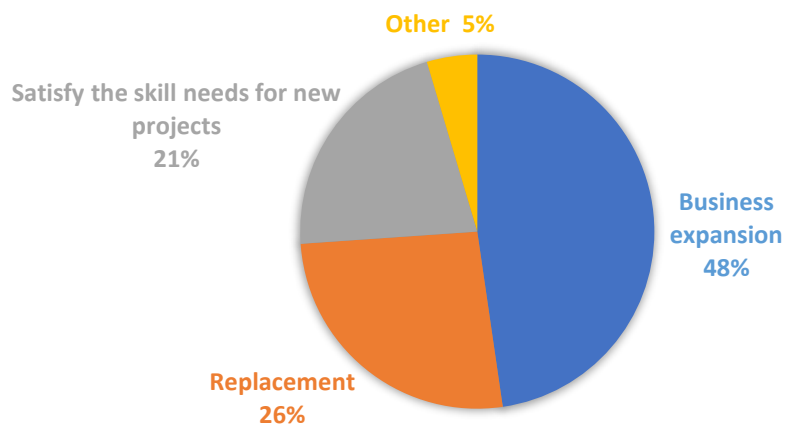


Figure 40 illustrates the common reasons for CSD companies or departments to hire employees. Forty-eight percent (48%) of the employers hire new employees for the purpose of business expansion and 47% of the recruitments are for the purpose of replacement or to satisfy the skill needs of new projects.

Figure 40. Common Reasons for Hiring a New Employee



As the survey reached the end, the number of skipped questions increased. Due to the 30 per cent non-response rate in the last two questions, some caution should be taken in generalizing the results.

Interview findings:

In addition to the survey findings, there are some findings that were obtained through interviews with local employers. Some parts of these findings are presented along with interpretation of survey results where the survey and interview questions were similar. The following are the findings from questions that were included only in the interviews:

1. Some employers preferred to hire individuals with Canadian educational backgrounds and experience as compared to internationally trained professionals due to one/some of the following reasons: (Not all internationally trained professionals have the following skill shortages)
 - Lack of communication skills
 - Lack of ability to present their qualifications and expertise
 - Lack of willingness to remain with the employer after a few month (especially when the job does not quite match with their expertise and when they find higher paying jobs)
 - Lack of knowledge about the Canadian CSD industry and Canadian workplace culture.

The overall conclusion about immigrant hiring challenges is that the majority of local employers, especially large corporations, are willing to hire internationally trained professionals; however, they are mostly willing to hire individuals with experience working for well-known brands or multinational corporations. The main reason is that employers can better understand and assess candidates' expertise.

To solve this problem, some companies introduced technical assessment tests in their recruitment processes to give all candidates equal chances to show their expertise.

A second issue that was mentioned by employers, especially for customer facing positions, was a lack of experience in the Canadian context.

2. The new and emerging occupations (e.g. DevOps engineer) are hard for employers to fill, since there is a lack of candidates with certain levels of experience at those areas. New graduates also are not normally aware of these jobs or they do not have enough information about the required qualifications for and the duties of those jobs.
3. Innovation is the key factor to make the Canadian CSD industry competitive. The proximity to the US market has had some negative effects on retention of CSD and IT talent in the domestic market. To make the Canadian market more appealing, companies should support innovative ideas.
4. Job seekers and individuals who want to be successful in the current and future CSD industry should acquire hybrid skills, since the in-demand skill sets are continuously changing. Nowadays educational degrees or even relevant experience is not enough to proceed in the CSD job market. In some CSD occupations, technical skills is only one of

the skill sets required for the job. Other skill sets such as negotiation, marketing, customer interaction, project management and project assessment are also required to get the job.

5. According to employers' point of view, the most important factors that make employees remain in a company are job satisfaction, career development opportunity, company culture, learning opportunity, team collaboration and compensation.
6. There are two different points of view among employers about hiring IT talents. One group believed that governments should give immigration preference to bring in IT people from all around the world and another group believed that Canadian/local resources should be given priority. Overall, the number of employers who are willing to hire talent from all around the world including Canada was much higher than the other group.

