

Stacking Up:

A snapshot of Canada's
developer talent

December 2017



AUTHORS

CREIG LAMB Senior Policy Analyst

Creig is a Senior Policy Analyst at the Brookfield Institute. Prior to joining BII+E, Creig held research roles with Toronto Artscape and Economic Development and Culture at the City of Toronto. Creig also worked for Public Works and Government Services Canada for several years, designing and implementing communications strategies and materials. Creig holds a Master of Public Policy from the University of Toronto and a Bachelor of Communications from the University of Ottawa.



creig.lamb@ryerson.ca

The Brookfield Institute for Innovation + Entrepreneurship (BII+E) is a new, independent and nonpartisan institute, housed within Ryerson University, that is dedicated to making Canada the best country in the world to be an innovator or an entrepreneur.

BII+E supports this mission in three ways: insightful research and analysis; testing, piloting and prototyping projects; which informs BII+E's leadership and advocacy on behalf of innovation and entrepreneurship across the country.

ISBN: 978-1-926769-79-0

In partnership with



DAVID RUBINGER Data Scientist, Polar

David is a collaborator with the Brookfield Institute and data scientist at Toronto-based tech company Polar, where he leads and executes the organization's data analysis and statistical learning projects. He was previously an economist at the Department of Finance Canada, providing economic and financial analysis that underpinned Canada's participation at the International Monetary Fund and G20. He holds a master's degree in economics from the University of Toronto and a bachelor's degree in biology from McGill University.




david@polar.me

For more information, visit brookfieldinstitute.ca

 /BrookfieldIIE

 @BrookfieldIIE

 The Brookfield Institute for Innovation + Entrepreneurship

 [See an interactive map on our website](#)

20 Dundas St. W, Suite 921
Toronto, ON
M5G 2C2

ACKNOWLEDGEMENTS

Annalise Huynh, Policy Analyst
Matthew Seddon, Former Policy Analyst
Asher Zafar, Policy, Strategy + Analytics Fellow
Sarah Doyle, Director of Policy + Research

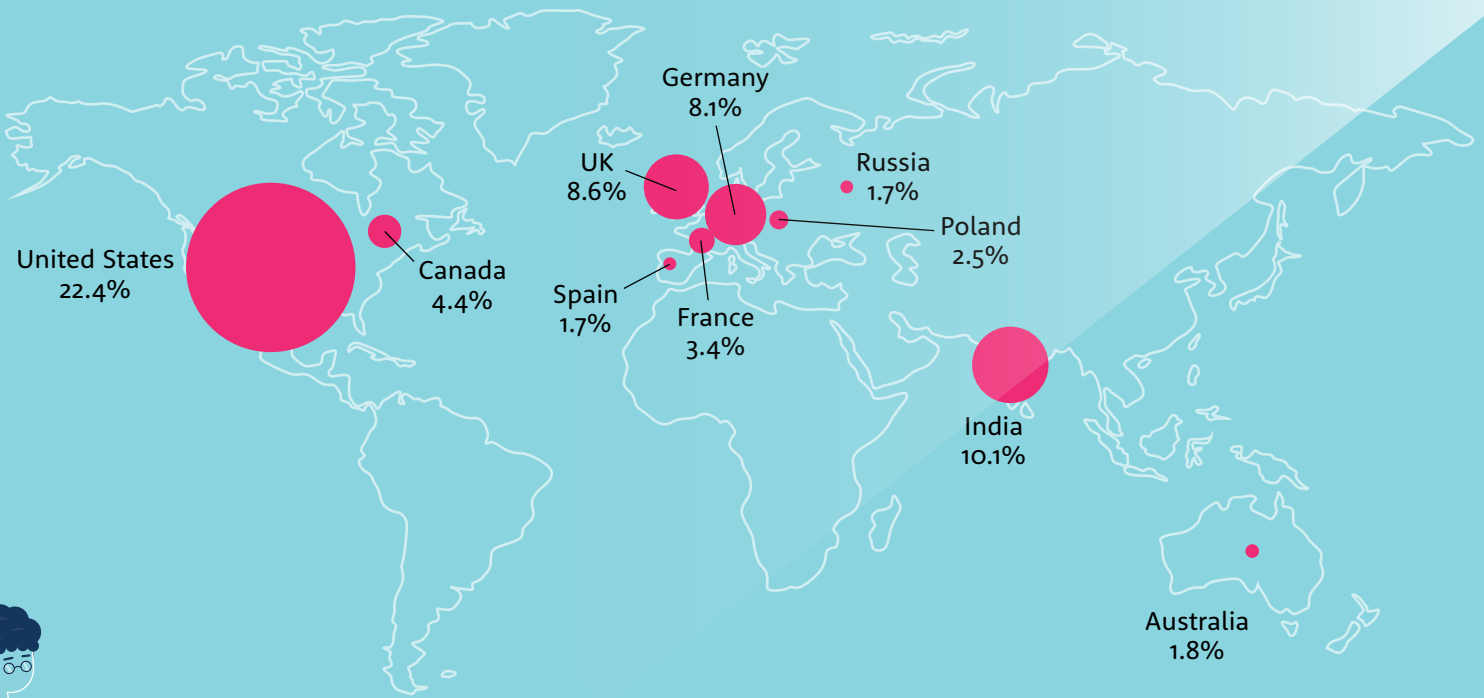
TABLE OF CONTENTS

Executive Summary	2	How Do Developers Fare in the Labour Market?	35
Profile of Canadian professional developers	4	Canadian developers are employed predominantly in full-time roles	35
Introduction	5	Being a developer in Canada is a lucrative career	36
Data Sources	7	Most full-time developers aren't pursuing other jobs	39
Annual Developer Survey data	7	How Are Developers Building Skills?	42
Web traffic data	7	Developers rely on a mix of formal and informal education	42
External validity	8	Who Are Canada's Developers?	49
Expert interviews	8	Canada's developer talent pool is predominantly male	49
Where Are Canada's Developers?	9	Developers lack ethnic and racial diversity	52
Canada is a major and growing source of developer talent internationally	9	Conclusion	53
Ontario is Canada's provincial hub for developer talent	12	<hr/>	
Canada's developers are most concentrated in major cities	14	Appendix: Developer Roles	57
Toronto has one of the largest and fastest growing developer talent pools globally	17	Endnotes	59
What Do Canadian Developers Do for a Living?	19		
Developers work in a multitude of roles	20		
Cities across Canada specialize in different types of software development	22		
Canada's developers "speak" many languages	25		
Canadian developers are staying up-to-date with popular programming languages	26		
Where Do Developers Work?	29		
Canada's developers work in organizations of all shapes and sizes	29		
From software to healthcare, developers can be found in industries across the economy	31		

EXECUTIVE SUMMARY

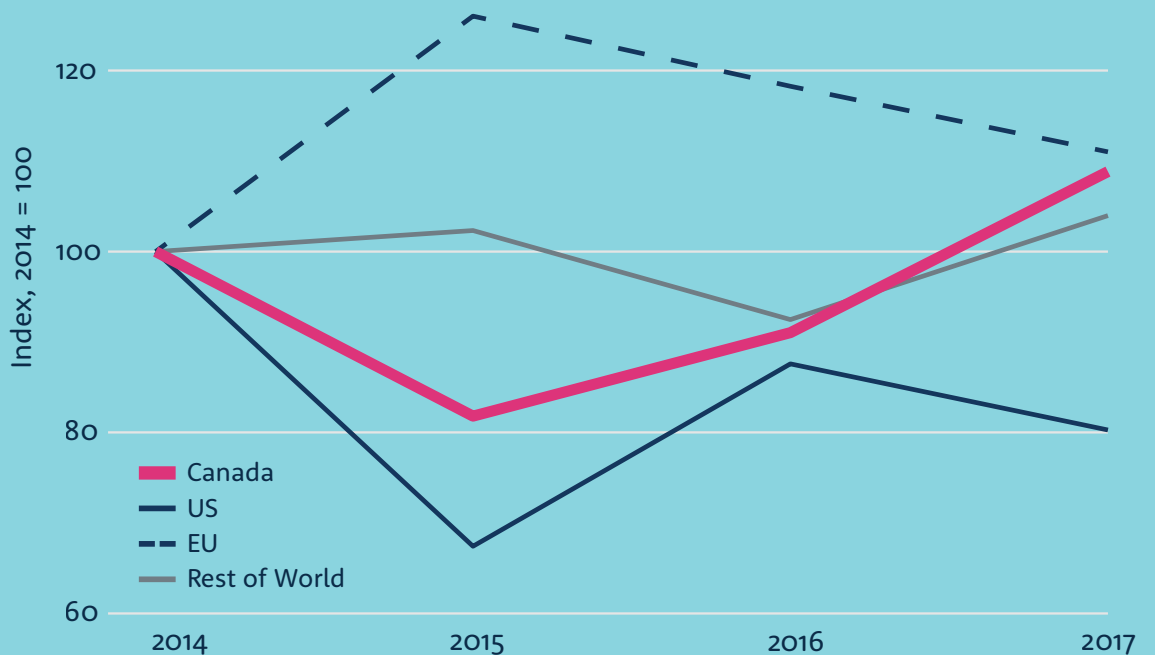
SHARE OF DEVELOPERS AMONG TOP 10 COUNTRIES, 2017

% of survey respondents



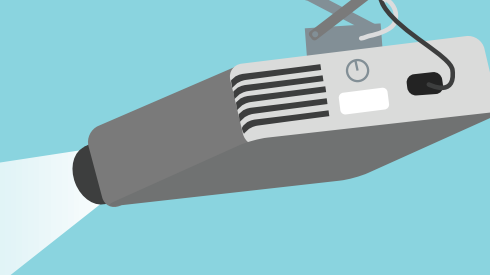
SHARE OF DEVELOPERS AMONG COUNTRIES/REGIONS OVER TIME, 2014–2017

Index of % of survey respondents, 2014 = 100



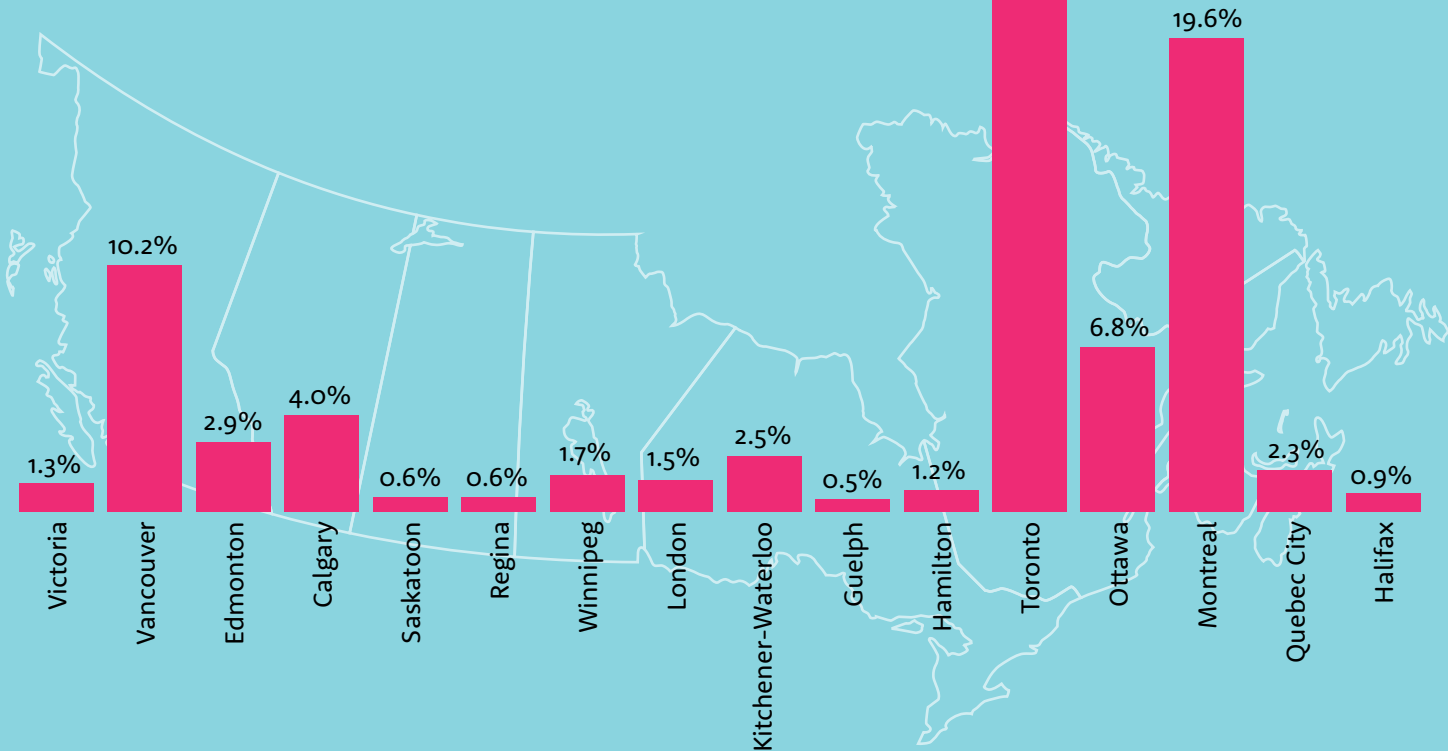
Sources: 2014–2017 Annual Developer Surveys; BII+E analysis





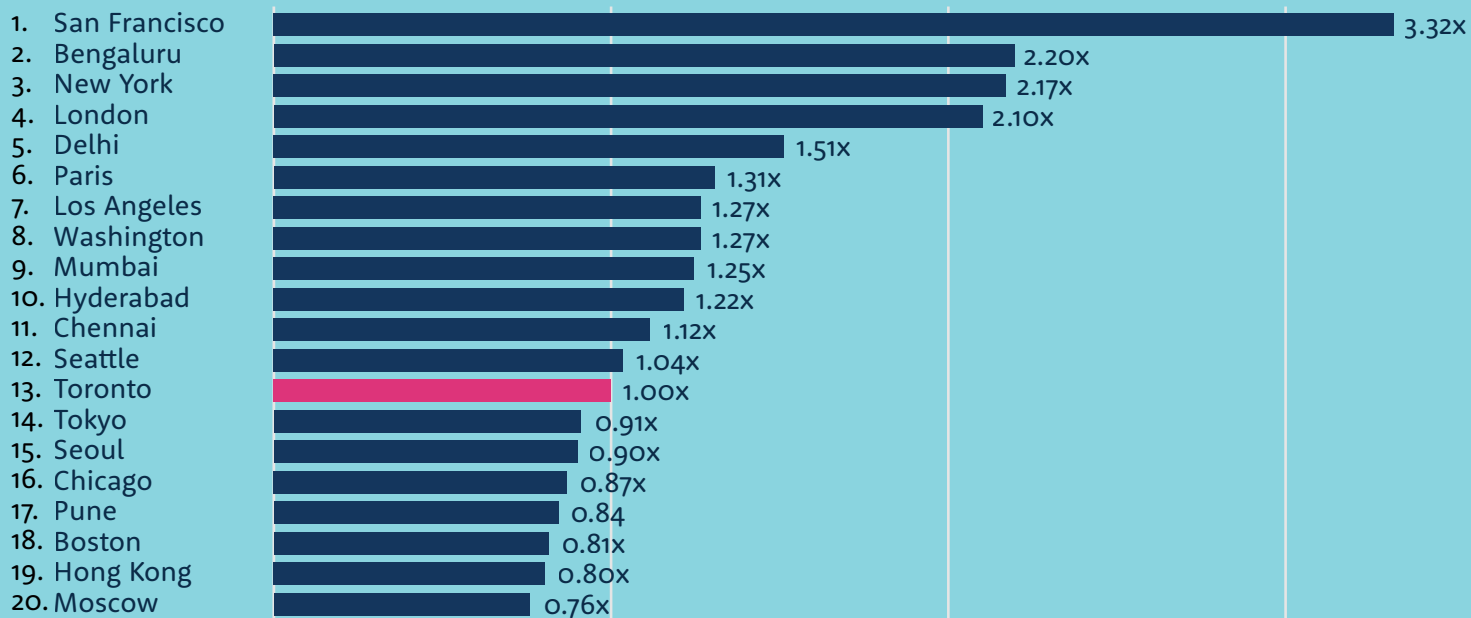
SHARE OF CANADIAN DEVELOPERS BY CITY, 2017

% of web traffic to Stack Overflow



DEVELOPERS AMONG TOP 20 CITIES, 2017

Web traffic to Stack Overflow relative to Toronto traffic



PROFILE OF CANADIAN PROFESSIONAL DEVELOPERS, 2017*



85%

employed in full-time roles



C\$70,000

median salary



Over

72%

identify as web developers



More than

two thirds

of web developers classified themselves as full-stack developers



90%

reported using more than one programming language, while half reported using four or more



JavaScript

is the most commonly used language



95%

have at least some college or university education



60%

reported being at least partially self-taught and over one quarter had taken an online course



Primarily work in the software and internet or web services industries, but many work in other sectors such as finance, media and healthcare



9%

identified as female

83%

identified as white or of European descent

* Based primarily on Stack Overflow's 2017 Annual Developer Survey

INTRODUCTION

In 2015, the tech sector contributed \$117 billion or 7.1 percent of Canada's total economic output, employed 864,000 Canadians, and was by far the largest private sector investor in research and development (R&D).



Over the past several decades, rapid technological advancement has transformed everything from how we move and interact to what we do for work. Technology has improved living standards, created and transformed jobs across the economy, and given rise to entirely new industries. Against this backdrop, Canada's tech sector has developed into an economic powerhouse, contributing to prosperity and employment across the country and across sectors.

Last year, BII+E released [*The State of Canada's Tech Sector, 2016*](#), which for the first time defined and examined the impact of Canada's tech sector. We found that this dynamic sector spanned well beyond digital technology companies, encompassing everything from aerospace to life sciences. In 2015, the tech sector contributed \$117 billion or 7.1 percent of Canada's total economic output, employed 864,000 Canadians, and was by far the largest private sector investor in research and development (R&D).¹

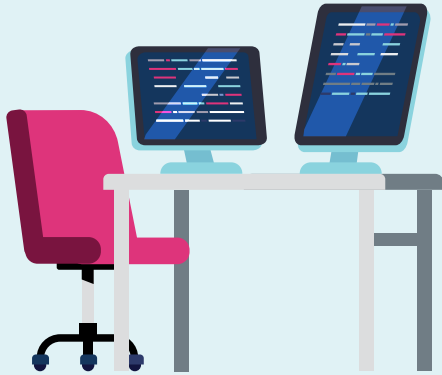
Beyond the tech sector, digital technologies are increasingly being leveraged by companies across the Canadian economy. This shift is fueled by a diverse, highly-skilled talent pool. This report will closely examine one critical component of Canada's tech talent: software developers. Developers have a variety of digital skills and take on many different roles, ranging from web and mobile app developers to data scientists and machine learning specialists. They vary widely in the languages they use, the companies they work for, and the industries they work in. Collectively, they form the technical backbone of technology-driven organizations throughout the country.