Recommendations

The purpose of this section is to advise how local employers, educational institutions and industry associations can act effectively to solve the current problems of the CSD industry by working collaboratively. Although there are several other recommendations that could be beneficial to the CSD industry such as policy changes, they are not aligned with the objectives of this report. This report aims to offer recommendations that can be implemented at the community level with the help of local institutions and agencies.

Promote Entrepreneurship

As mentioned earlier, CSD is a service based industry that sells expertise. The only factor that assures continuous growth in such industries is innovation. Generally, the industry growth happens when companies expand their businesses or new firms enter the market. However, business expansion and the formation of new businesses cannot guarantee sustainable industry growth without investing in innovation. Innovation can differentiate the businesses and increase their competitive advantages in the market place.

In order to support innovation and promote entrepreneurship, the following suggestions are recommended:

1. Well established companies can hire individuals with entrepreneurial mindsets for their current or new positions. This will help them to look at their problems through a new lens and find innovative ways to fix them. Unfortunately, some employers believe that it is a costly investment and they prefer to hire someone who can do the job as quickly as

possible to save time and money. Although, it looks costly in the short-run, it will be a successful investment in the long-run. This approach will increase companies' competitiveness and prosperity in an ever-changing industry like CSD.

2. Start-ups are one of the focal points of innovation and can make a huge difference in local economies. Lack of financial and advisory support are the most common challenges reported by entrepreneurs which can be addressed through government support. However, in addition to these supports, new businesses need to be recognized and appreciated for their hard work, outstanding innovation, fast growth, hiring local workforce, industry contribution, etc. This culture will encourage hard work resulting in faster growth and prosperity. Moreover, it will help create industry connections resulting in new business opportunities. As an example, this kind of support can be realized by organizing industry networking events hosted by municipalities, industry associations, or chambers of commerce.
3. Educational institutions and industry associations in collaboration with Regional Innovation Centres such as the MaRS Discovery District, RIC Centre and Haltech Innovation Center could organize events and workshops for students and young talent to familiarize them with various aspects of being an entrepreneur. The young generation have brilliant ideas; however, they might not know how to start entrepreneurship and what types of support will be available to them. In addition to the lack of knowledge, in some cases, they do not have the right team members. Holding such events, not only enhances their knowledge about entrepreneurship, but also increases their chance to meet people with the same interest. It is important to note that although these supports are available through Regional Innovation Centres, it is recommended to make them available at the educational institution level.

Fill Skill Gap

1. Educational institutions, employers and industry associations can collaborate closely to develop programs that meet the CSD labour market needs and prepare a platform for students to gain hands-on experience. According to the survey responses and interviews with local employers, new graduates have enough knowledge but lack the applied experience. As stated by one of the employers:

"It is astounding the number of applicants that have the education, but do very poorly on our technical screening test"

Based on the analysis conducted in this report, work experience, obtained through co-op or summer internship is critical to finding career opportunities in the CSD industry after graduation.

2. Although the majority of employers were satisfied with the theoretical knowledge of recent graduates, more than 26% stated that their needs are barely met or not met by the knowledge of fresh graduates. As a result, in order to prepare the young generation for future career opportunities and nurturing the labour supply, it is essential to provide targeted training in colleges, post-secondary institutions or professional associations to meet new labour market needs in the CSD industry. As an example, new technologies such as cloud computing and cyber security require niche skill sets and some of the emerging technologies such as Fintech, and Internet of Things (IoT) require professionals with good combinations of computer skills and business knowledge.