Since this profession is rapidly evolving, it has become difficult to gain a current and detailed understanding of it from national labour market statistics, which tend to be based on occupations that are updated infrequently rather than on specific skills and knowledge. For a more up-to-date and granular picture of the developer landscape in Canada, we partnered with Stack Overflow, who has provided us with rich datasets that help identify where Canadian developers work, what kinds of jobs and industries they work in, which languages they use, what they earn, and who they are. While this dataset does not provide a complete picture, it offers more immediate and detailed insights into this talent segment than are found in official data sources.

This report aims to provide policymakers, businesses, and Canadians across the country with a better understanding of this important segment of Canada's labour market, to inform decisions about employment and training, as well as employer talent acquisition strategies and location decisions. It can also help developers understand how they fit into the broader ecosystem and how they compare to their peers.

The Brookfield Institute will continue to explore alternative data sources to shed light on Canada's evolving labour market. In a context of rapid change, data that can complement traditional labour market information is critical to understanding the supply of and demand for specific skills, as well as the characteristics and development pathways associated with particular skill sets and jobs.

Founded in 2008, [Stack Overflow](#) is the largest and most trusted online community for developers to learn, share their knowledge, and build their careers. More than 50 million professional and aspiring programmers visit Stack Overflow each month to help solve coding problems, develop new skills, and find job opportunities.



The principal provider of data for this report is Stack Overflow—a widely-used website where software developers go to ask questions, share their knowledge, and search for jobs. It draws over 50 million visitors a month and an average of seven visits a month per user.

This report mainly draws on two data sources provided by Stack Overflow: (i) its Annual Developer Surveys;² and (ii) traffic to the Stack Overflow website.

ANNUAL DEVELOPER SURVEY DATA

Stack Overflow has conducted annual surveys of its users stretching back to 2011. We largely focus our analysis on the most recent 2017 edition. The 2017 survey was conducted between January 12 and February 6, 2017 and was completed by 64,000 developers worldwide, 2,223 of which were from Canada. The survey posed over 100 questions on topics including work, programming languages, education, salary, and demographic background.

While Stack Overflow is a crucial resource for many developers, its users and survey respondents are not perfectly representative of the broader developer community. Since the site

The principal provider of data for this report is Stack Overflow—a widely-used website where software developers go to ask questions, share their knowledge, and search for jobs.

is predominantly in English, its user base will likely overrepresent English-speaking developers; within Canada, for example, this could cause an underrepresentation of French-language developers in Quebec. Moreover, the survey was completed on a volunteer basis, which may make it less representative. Sample sizes in the survey are also often too low to draw reliable conclusions. Caution should therefore be exercised when projecting the survey results and analyses to the broader population of developers.

WEB TRAFFIC DATA

We also use data on traffic to Stack Overflow’s website from late January to early March 2017 from select countries, provinces, and cities around the world. Site visitors were considered to be developers if they had visited Stack Overflow three times over a 28-day period and if Stack Overflow was able to statistically estimate what kind of developer role they fill.* The strength of this data source is in providing information on developers at a more granular geographic level.

* For web traffic-based comparisons between Canadian and international cities, the criterion of being able to estimate a visitor’s developer role was not applied.

Web traffic data contains some of the representativeness issues present in the survey datasets. It also has some from technical problems, such as occasionally overcounting users if they connect to the website from multiple devices, or if Stack Overflow’s statistical models classify users into multiple developer roles—all putting an upward bias on the total number of visitors to the site. Again, caution should be exercised in generalizing the data and analyses from this source to the broader developer population.

We often use the term “developers” when describing either survey respondents or website visitors. The types of developers engaging with Stack Overflow in these different ways do not necessarily reflect the same developer community, or the developer population at large. We attempt to clearly disclose which data source an insight is derived from.

EXTERNAL VALIDITY

To test the external validity of the survey data, several of its labour force and demographic statistics are compared with a composite of six National Occupation Classification (NOC) Codes from Statistics Canada that most closely resemble developers, comprising:

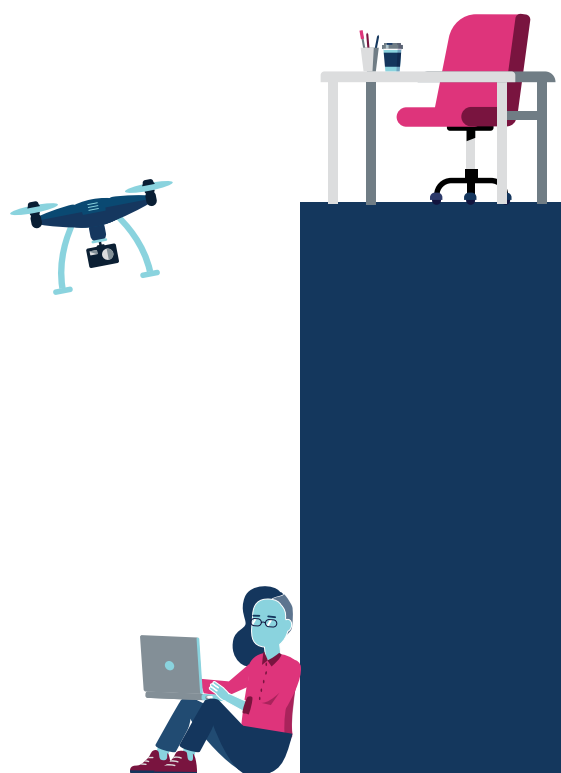
- + Software engineers and designers (code #2173)
- + Computer programmers and interactive media developers (code #2174)
- + Web designers and developers (code #2175)
- + Database analysts and data administrators (code #2172)
- + Computer network technicians (code #2281)
- + Mathematicians, statisticians and actuaries (code #2161)

EXPERT INTERVIEWS

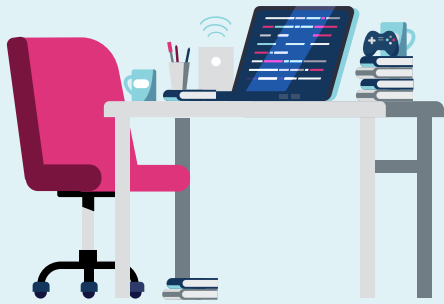
To gain more personal insight into who Canada’s developers are, we asked industry experts including company founders, Chief Technology Officers (CTOs), developers, and user experience (UX) designers for their perspectives on the profession. Questions included: which regions are perceived to be the most attractive places to work, the best avenues through which to acquire skills, and the types of employers—and employees—that they tend seek out. We obtained 15 responses from experts across Ontario and Quebec: seven from founders and CTOs, and eight from developers and UX designers. Insights from these interviews are captured in quotes throughout the report.

DATA ANALYSIS CODE

In the aim of transparency, reproducibility, and collaboration, all the code and public data used for the analysis in this report can be found on GitHub (<https://github.com/BrookfieldIIE/developer-talent-map/tree/master/report>). We encourage you to review our work and build off our analysis to develop further insights.



WHERE ARE CANADA'S DEVELOPERS?



Canada is the fifth most represented country in terms of developer talent internationally.

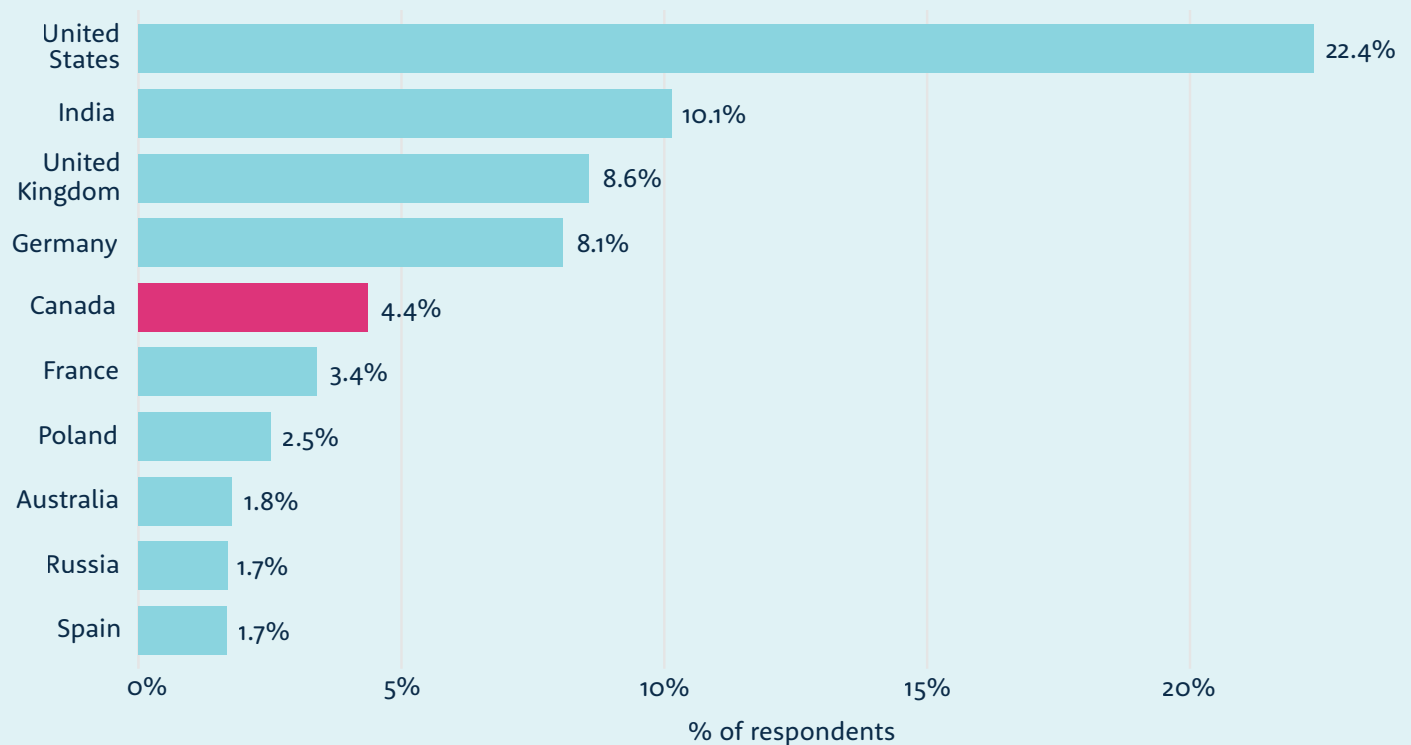
Canada is home to a significant and growing share of global developer talent. Toronto leads the country in both number and concentration of developers, and has one of the fastest growing developer talent pools internationally.

CANADA IS A MAJOR AND GROWING SOURCE OF DEVELOPER TALENT INTERNATIONALLY

Canadians accounted for 4.4 percent of developers in Stack Overflow's 2017 Annual Developer Survey, making Canada the fifth most represented country in terms of developer talent internationally.

Share of Developers Among Top 10 Countries, 2017

% of survey respondents



Sources: 2017 Annual Developer Survey; BII+E analysis

51,252 responses

Note 1: Non-responses omitted.

Note 2: This likely overestimates Canada's share of all developers globally, however, given that engagement with Stack Overflow's website and survey are biased towards English-speakers.

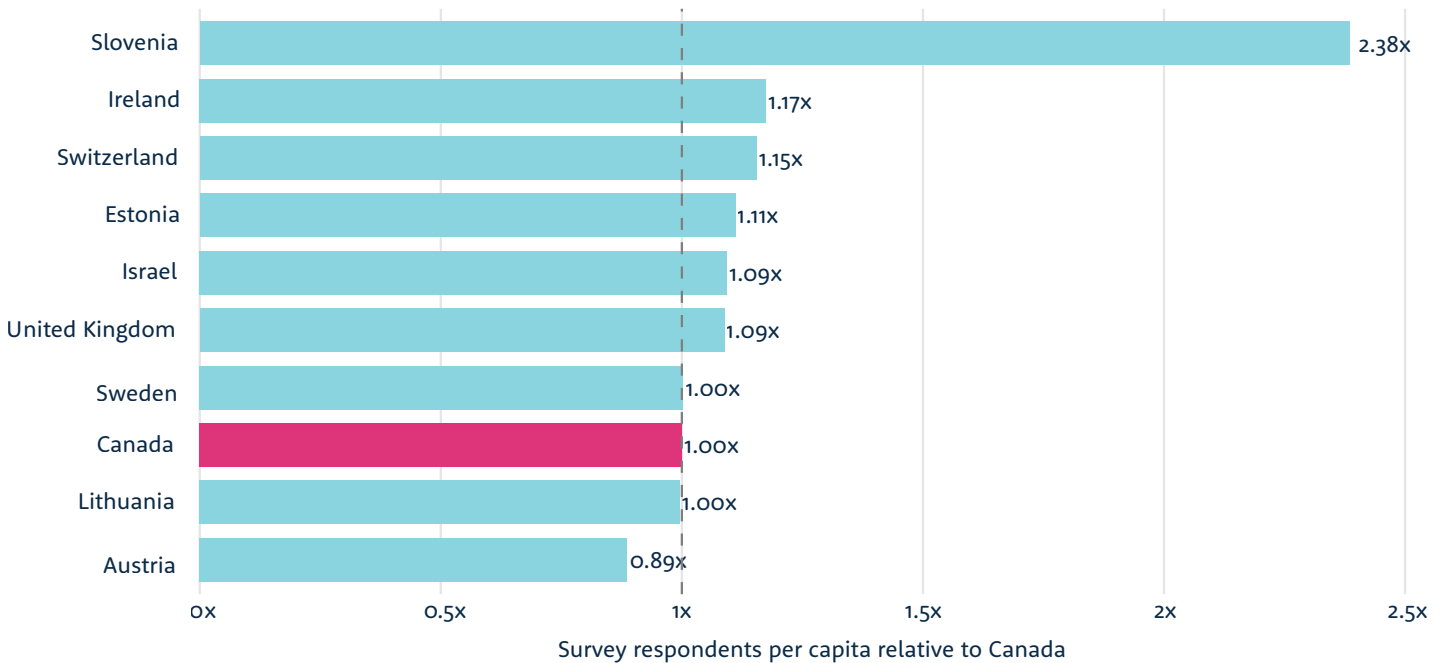
In addition to having a large aggregate developer population, Canada has a relatively high national concentration of developer talent. Canada had the eighth most survey respondents per capita (out of 80 countries with a minimum of 50 respondents), and Canada's share of developers worldwide was both more than eight times its share of the world's population (0.5 percent in 2016)³ and more than triple its share of global gross domestic product (1.4 percent in 2016).⁴

Canada's share of developers globally has now grown in two consecutive annual surveys for a total increase of 33 percent from 2015. Of the 15 most represented countries in the survey since 2015, no other country has surpassed Canada's growth.*

* Representation since 2015 is defined as a country's average share of survey respondents over 2015-2017.

Developers per Capita Relative to Canada Among Top 10 Countries, 2017

Ratio of country's survey respondents per capita to Canada's survey respondents per capita



Sources: 2017 Annual Developer Survey; World Bank; BII+E analysis.

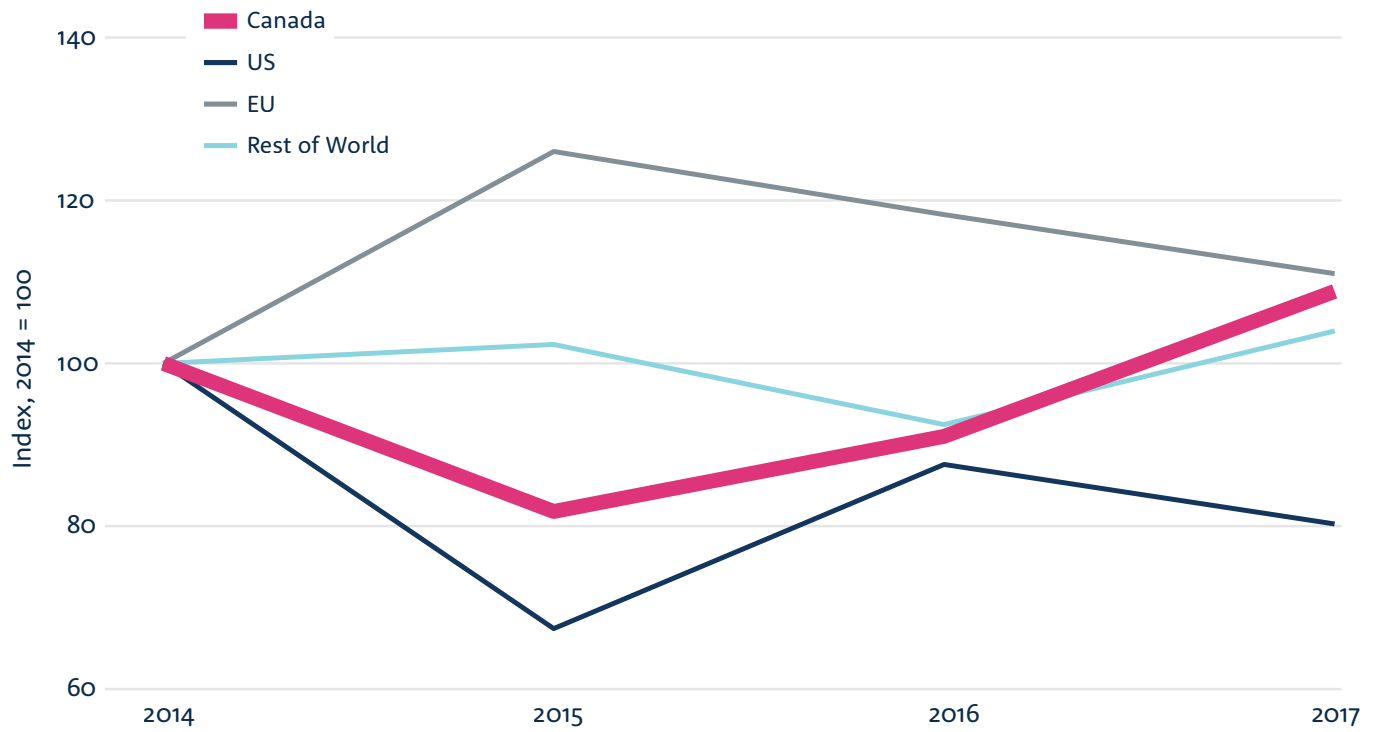
Note 1: Population as of 2016.

Note 2: Minimum 50 responses per country.

Note 3: 80 countries in sample.

Share of Developers Among Countries/Regions Over Time, 2014–2017

Index of % of survey respondents, 2014 = 100



Sources: 2014–2017 Annual Developer Surveys; BII+E analysis.

Note: Non-responses omitted.

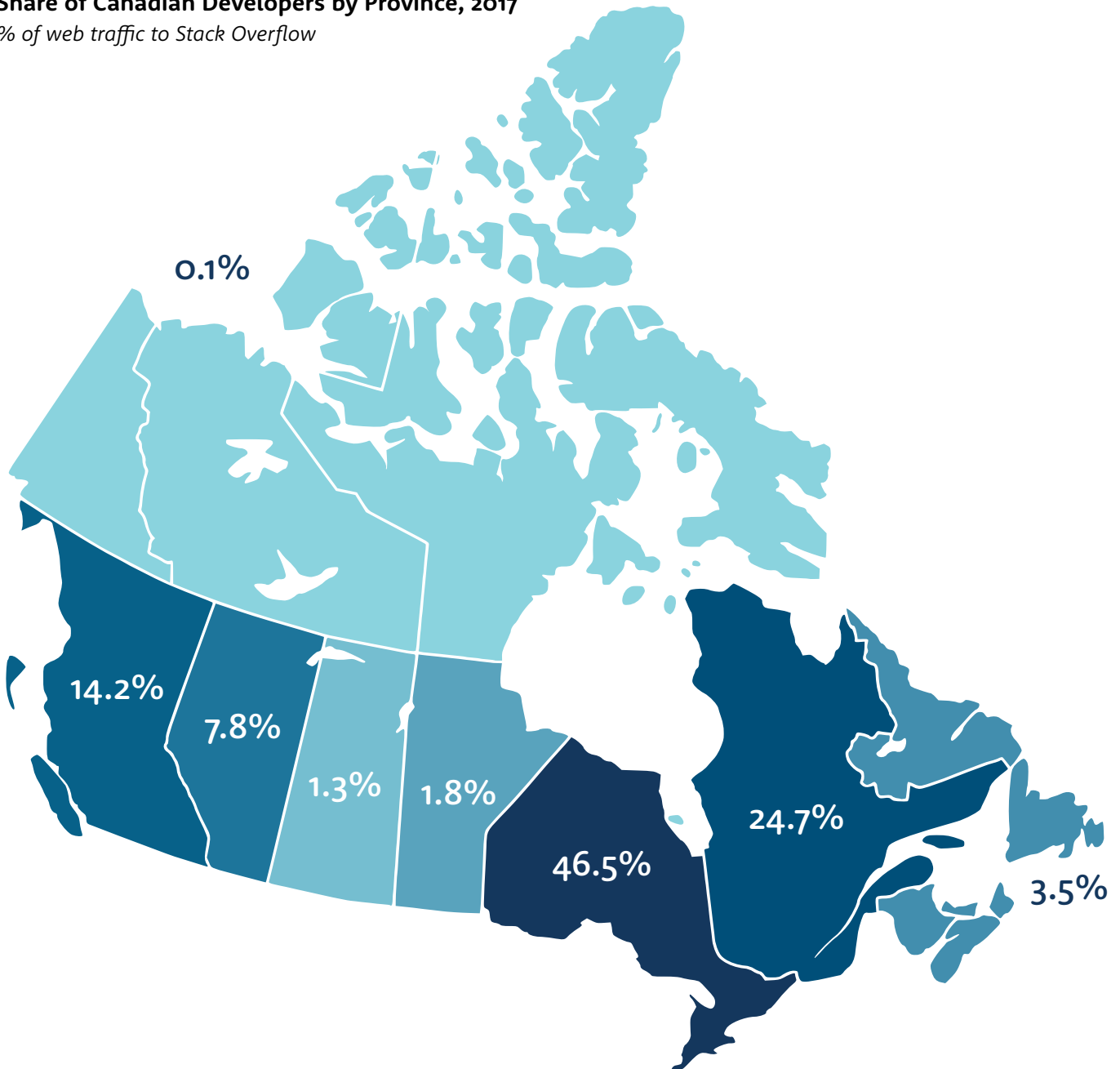
ONTARIO IS CANADA'S PROVINCIAL HUB FOR DEVELOPER TALENT

Ontario accounted for nearly half (46 percent) of all Canadian traffic to Stack Overflow's website in early 2017. This share exceeds Ontario's share of total national employment by 20 percent—the highest among all provinces—suggesting that Ontario's economy may be more specialized in developer talent than any other province.⁵

However, web traffic data may underestimate the number of developers in Quebec since Stack Overflow is an English-language website.

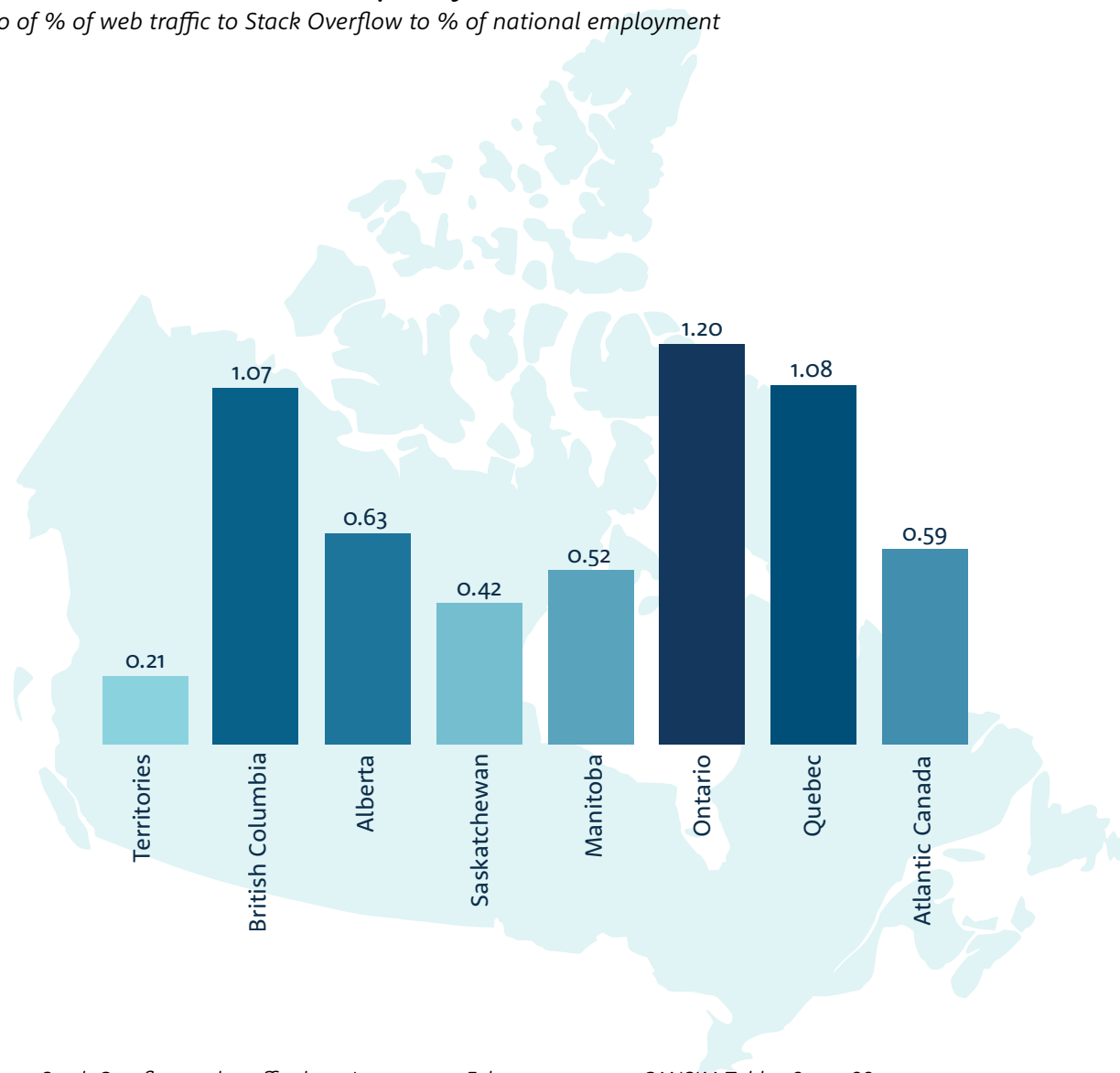
Share of Canadian Developers by Province, 2017

% of web traffic to Stack Overflow



Concentration of Canadian Developers by Province, 2017

Ratio of % of web traffic to Stack Overflow to % of national employment



Sources: Stack Overflow web traffic data, January 24–February 20, 2017; CANSIM Table 282-0088; CANSIM Table 282-0100; BII+E analysis.

Note 1: Shares scaled down proportionally to sum to 100% due to double counting in web traffic data.

Note 2: Statistics Canada employment numbers averaged over Jan 2017–Feb 2017.

CANADA'S DEVELOPERS ARE MOST CONCENTRATED IN MAJOR CITIES

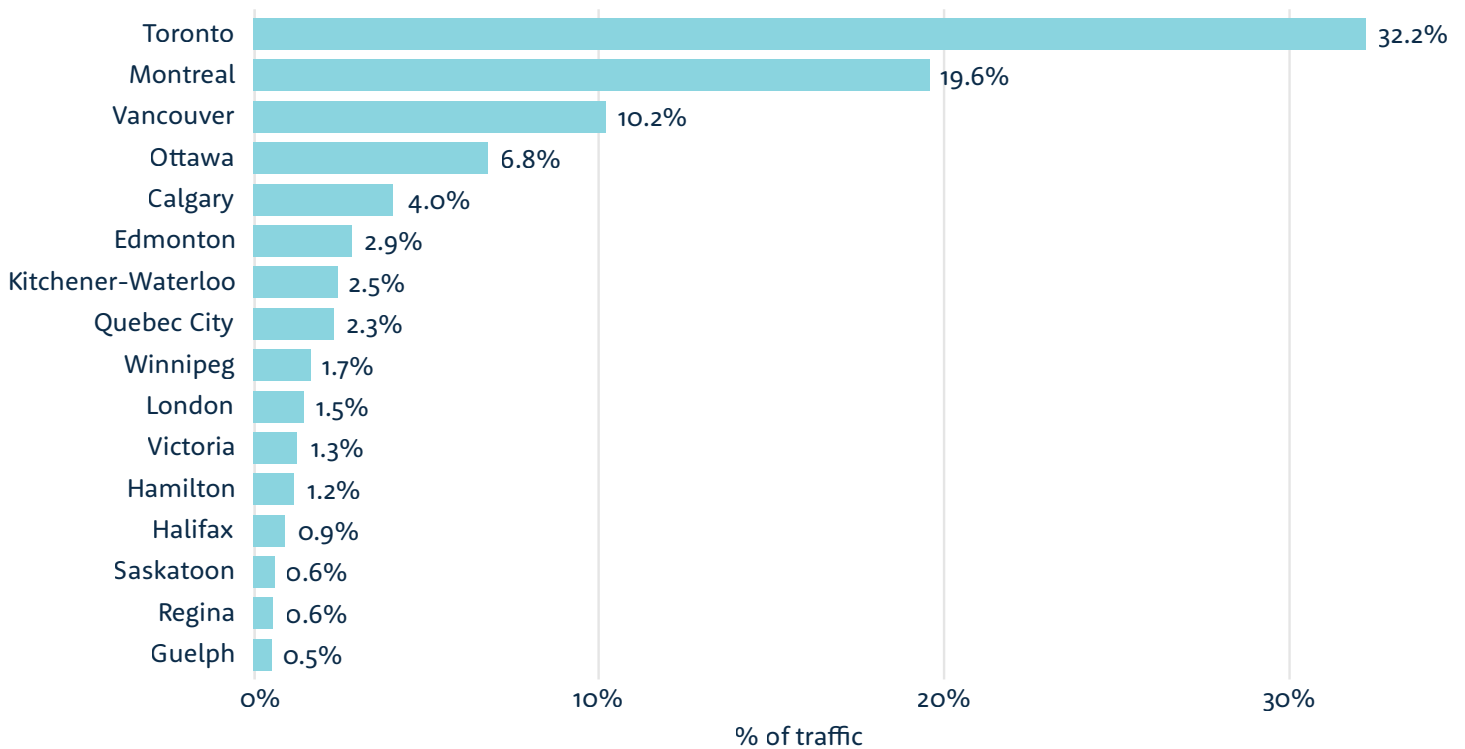
At the city level, Toronto represented over 32 percent of Canada's developer talent pool according to Stack Overflow web traffic data. Montreal and Vancouver ranked second and third respectively, and collectively accounted for nearly 30 percent of Canadian developers. These three cities accounted for roughly 62 percent of traffic to

Stack Overflow in early 2017 while only accounting for 38 percent of the country's total employment, pointing to a much greater concentration of developer talent in Canada's largest urban centres.⁶

Other Canadian cities across the country, such as Ottawa, Kitchener-Waterloo, Vancouver, Victoria, Guelph, and London also have above average concentrations of developer talent.

Share of Canadian Developers by City, 2017

% of web traffic to Stack Overflow



Sources: Stack Overflow web traffic data, January 24–February 20, 2017; BII+E analysis.

Note: Shares of web traffic were scaled down to reduce overcounting.

INDUSTRY PERSPECTIVES

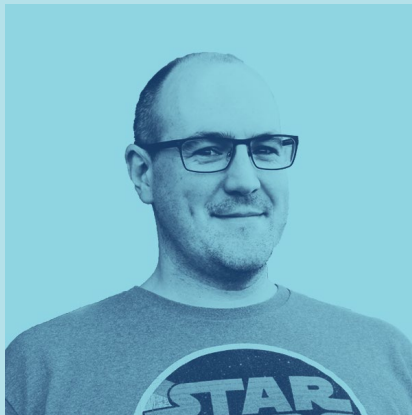


In what industries and regions are there the most opportunities for developers?

“For software developers, Waterloo Region is amazing. There’s quite a large local tech community here with tons of [mature] companies and startups. With help from ... Communitech, local accelerator centres, and universities, this area employs a huge number of talented software developers.”

Erin Cramer

Android Developer at Bridgit



What is the quality of developers in Canada?

“I think Canada has top-quality developers. We’ve got a good schooling system, whether that’s software engineering or computer science. The University of Waterloo is known as one of the best schools in the world for these programs, and other Canadian universities and colleges are strong in this area as well (like the University of Toronto and McGill [University]). [Plus, the] co-op education available at these schools gives students hands-on experience that is so valuable when you enter the job market. It helps when our new developers come in—we know that we can throw them in the deep end.

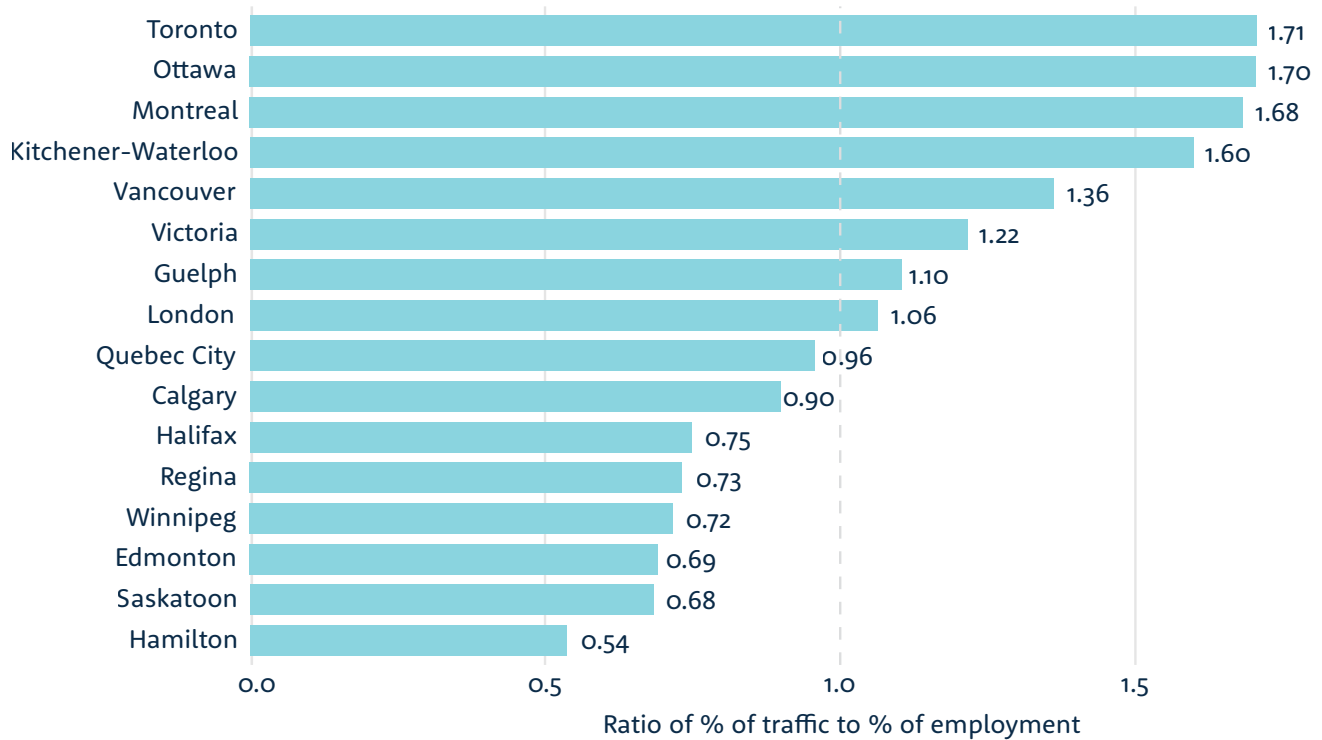
Canada also has some great hot spots that help to keep talent in the country. Montreal has a community focused on AI, Ottawa’s tech community is well established, then you have Vancouver, Toronto, and Kitchener-Waterloo. There’s lots to choose from—you don’t have to go to Silicon Valley (or even leave Canada) to get development experience.”

Andrew Lockwood

Director of Development at Bridgit

Concentration of Canadian Developers by City, 2017

Ratio of % of web traffic to Stack Overflow to % of national employment



Sources: Stack Overflow web traffic data, January 24–February 20, 2017; CANSIM 282-0135; BII+E analysis.

Note 1: Ratio calculated as city's share of Canadian web traffic to Stack Overflow divided by city's share of national employment.

Note 2: Statistics Canada employment numbers averaged over January 2017 to March 2017 and seasonally adjusted. Cities were defined on the relevant 2011 census metropolitan area (CMAs). Toronto and Oshawa CMA employment numbers were aggregated to better match the boundaries in web traffic data.

Note 3: Shares of web traffic were scaled down to reduce overcounting.