Increase Training Hours

According to the survey results and interview responses, more than 55% of local employers provide no or less than 30 hours of training per year. Since CSD and IT are highly dependent on specialized skill sets, maintaining workforce knowledge and keeping skills up-to-date is crucial and requires ongoing training. A part of this training should be provided by employers (in the form of on-the-job training or formal training), and a part could be obtained through attending courses or working toward a designation. According to the Conference Board of Canada¹⁹, organizational spending on learning and development has slightly increased since 2010; however, it is approximately 40% lower than its historical high 20 years ago. This issue has been affecting the industry for years and it has caused an increasing shortage of qualified labour. Training dollars are future investments especially in fast growing and ever-changing industries. As stated by one local employer:

"It is difficult to find good talented individuals. This IT industry is going to transform in next 5 years and people need to enhance their skills."

If all companies increase their employee training budgets, the whole industry will eventually benefit from a more experienced labour force.

According to survey responses, the primary reason for less spending in training is insufficient financial resources, as stated by survey respondents. It is helpful to inform employers about current government funding programs (e.g., Canada Ontario Job Grant (COJG)) to support training of new and existing employees. It is suggested that industry associations with the help of Employment Ontario organize informational events to inform employers about available financial support programs. Interviews with employers revealed that the majority of small and

¹⁹ Learning and development outlook 2014

medium sized enterprises (SMEs) are not aware of these support programs. Since more that 98% of local businesses are SMEs, such informational events will have a significant impact on promoting the employee training in this industry.

Facilitate Hiring Global Talent

Historically, the CSD industry has relied on international talent to fill gaps in the local CSD labour market. In 2016, more than 350,000 (40%) of the information and communication technology (ICT) employees [in Canada] were immigrants²⁰. Immigrants play key roles in local technology sector development; however, there are some barriers to them getting hired in the CSD industry. According to interviews with job seekers, it is very challenging for them to compete with local talent who have the advantage of Canadian education and work experience. Although most of the immigrants have international work experience and the CSD knowledge and skills are uniform across the globe, some of them find it difficult to demonstrate their skills to local employers. It is suggested to promote immigrant employment support programs such as bridging programs to help the immigrant talent become familiar with the Canadian CSD industry, meet with employers, and make connections. In addition to networking opportunities, it is recommended that professional associations and industry leaders design a series of qualification exams relevant to major CSD and IT occupations. This will help to assess the level of expertise in immigrant job seekers and will eventually help to create a pool of prescreened candidates that is accessible for all employers. Using the talent and skill sets of internationally trained professionals will be beneficial to fostering the labour market in the CSD industry and solve skill shortages and skill mismatch problems.

Develop Succession Plan

As shown in Table 3 (page 20), over the next five years, the number of retirements will increase, suggesting more CSD jobs to be filled which was also indicated through interviews with employers and recruitment agencies. The decline of the number of experienced and expert professionals will impact the knowledge based service industries. If companies do not take action to prepare themselves, the number of unfilled positions will rise in the near future. As a result, it is suggested that CSD professional associations in collaboration with experienced business advisors provide advisory services for companies who are at the risk of losing experienced employees. These services can assist companies to develop a succession plan based on their current situation and create a platform for knowledge transfer from senior employees

²⁰ ICTC (2016), Digital Economy Talent Supply: Immigration Stream
Page | 52

to a group of prescreened and high potential employees. Developing such plans will prevent chaos in case of retirement of a key employee and will work as a career ladder for internal employees to get promotion and take the responsibilities of higher-level positions.

Conclusion:

This research has attempted to identify the gaps, shortages and challenges in the Professional, Scientific and Technical Services (PST) industry and its subsector Computer System Design and related services (CSD) in the Peel and Halton regions. The emergence of the knowledge economy and technology advancement increased the importance of PST and CSD industries over time. PST and CSD are two of the main contributors to the Peel and Halton economies, however, limited information about local labour market issues in these industries is available. This report has contributed to filling this important gap by providing valuable information about PST and CSD labour market trends, and gaps at the provincial and regional levels.

The majority of challenges which were highlighted in this research are not limited to Peel and Halton regions, and they are similar to those in Toronto CMA and Ontario. The report also has provided recommendations to improve local labour market outcomes in the CSD industry. Although there is room for improvement in some current programs/policies to support employment in the CSD industry, the intention of this report was to make recommendations that could be implemented at the community level.