TORONTO HAS ONE OF THE LARGEST AND FASTEST GROWING DEVELOPER TALENT POOLS GLOBALLY

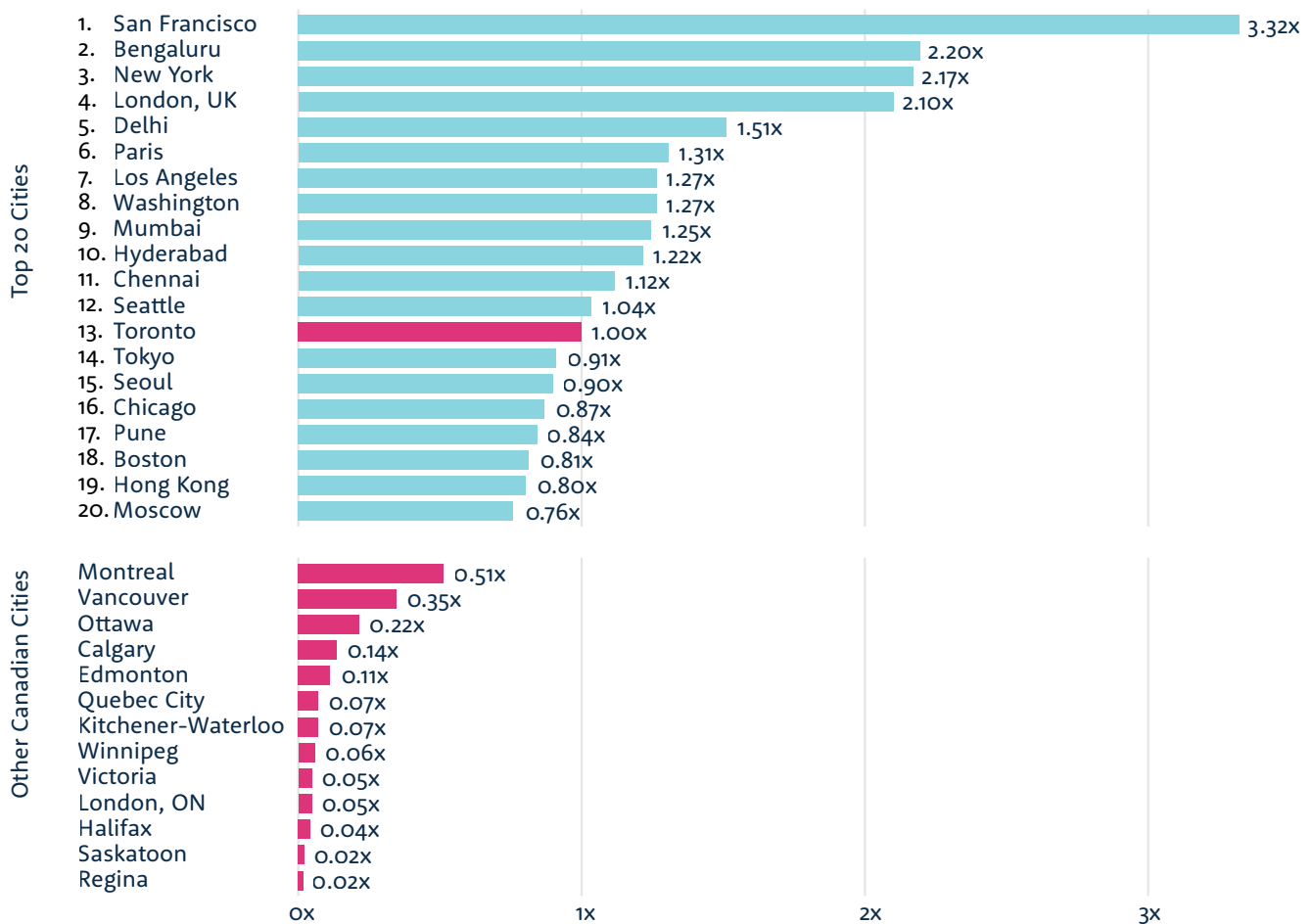
Internationally, Toronto ranked 13th among all cities in terms of number of developers based on Stack Overflow web traffic data, and was the lone Canadian city in the top 30. A number of major cities in the US and India ranked above Toronto, led by San Francisco (including Silicon Valley), which had more than triple Toronto’s volume of web traffic.

Toronto ranked fifth highest in terms of growth of developers from March 2016 to March 2017, at 14 percent, falling just behind San Francisco and ahead of New York.

Toronto is home to one of the fastest growing developer communities among international cities that are major sources of traffic to Stack Overflow. Toronto ranked fifth highest in terms of growth of developers from March 2016 to March 2017 at 14 percent, falling just behind San Francisco and ahead of New York.

Developers Among Top 20 and Other Canadian Cities, 2017

Web traffic to Stack Overflow relative to Toronto traffic



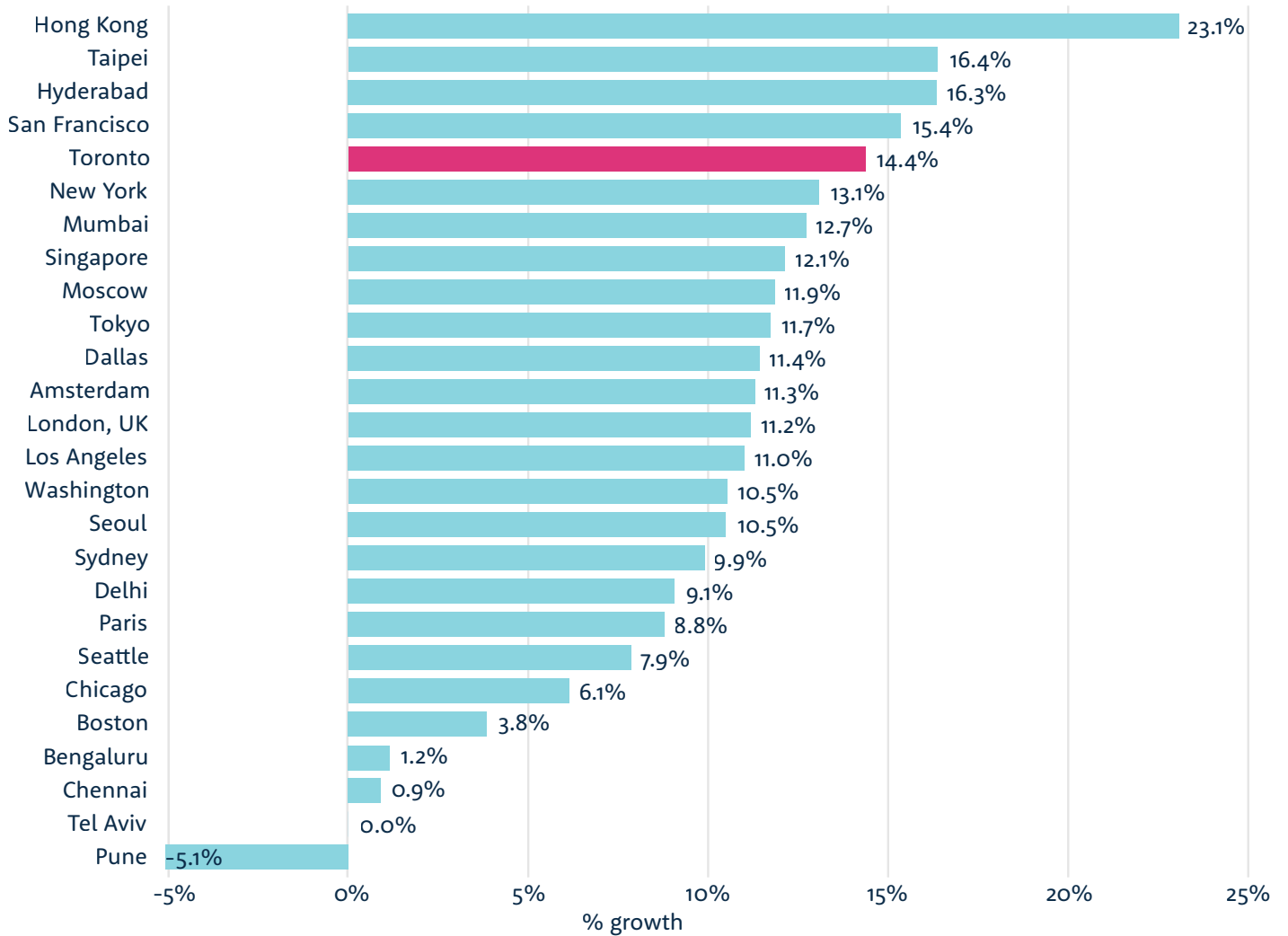
Sources: Stack Overflow web traffic data, March 1–28, 2017; BII+E analysis.

Note 1: Metro areas defined as a 30 mile radius around center of city, except for San Francisco (50 mile radius) and Waterloo (10 mile radius). Hamilton and Guelph traffic is included under Toronto.

Note 2: Hong Kong refers to Central, Hong Kong specifically.

Growth in Developers Among Developer-Populous Cities, 2017

% growth year-over-year in web traffic to Stack Overflow



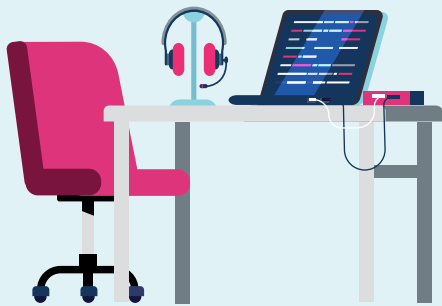
Sources: Stack Overflow web traffic data, March 1–28, 2016 and March 1–28, 2017; BII+E analysis.

Note 1: Growth in website traffic from March 2016–March 2017. Includes only cities with at least 100,000 visitors in March 2016.

Note 2: Metro areas defined as a 30-mile radius around center of city, except for San Francisco (50-mile radius) and Waterloo (10-mile radius).

Note 3: Hong Kong refers to Central, Hong Kong specifically.

WHAT DO CANADIAN DEVELOPERS DO FOR A LIVING?



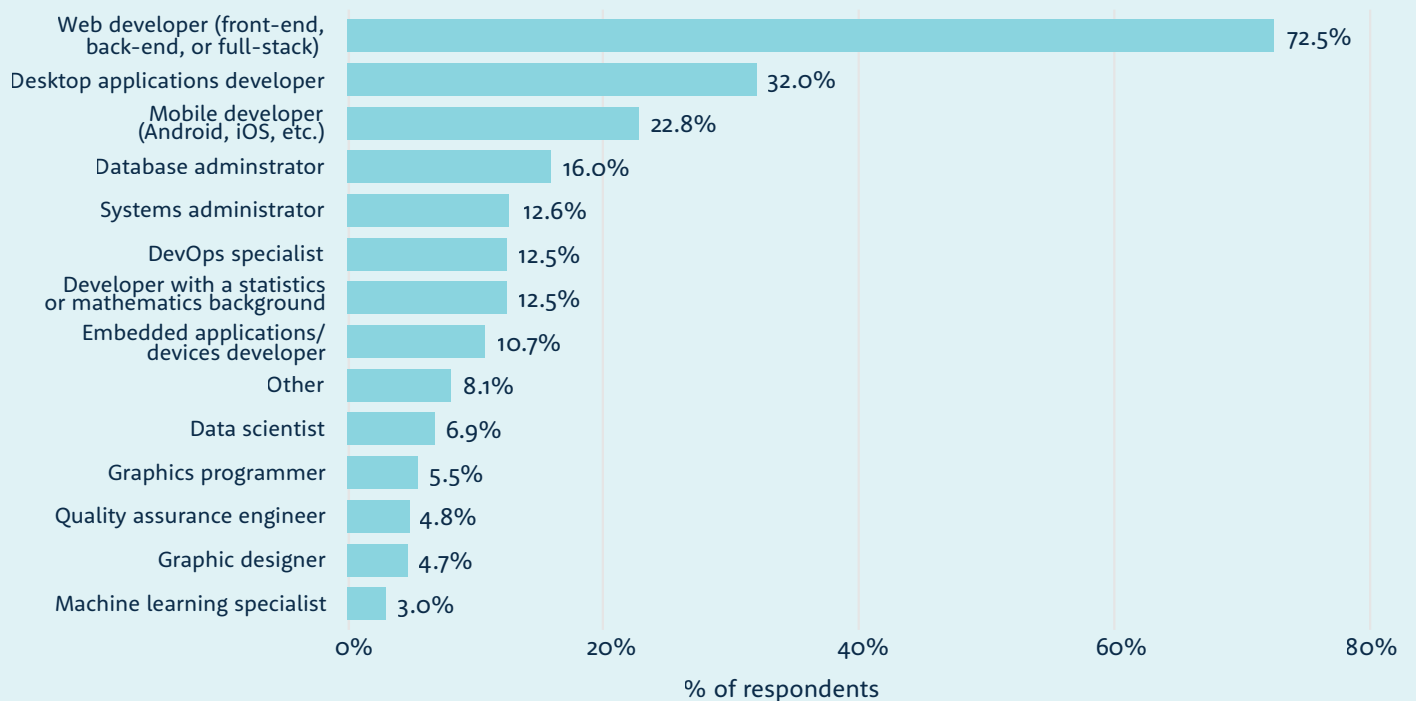
Over 72 percent of professional developers in Canada identified as web developers, making it more than two times more common than any other role.

Developers in Canada vary significantly in terms of what they do on a day-to-day basis. While the majority of Canadian professional developers work in web development, they also take on other roles ranging from mobile developers to machine learning

specialists, with the majority (over 54 percent) identifying with more than one role. Canadian professional developers also use a variety of languages; most use more than one.

Share of Canadian Professional Developers by Role, 2017

% of survey respondents



Sources: 2017 Annual Developer Survey; BII+E analysis.

1,605 responses

Note 1: Respondents could pick more than one occupation they identify with, and therefore shares will not add up to 100%.

Note 2: Only professional developers included.

DEVELOPERS WORK IN A MULTITUDE OF ROLES

The majority of Canadian respondents to Stack Overflow's 2017 Annual Developer Survey were professional software developers (72 percent), followed by students (16 percent), and professional non-developers (8 percent).

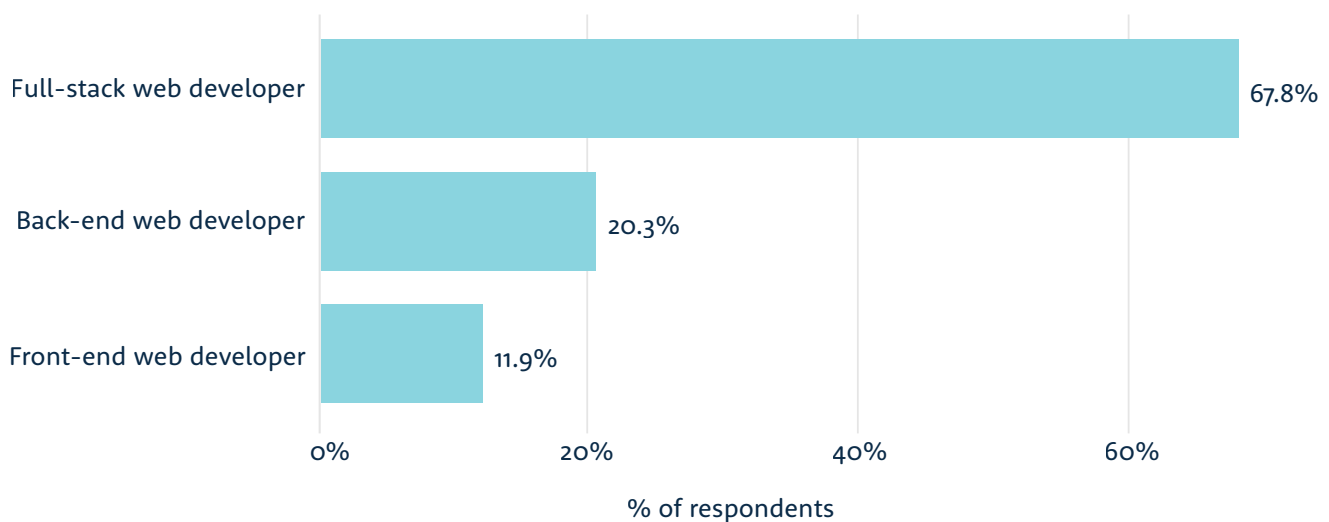
Over 72 percent of professional developers in Canada identified as web developers, making it more than two times more common than any other role. Forty-five percent of Canadian professional developers identified as desktop or mobile developers or both. Other notable roles

included database administrators (16 percent) and systems administrators (13 percent). The majority (over 54 percent) of Canadian professional developers identified with more than one role.

More than two thirds of Canadian professional web developers classified themselves as full-stack developers in the 2017 survey, requiring skills for both front-end web development (creating the user-facing elements of a website) and back-end web development (building and maintaining the underlying infrastructure that powers a website).

Share of Canadian Professional Web Developers by Type, 2017

% of survey respondents



Sources: 2017 Annual Developer Survey; BII+E analysis.

453 responses

Note: Only professional developers included.

INDUSTRY PERSPECTIVES

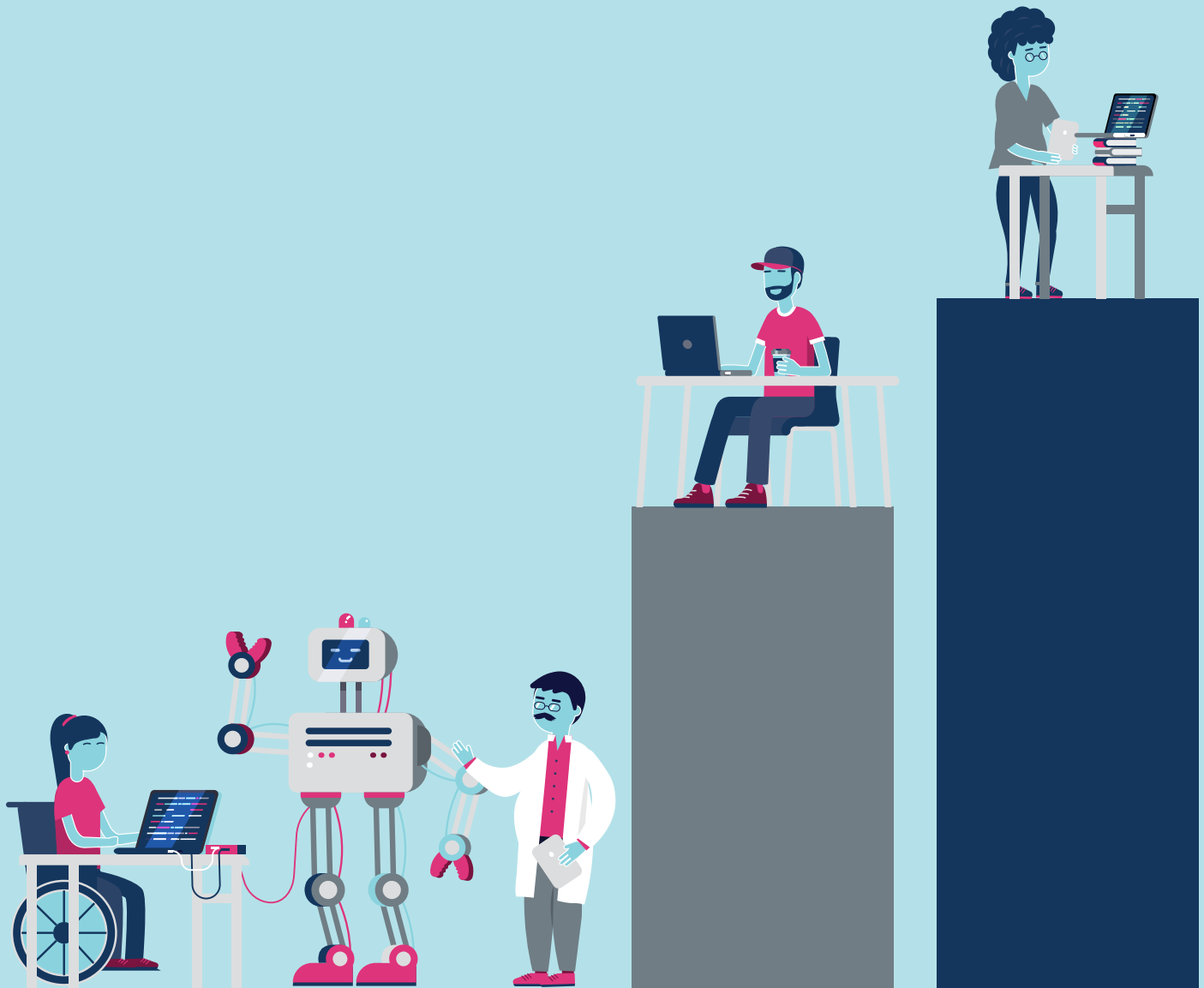


What is the quality of developers in Canada?

“[Developers in Canada have] strong technical skills but not at the expense of empathy, good communication and resilience.”

Sherif Zaroubi

Founder and CTO at BidSettle



CITIES ACROSS CANADA SPECIALIZE IN DIFFERENT TYPES OF SOFTWARE DEVELOPMENT

The landscape of developer roles is not consistent across the country. Stack Overflow web traffic data indicates that smaller cities in Southwestern Ontario, such as Guelph and Kitchener-Waterloo, specialize strongly in embedded developers, data scientists, and machine learning specialists.

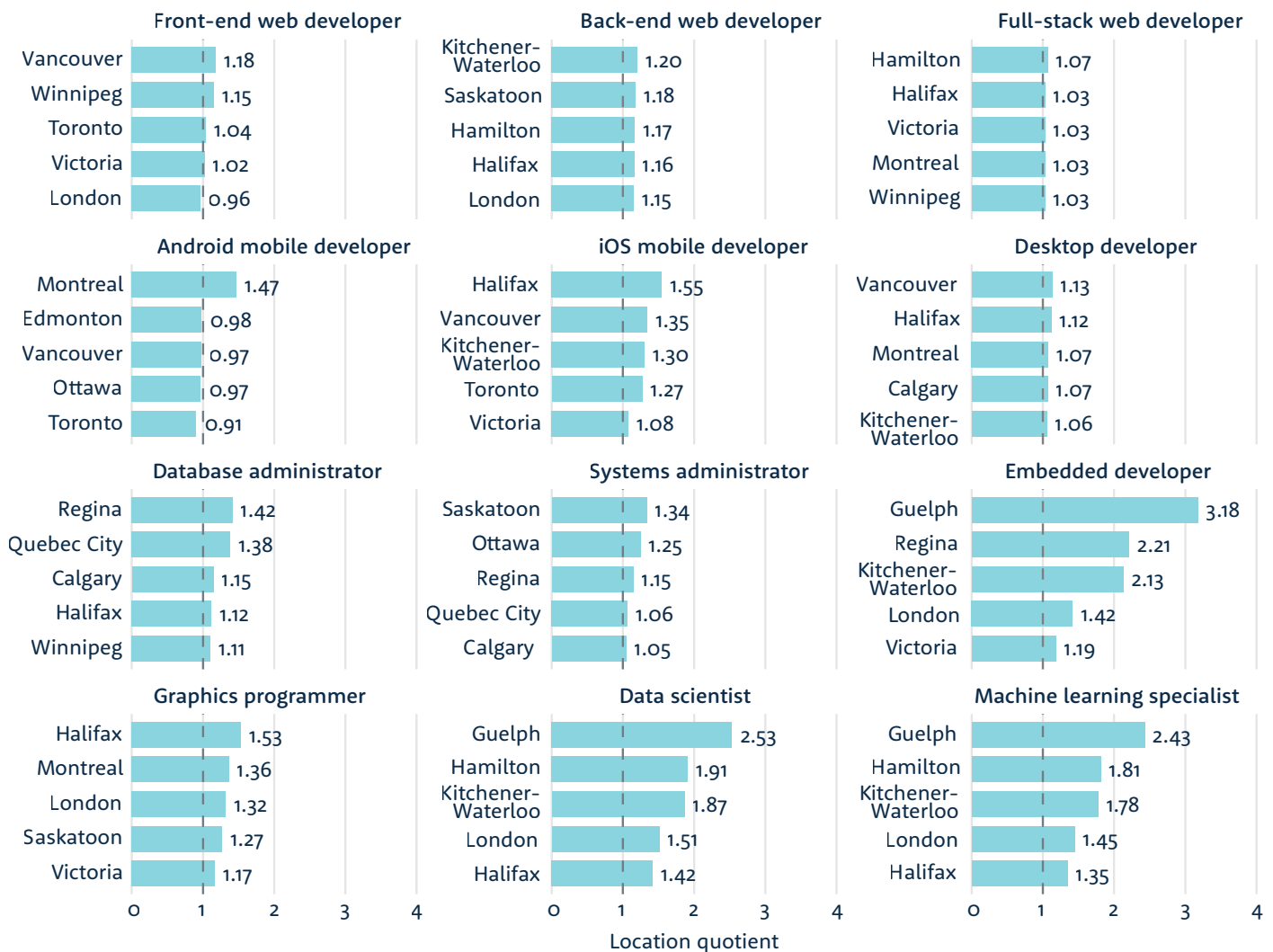
The concentration of embedded developers in Southwestern Ontario may result from the former dominance of Blackberry in the region. Similar to

the positive influence that the decline of Nokia’s mobile business had on the Helsinki talent base, Blackberry’s loss of market dominance may have resulted in a deep pool of experienced, qualified developers (especially embedded developers) in the region available to start or join new companies.^{7,8}

Other notable concentrations of developers include iOS developers and graphics programmers in Halifax, and Android developers in Montreal. (See Appendix for further information on these developer roles).

Concentration of Canadian Developer Roles by City, 2017

Location quotients based on % of web traffic to Stack Overflow

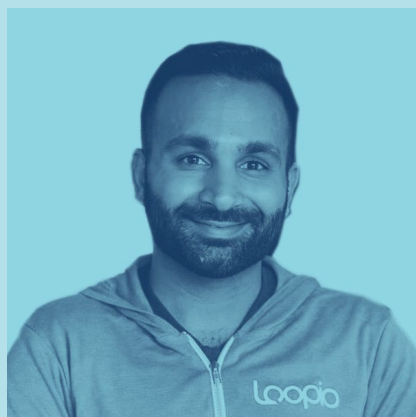


Sources: Stack Overflow web traffic data, January 24-February 20, 2017; BII+E analysis.

Note: Location quotient is calculated as the share of developers in the city with a particular role divided by the share developers with the same role nationally. A location quotient above one signals that talent for a specific developer role is more concentrated in the particular city than it is nationally; a location quotient below one indicates the reverse.

INDUSTRY PERSPECTIVES

Where do you notice gaps in skill sets?



“[There are gaps in developers’ capacity for] scaling software platforms, and in strong front-end and UX skills.”

Zakir Hemraj

CEO at Loopio



“Hiring new grads is hard. Most [computer science] departments care deeply about being purely academic, and the result is that grads don’t know current tech, don’t know how to work on a team, can’t navigate pre-existing codebases, and don’t have interdisciplinary knowledge.”

Florencia Herra-Vega

CTO at Peerio



“Just general ‘working environment’ behaviours—how to work in a team, how to communicate effectively, etc.”

Megan Hall

Head of People and Culture at Smile.io

INDUSTRY PERSPECTIVES

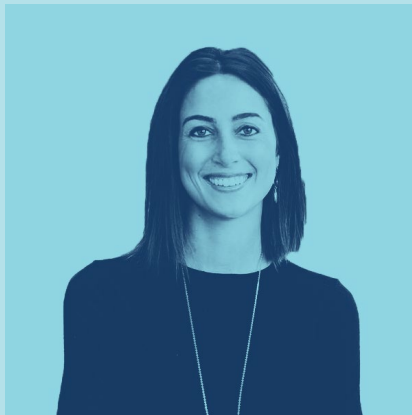
Where do you notice gaps in skill sets?



“Experience with the platform we specialize in (Drupal) is very hard to find.”

Suzanne Dergacheva

Cofounder at Evolving Web



“Although there are no major skill set gaps we have experienced, I don’t doubt that every company would always like to see an even larger pool of technical talent. The more people we can continue to educate in technology related fields, and then recruit to stay in Canada, the better.”

Mallorie Brodie

Cofounder and CEO of Bridgit

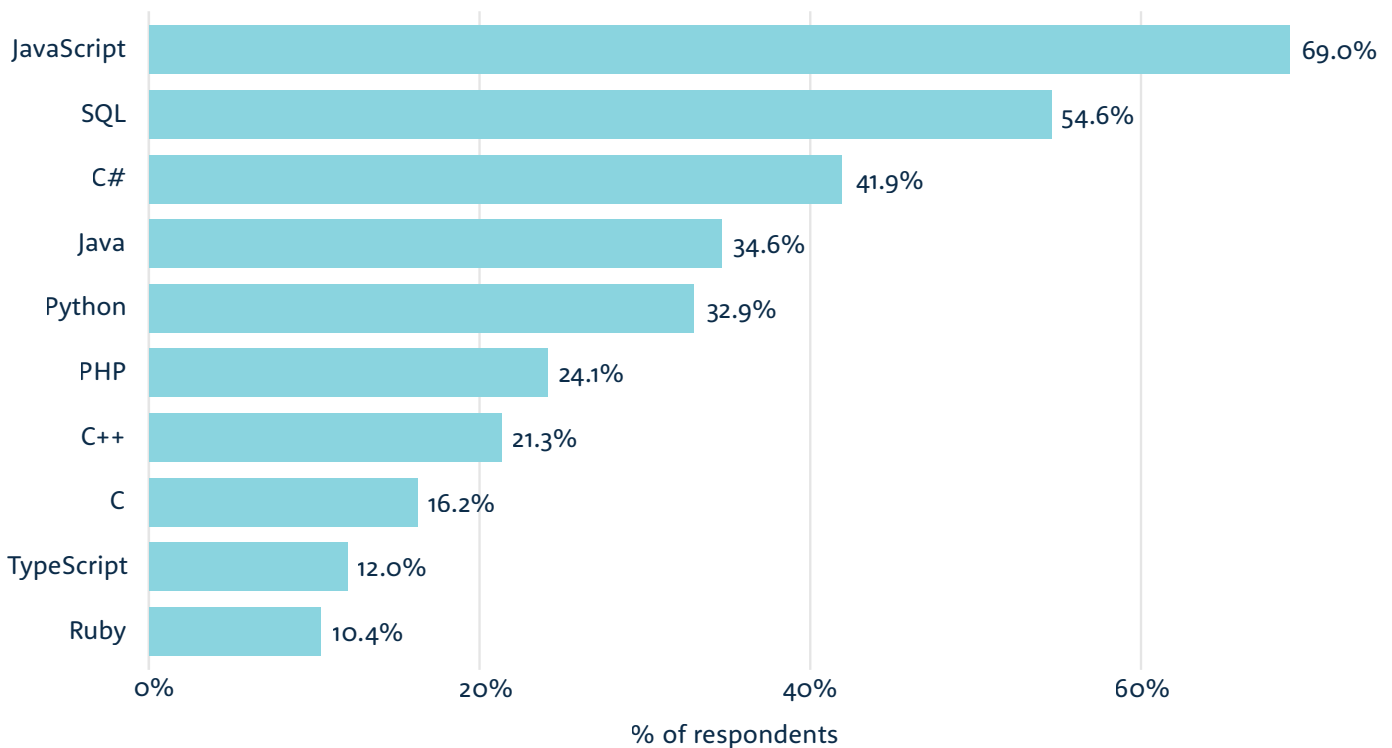
CANADA'S DEVELOPERS "SPEAK" MANY LANGUAGES

Not only do web developers vary widely in terms of their roles, they also use a variety of programming languages. JavaScript, which is largely used for web development,⁹ was the most commonly used language among Canadian developers, with 69 percent of Canadian professional developers reporting in the 2017 survey that they had done extensive development work using it over the past year. SQL, a language for querying databases,¹⁰ was also very common among Canadian professional developers.

Ninety percent of Canadian professional developers reported using more than one programming language in the 2017 survey, while half reported using four or more languages.

Share of Canadian Professional Developers Using Top 10 Languages, 2017

% of survey respondents



Sources: 2017 Annual Developer Survey; BII+E analysis

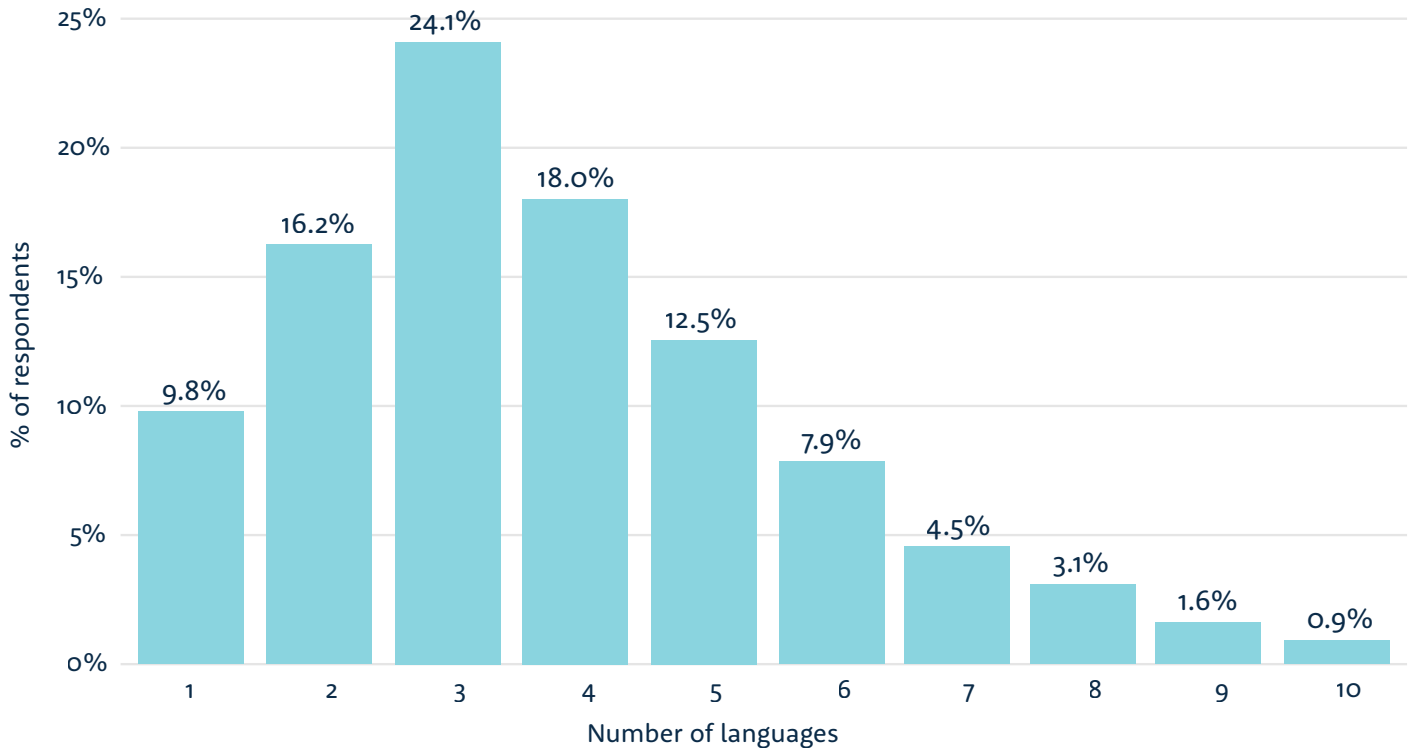
1,299 responses

Note 1: Respondents could pick more than one language that they have done extensive development with over the past year; therefore shares will not add up to 100%.

Note 2: Only professional developers included.

Share of Canadian Professional Developers by Number of Languages Used, 2017

% of survey respondents



Sources: 2017 Annual Developer Survey; BII+E analysis.

1,299 responses

Note: Only professional developers included. Respondents using over 10 languages were omitted (17 total respondents).

CANADIAN DEVELOPERS ARE STAYING UP-TO-DATE WITH POPULAR PROGRAMMING LANGUAGES

In general, Canadian professional developers reported working with the more frequently-used languages globally to a higher degree than their international counterparts. This included some of the most popular languages such as Python, C#, and C++.^{11*} The largest gaps where Canadian usage exceeded international usage were among the Visual Basic family of languages, with the share of Canadians working with VBA and VB.NET exceeding the share among the rest of the world by 31 percent and 28 percent, respectively. Visual Basic is highly effective in supporting rapid application development and graphical user interfaces.¹²

While Canadian professional developers' use of many languages exceeds their international peers' use on average, their use of Java, which has been ranked as the 3rd top language of 2017 and the top language in demand for employers, was well below the international average (by 11 percent).¹³

Python saw the largest increase this year in the share of developers using the language.

Among the most widely-used languages, Python saw the largest increase this year in the share of developers using the language, rising to 37 percent of Canadian developers compared to 26 percent in 2015.**

This could signal an increase in startup activity in Canada since Python is often used by startups given its versatility, ease of learning, use in data science, and capacity for rapid prototyping.^{14,15}

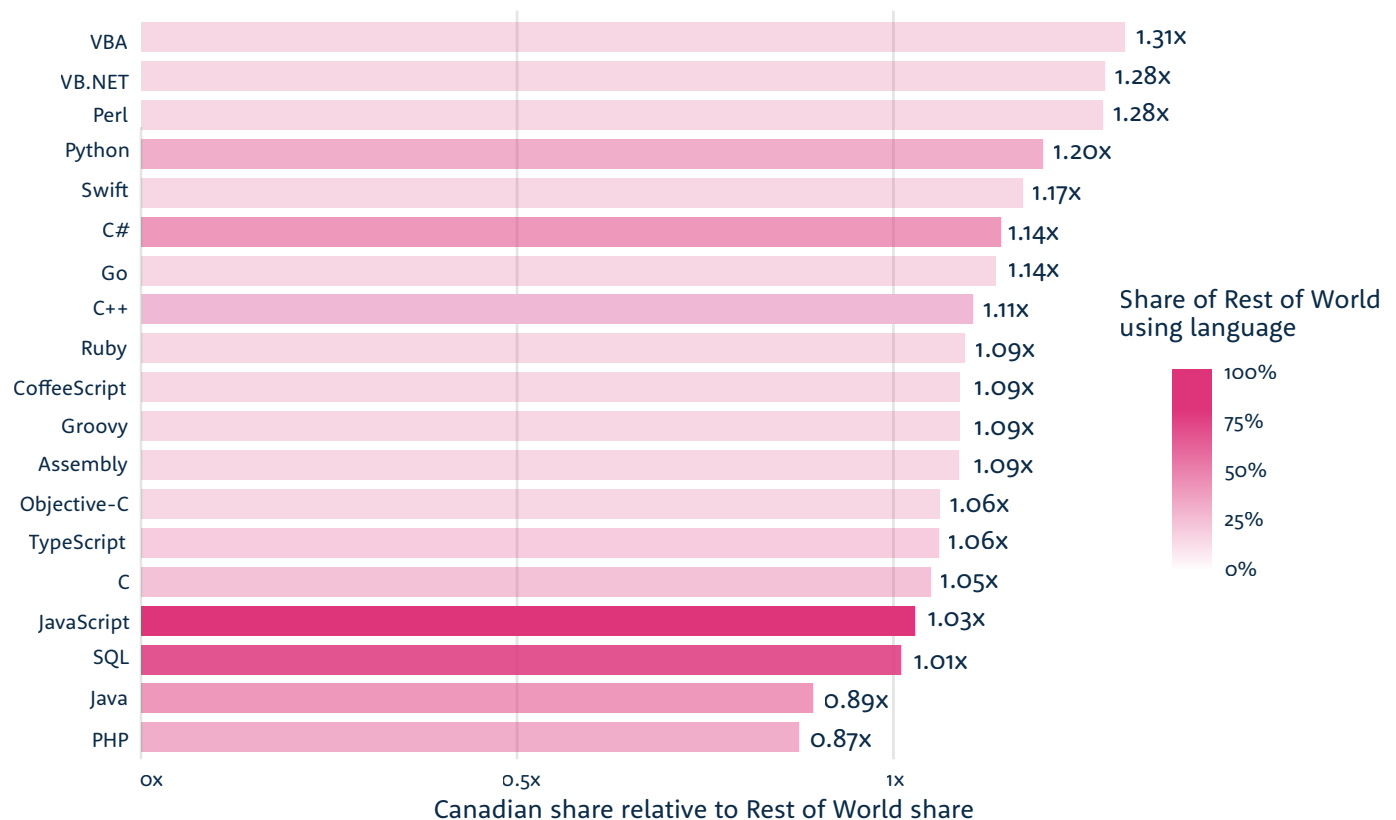
JavaScript, the most widely used language by Canadian developers and another popular language among startups, saw a 14 percent increase in its usage in 2017 after two years of minimal growth.¹⁶

* According to IEEE Spectrum Magazine.

** Languages included are only those that have been in Stack Overflow Annual Surveys since 2014, with more than 10 percent of Canadian developers using them on average since the 2014 survey.

Difference in Share of Professional Developers Using Language Between Canada and Rest of World, 2017

Ratio of Canadian share of survey respondents to rest of world share per language



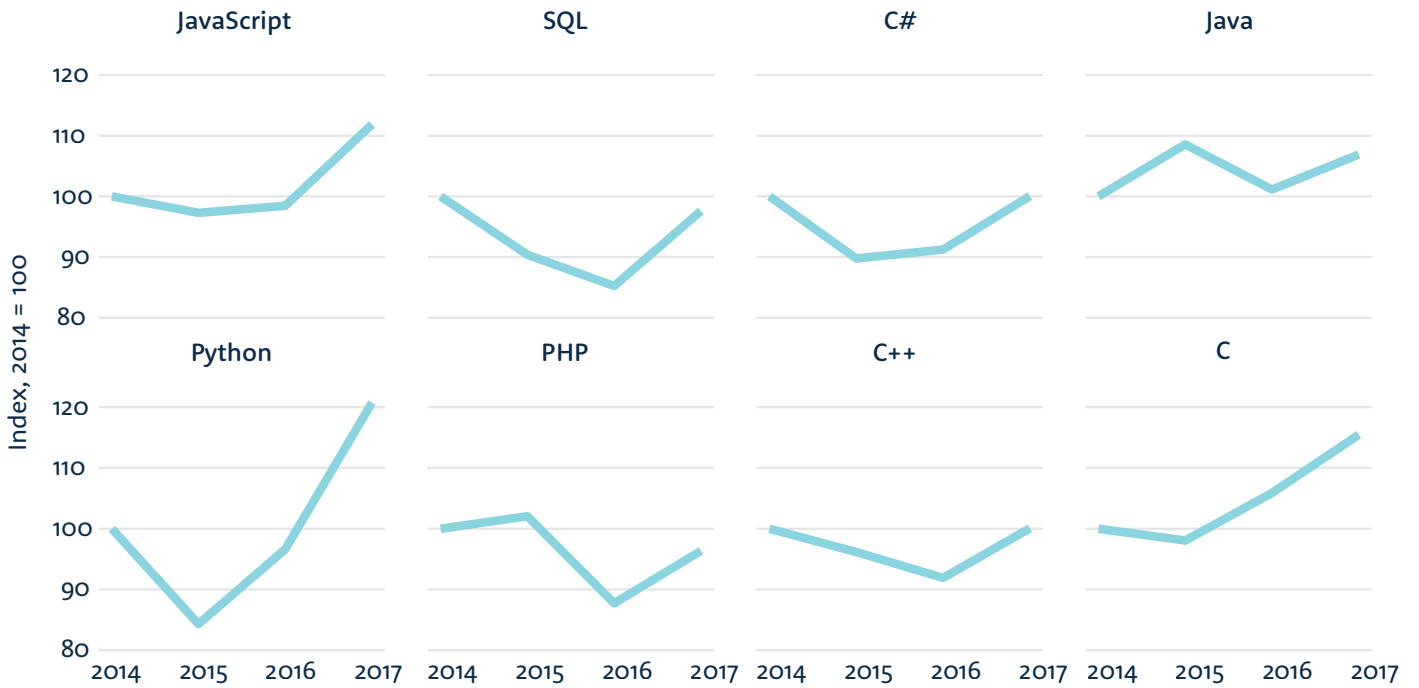
Sources: 2017 Annual Developer Survey; BII+E analysis.

Note 1: Only professional developers included.

Note 2: Minimum 50 respondents per language.

Share of Canadian Developers Using Widely-Used Languages Over Time, 2014–2017

Index of % of survey respondents, 2014 = 100

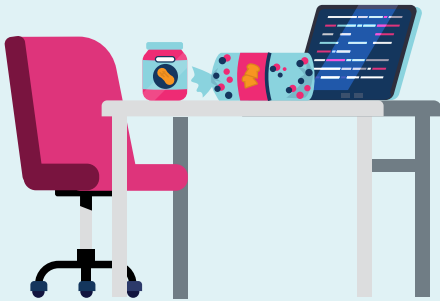


Sources: 2014–2017 Annual Developer Surveys; BII+E analysis.

Note 1: Includes the eight most commonly-used languages that have been an option on the Stack Overflow Annual Surveys since 2014 and had an over 10 percent share of respondents on average over that entire period.

Note 2: Non-responses omitted.

WHERE DO DEVELOPERS WORK?



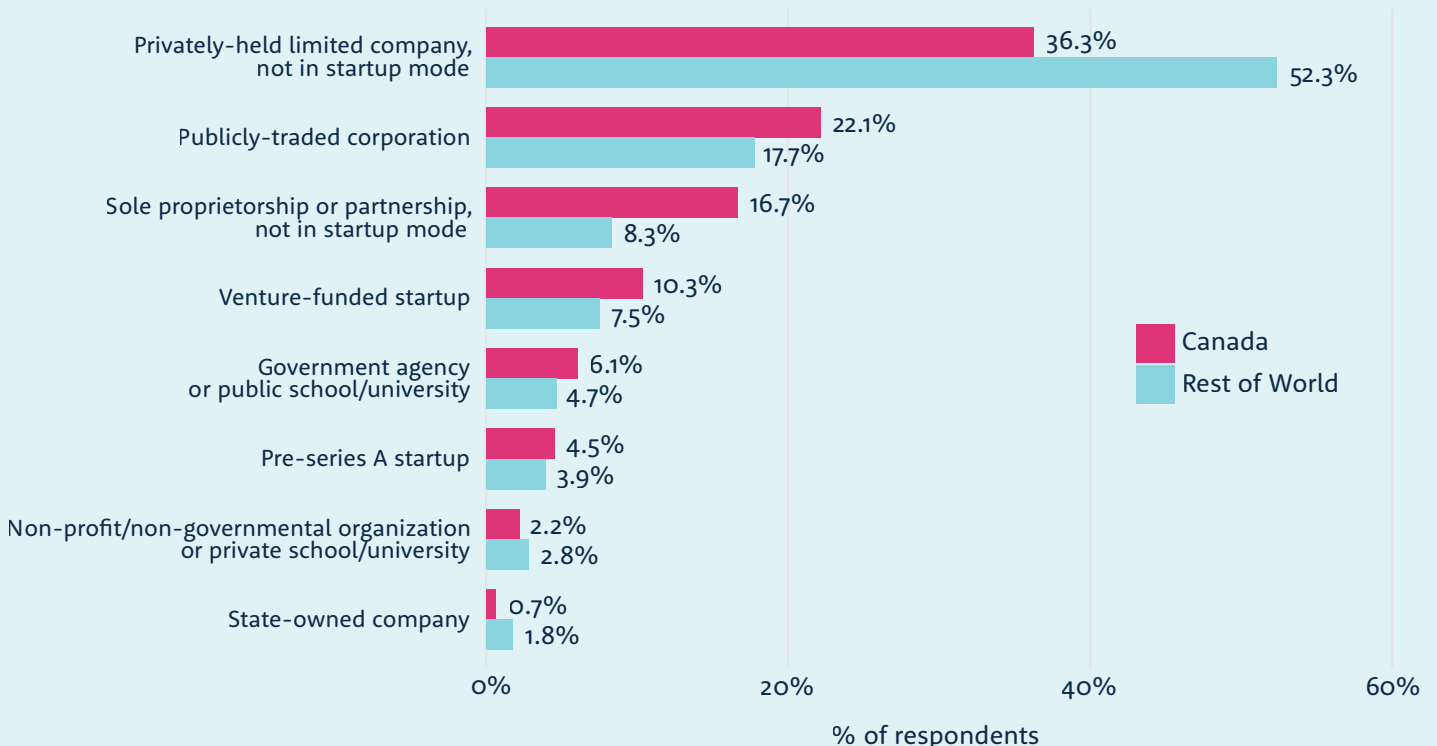
Canadian developers work in organizations ranging from startups and government agencies to publicly-traded corporations. They also work in a variety of different industries—from information and communications technology (ICT) to healthcare—pointing to the pervasiveness of software use and demand for developer talent throughout the economy.

CANADA'S DEVELOPERS WORK IN ORGANIZATIONS OF ALL SHAPES AND SIZES

More Canadian professional developers worked in privately-held limited companies (excluding sole proprietorships and startups) than any other type of organization, accounting for 36 percent of respondents to the 2017 Annual Developer Survey.

Share of Professional Developers by Organization Type, 2017

% of survey respondents



Sources: 2017 Annual Developer Survey; BII+E analysis.

Note: Only professional developers included.

While developers in Canada are less concentrated in privately-held limited corporations than developers in the rest of the world; they are more likely to be found in other types of organizations, including publicly-traded corporations, sole proprietorships, and startups.

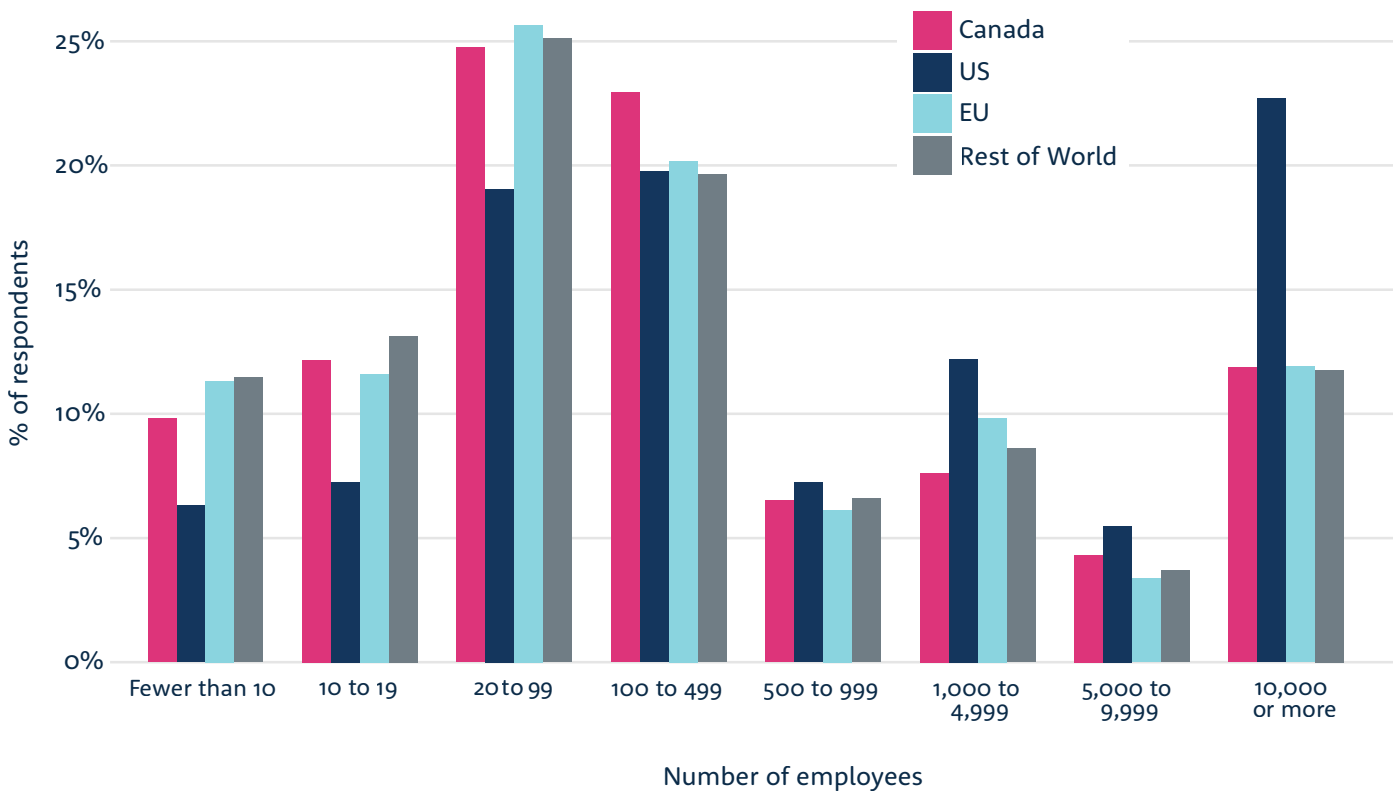
Nearly half (47 percent) of Canadian professional developers worked in organizations with less than 100 employees, while organizations with 10,000 or more employees accounted for 12 percent of respondents to the 2017 survey.

Nearly half (47 percent) of Canadian professional developers worked in organizations with less than 100 employees.

In contrast, developer talent in the US was far more concentrated in larger organizations, with nearly double the share of respondents working in organizations with over 10,000 employees. This may point to the dominance of such US-based tech companies as Amazon, Google, and Facebook in hiring developers.

Share of Professional Developers by Organization Size, 2017

% of survey respondents



Sources: 2017 Annual Developer Survey; BII+E analysis.

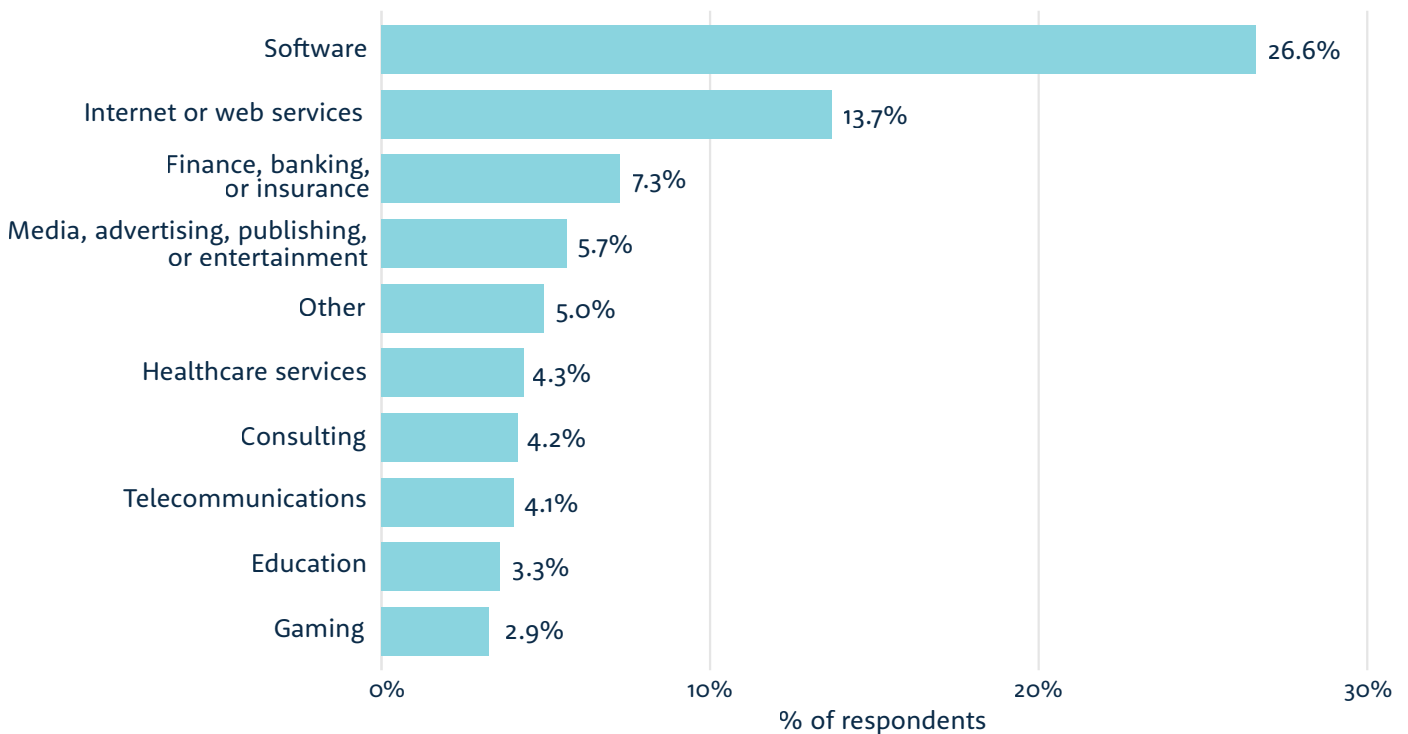
Note: Only professional developers included.

FROM SOFTWARE TO HEALTHCARE, DEVELOPERS CAN BE FOUND IN INDUSTRIES ACROSS THE ECONOMY

As software becomes increasingly pervasive, developers are being employed in industries ranging from finance and media to healthcare and education. Similar to their international peers, Canadian professional developers worked primarily in the software and internet or web services industries, which collectively accounted for 40 percent of Canadian survey respondents. However, finance, media, advertising, and healthcare services also accounted for substantial shares of Canadian professional developers.

Share of Canadian Professional Developers Among Top 10 Industries, 2017

% of survey respondents



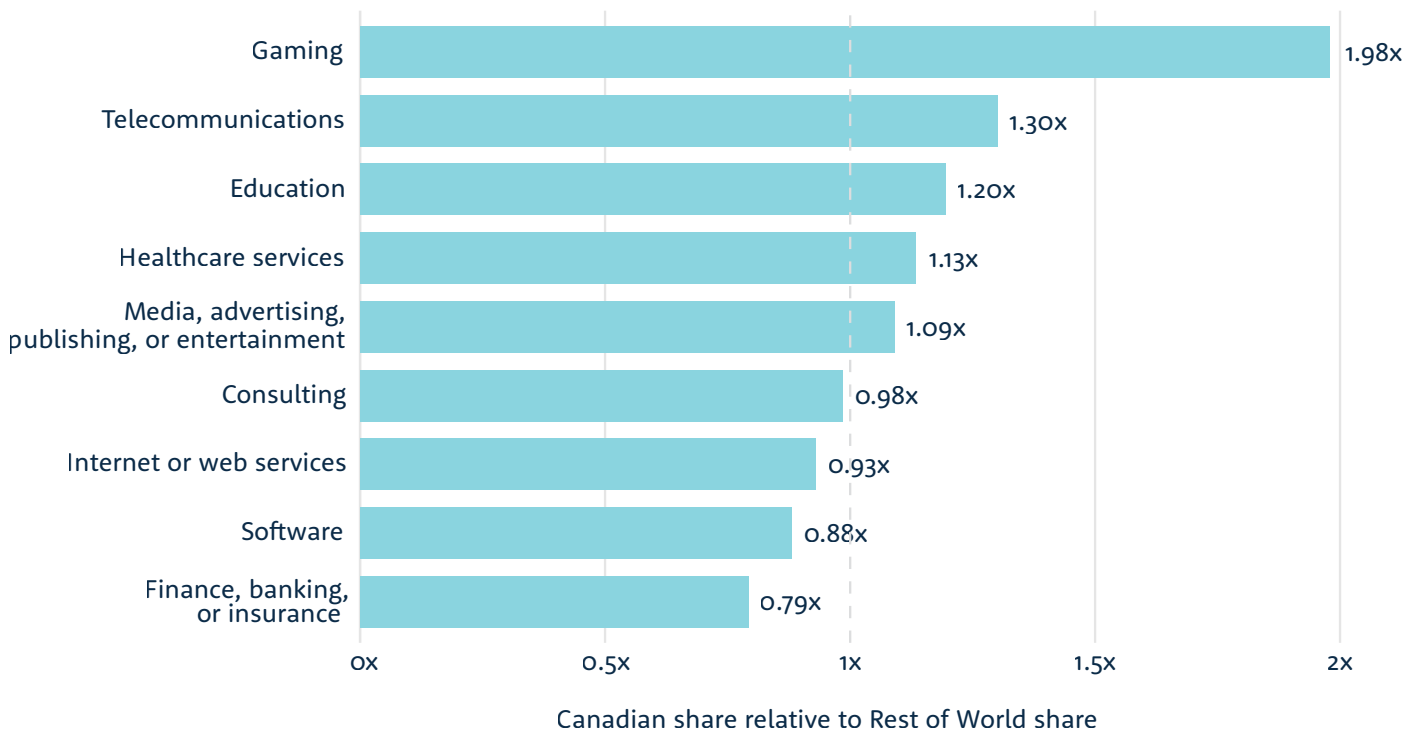
Sources: 2017 Annual Developer Survey; BII+E analysis.

1,555 responses

Note: Only professional developers included.

Difference in Share of Professional Developers by Industry Between Canada and Rest of World, 2017

Ratio of Canadian share of survey respondents to Rest of World's share per industry



Sources: 2017 Annual Developer Survey; BII+E analysis.

Note: Only professional developers included. Minimum 50 respondents per Canada/Rest of World and industry.

Professional developers in Canada were less concentrated than their international counterparts in the most traditionally developer-intensive industries, such as software, internet or web services, and finance. In contrast, Canadian professional developers were more than twice as concentrated in the gaming industry compared to developers worldwide. This reflects the health of Canada's gaming industry which, according to one report commissioned by an industry association, employed 20,400 people and contributed \$3 billion to Canada's GDP in 2015.^{17,18}

Canadian professional developers were more than twice as concentrated in the gaming industry compared to developers worldwide.

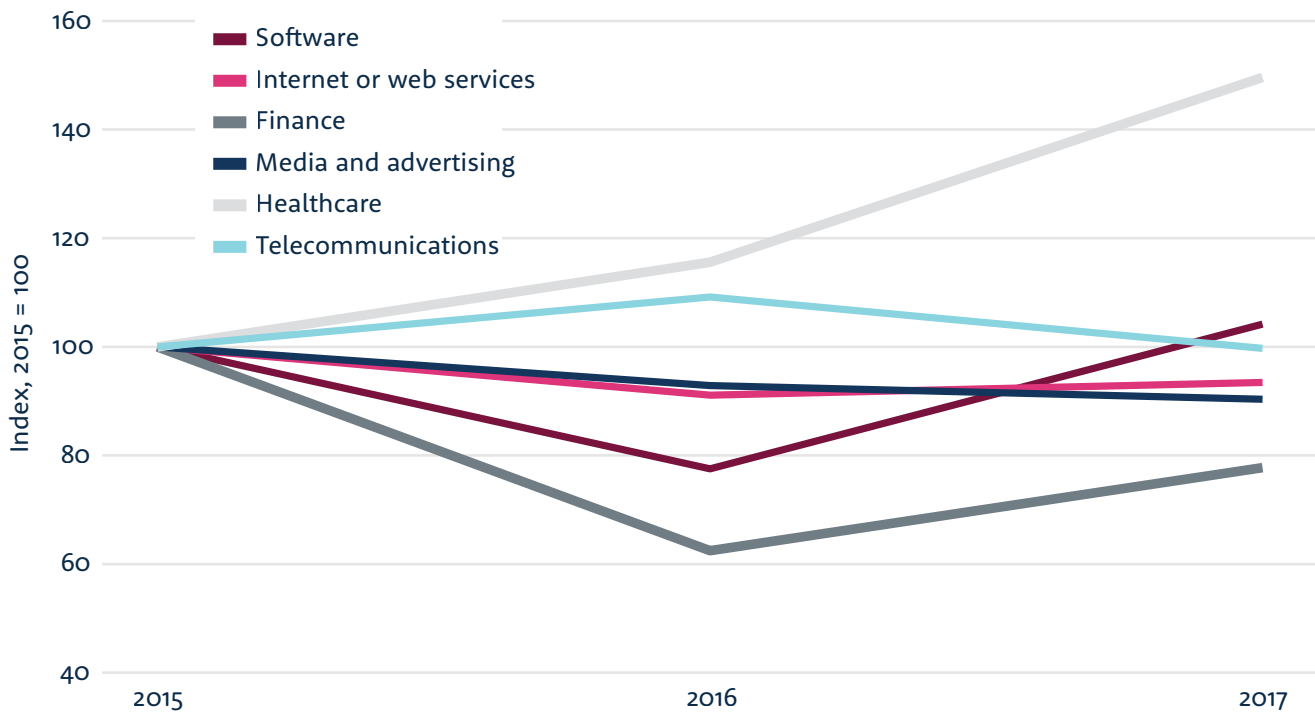
The share of Canadian developers in the telecommunications, education, healthcare services, and media and advertising industries also exceeded that of their international counterparts, according to the 2017 survey.

Between the 2015 and 2017 surveys, the healthcare industry saw one of the greatest increases in the share of developers it accounted for in Canada, growing by 50 percent. Over the past year, the software industry grew its share of Canadian survey respondents by 34 percent, followed by 29 percent growth in healthcare, and 24 percent growth in finance.

Between the 2015 and 2017 surveys, the healthcare industry saw one of the greatest increases in the share of developers it accounted for in Canada, growing by 50 percent.

Share of Canadian Developers Among Select Industries Over Time, 2015–2017

Index of % of survey respondents, 2015 = 100



Sources: 2015–2017 Annual Developer Surveys; BII+E analysis.

Note 1: Non-responses omitted.

Note 2: Minimum 20 respondents per industry per year.

Note 3: The pharmaceutical and/or medical device industry first appeared as a survey option in 2017. We included this within the healthcare industry under the assumption that those in pharmaceuticals and/or medical devices taking previous surveys would have selected healthcare as their industry. Removing pharmaceuticals and/or medical devices from healthcare would result in the industry showing negligible growth in 2017. This graph also omitted consulting, government, and manufacturing industries as their related survey options have been less consistent over time.



What is the job search like in Canada?

“I would say that there are tons of development jobs available in Canada, but not all of them are created equal ... Most passionate developers are looking for a place where they feel they contribute meaningful value while continuing to grow. They want to work for a company where they have a voice and are provided opportunities to learn.”

In what industries and regions are there the most opportunities for developers?

“In terms of industries, I notice a lot of opportunities in health technologies. It can be a difficult industry to break into due to understandably rigorous testing requirements, but the work provides obvious value and is incredibly rewarding. The need for better health-related technology is never going to go away, and interesting ideas are springing up all the time.”

Zak Thompson

Lead Web Developer at Bridgit

HOW DO DEVELOPERS FARE IN THE LABOUR MARKET?



Professional developers in Canada are primarily employed in full-time roles. They command high salaries relative to the rest of the Canadian labour market, although they fall far behind their counterparts in the US.

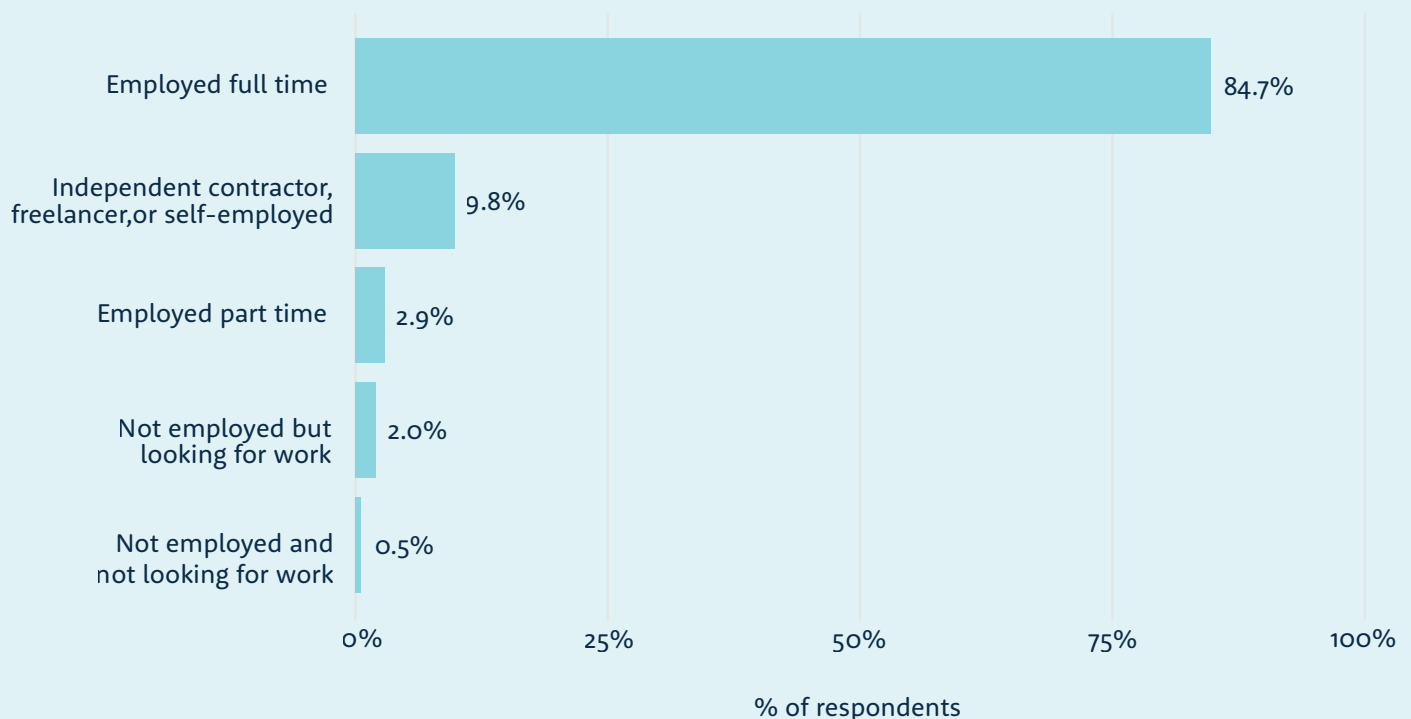
The vast majority (over 84 percent) of Canadian professional developers were employed in full-time roles. They command high salaries relative to the rest of the Canadian labour market.

CANADIAN DEVELOPERS ARE EMPLOYED PREDOMINANTLY IN FULL-TIME ROLES

The vast majority (over 84 percent) of Canadian professional developers were employed in full-time roles, according to the 2017 Annual Developer Survey, followed by 10 percent who reported being independent contractors, freelancers, or self-employed.

Share of Canadian Professional Developers by Employment Status, 2017

% of survey respondents



Sources: 2017 Annual Developer Survey; BII+E analysis.

1,596 responses

Note: Only professional, non-retired developers included.

BEING A DEVELOPER IN CANADA IS A LUCRATIVE CAREER

Professional developers in Canada earned a median salary of C\$70,000 according to the 2017 survey—the ninth highest among the 52 countries that had at least 20 salary responses.^{*19} This was far lower than the median of C\$122,760 reported by professional developers in the US, but much higher than the median annual income across all industries in Canada, which was C\$45,280 in 2016.²⁰

Professional developers in Canada earned a median salary of C\$70,000.

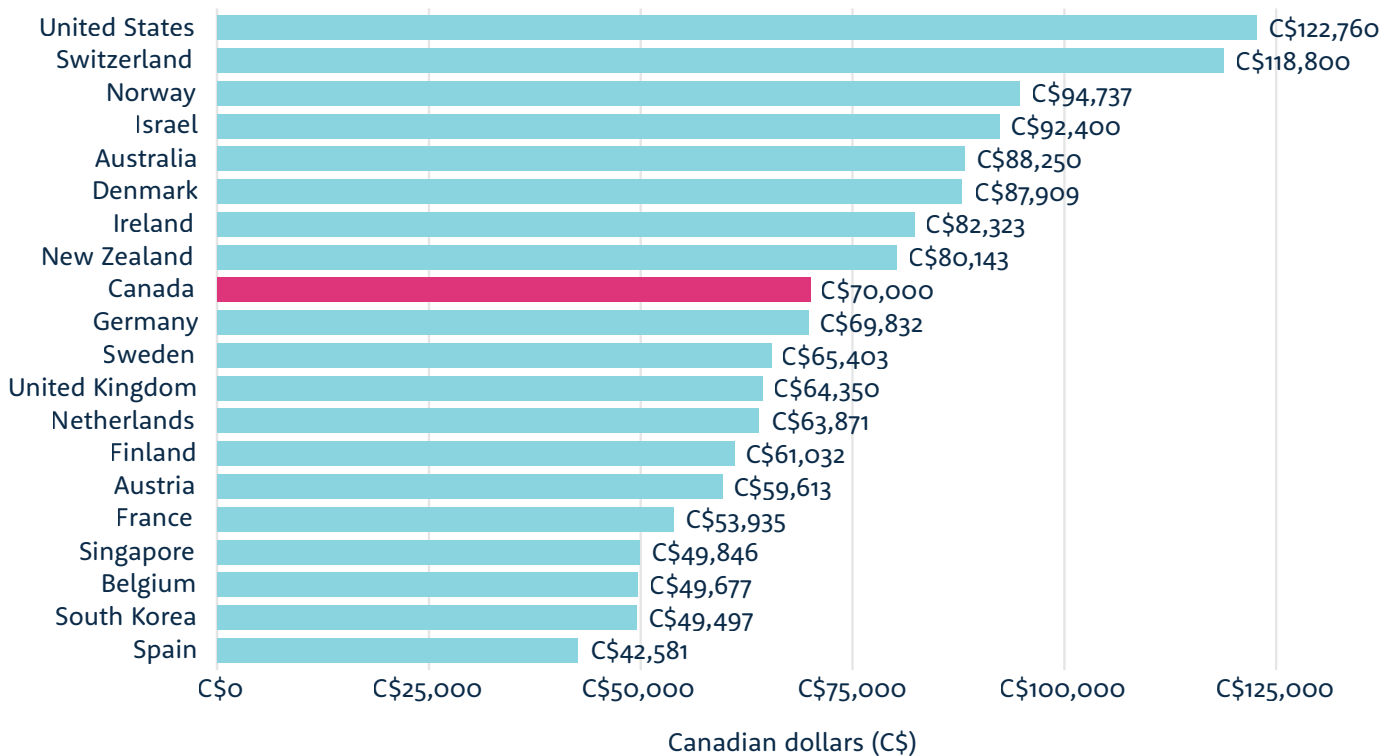
When adjusting developers' salaries for the purchasing power in their home country (using purchasing power parity exchange rates), Canada's median salary slips to 12th highest, as countries such as South Africa and China leap ahead.^{**} These salary adjustments do not account for cost of living variations within a country, however, which could alter such rankings.

* By comparison, the median salary for the six Statistics Canada NOCs related to developers was C\$60,190 according to the NHS, 2011.

** Valuing salaries at PPP exchange rates helps make more meaningful comparisons among different countries by accounting for different costs of living, among other reasons. PPP rates reflect the amount of US dollars required to purchase the same goods and services in the US.

Average Salary of Professional Developers Among Top 20 Countries, 2017

Median annual salary in C\$ of survey respondents

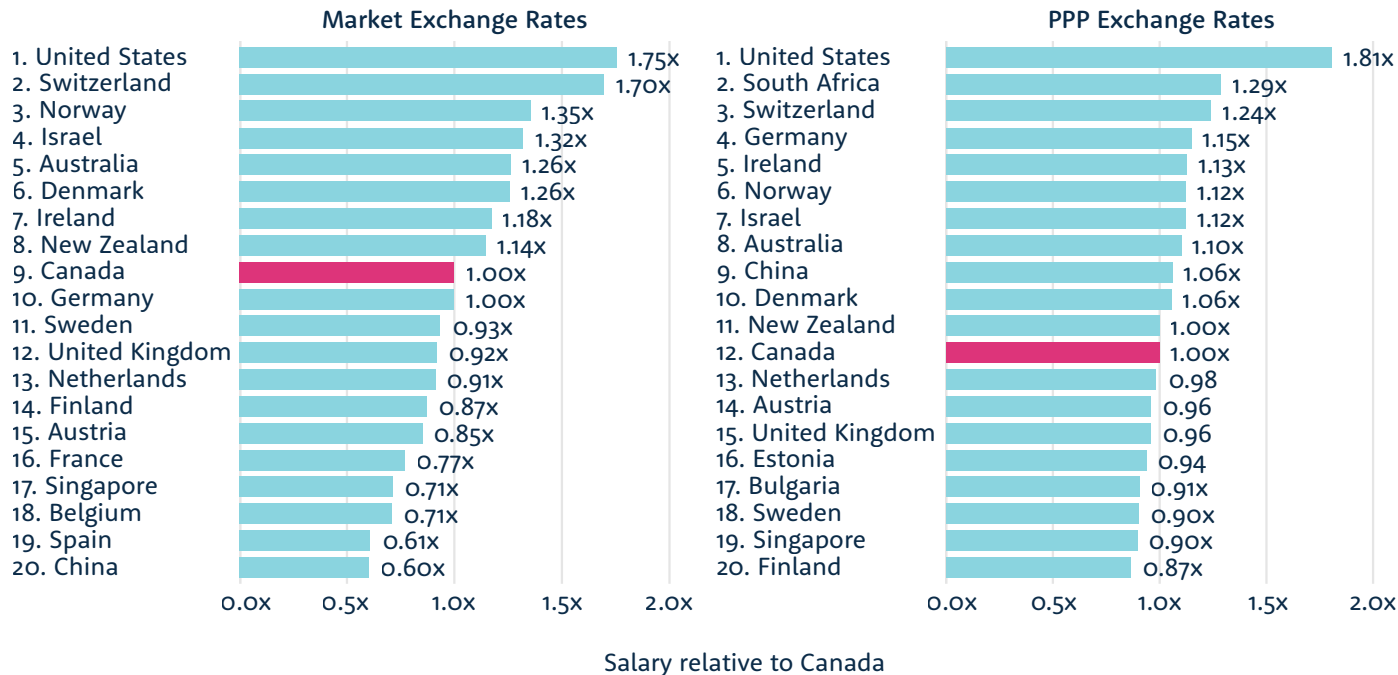


Sources: 2017 Annual Survey; BII+E analysis.

Note: Only professional developers included. Minimum 20 salary responses per country. 52 countries in sample.

Average Salary of Professional Developers Among Top 20 Countries Relative to Canada, 2017

Median annual salary of survey respondents by country relative to Canadian median salary measured at market and purchasing power parity (PPP) exchange rates



Sources: 2017 Annual Survey; World Bank; BII+E analysis.

Note: 46 countries in sample. Argentina had no PPP rates to be considered. This chart omits respondents who reported a salary in a currency other than their country’s currency, which amounted to under 7 percent of respondents. Only professional developers included. Minimum 20 valid salary responses per country.

Canadian professional developers earned the highest median salary working in publicly-traded corporations compared to other types of organizations, at C\$78,000 in the 2017 survey.

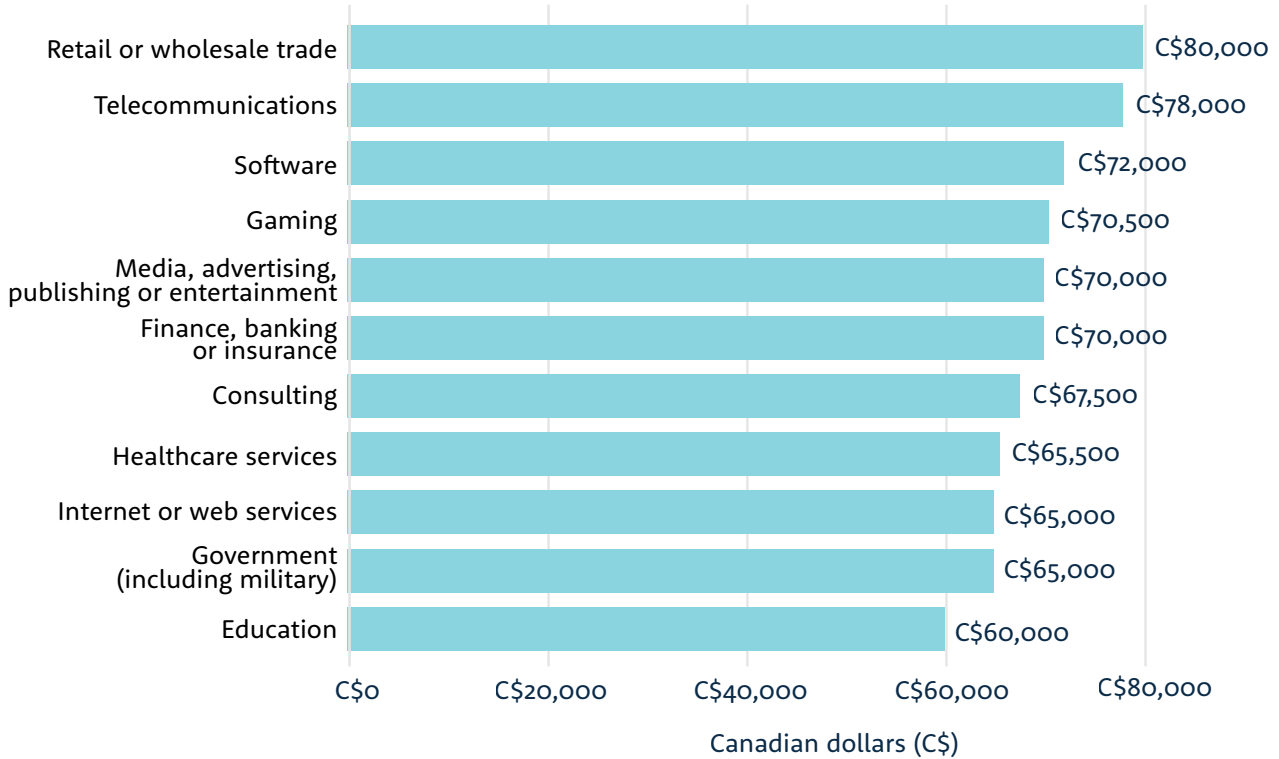
Among organization types with at least 20 salary responses, sole proprietorships or partnerships had the lowest median salary, at C\$65,000.

The highest median salary was commanded by Canadian professional developers working in the retail or wholesale trade industry, at C\$80,000, followed by telecommunications at C\$78,000 and the software industry at C\$72,000.

Professional developers in education earned the least among industries with at least 20 responses, with a median salary of C\$60,000.

Average Salary of Canadian Professional Developers by Industry, 2017

Median annual salary in C\$ of survey respondents

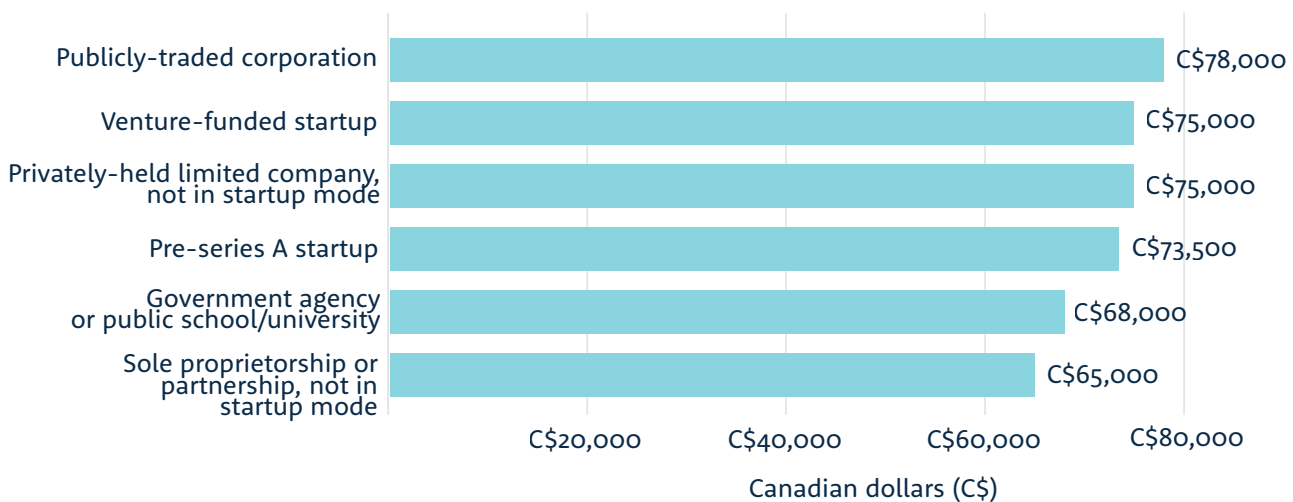


Sources: 2017 Annual Developer Survey; BII+E analysis.

Note: Only professional developers included. Minimum 20 salary responses per industry.

Average Salary of Canadian Professional Developers by Organization, 2017

Median annual salary in C\$ of survey respondents



Sources: 2017 Annual Developer Survey; BII+E analysis.

Note: Only professional developers included. Minimum 20 salary responses per industry.

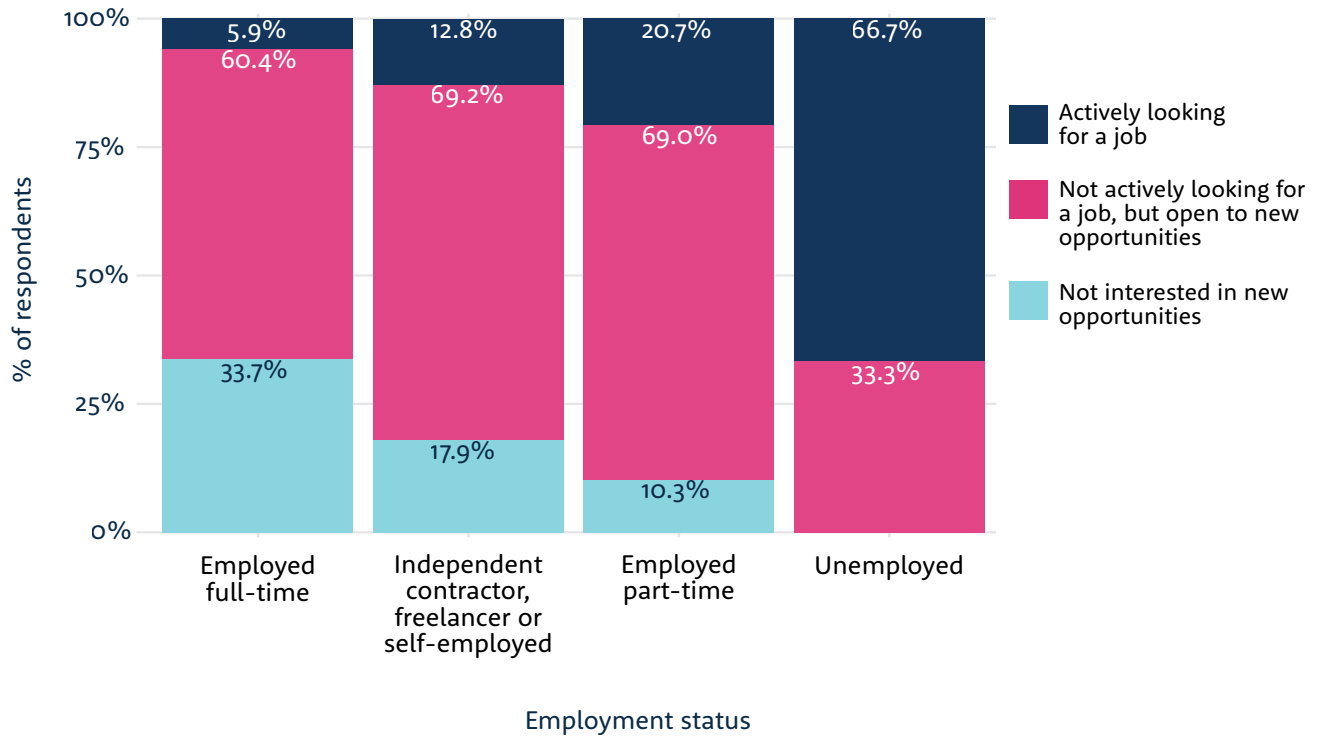
MOST FULL-TIME DEVELOPERS AREN'T PURSUING OTHER JOBS

Ninety-four percent of Canadian professional developers employed in full-time roles reported that they were not actively looking for a job. Among those who are independent contractors, freelancers, or self-employed, this figure dropped to 87 percent.

Over one quarter of Canadian professional developers found their current job through personal or professional networks. Twenty percent found their position through a job board (either general-purpose or tech-specific), while a further 26 percent found their job either by someone at the company or an external recruiter contacting them directly.

Share of Canadian Professional Developers by Employment and Job-Seeking Status, 2017

% of survey respondents per employment status

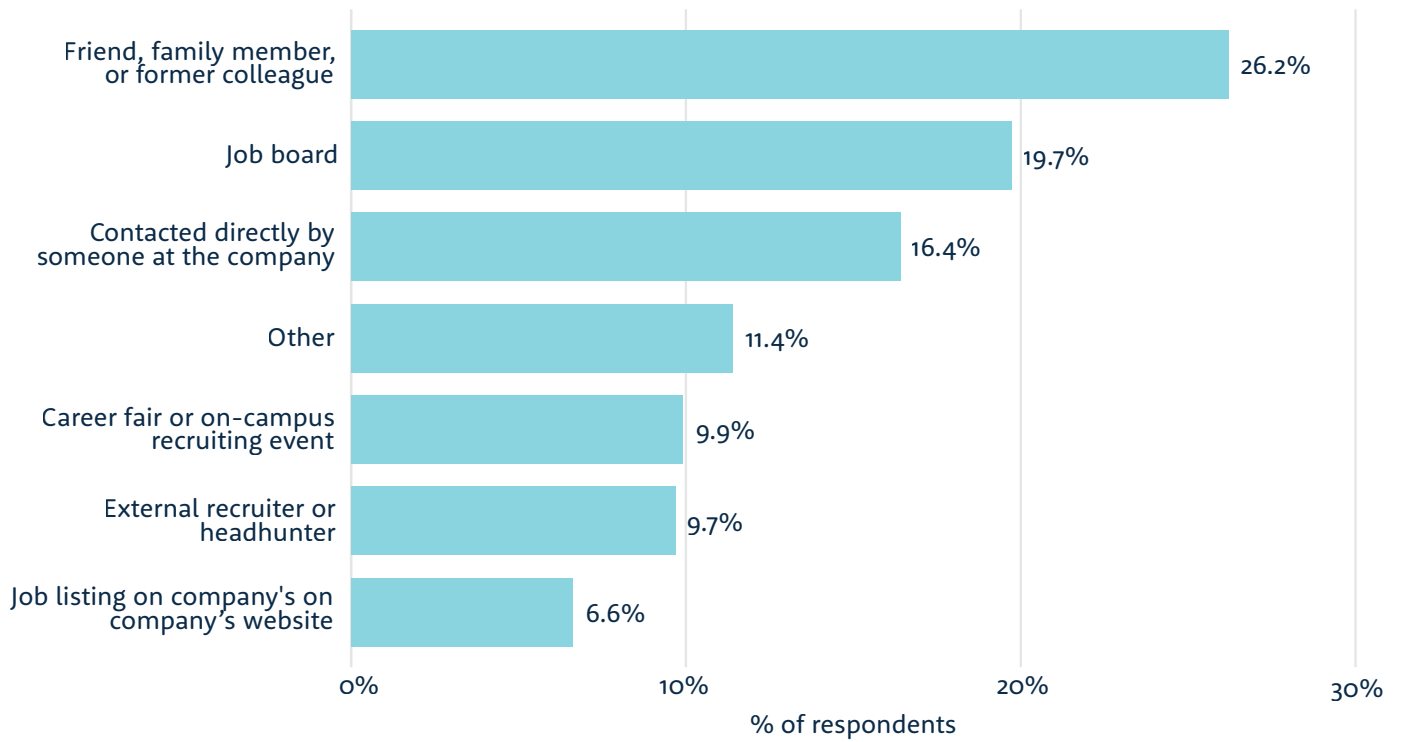


Sources: 2017 Annual Developer Survey; BII+E analysis.

Note: Only professional, non-retired developers included.

Share of Canadian Professional Developers by Job Discovery Channel, 2017

% of survey respondents



Sources: 2017 Annual Developer Survey; BII+E analysis.

938 responses

Note: Only professional developers included.

INDUSTRY PERSPECTIVES



Where do you find developers to hire?

“Referrals have been a great way to recruit new members to our development team. Of course, we leverage all of the typical recruitment channels as well—job boards, events etc. But referrals, at the end of the day, ensure that our growing team stays cohesive ... [H]iring people who our team already knows, and who they’ve maybe worked with before, has kept the bar high and maintained a strong culture.”

Mallorie Brodie

Cofounder and CEO at Bridgit



How did you acquire the necessary skills to do your work?

“Product management is a hard role to get into, unless someone takes a chance on you. For one of my co-op terms, I worked in product management, so I was able to get four months of experience before graduating from school. I thought that would be enough to get a product management job afterwards, but it wasn’t. Instead, I took a testing job at a startup. I made it clear upfront that I was interested in product management, and was able to switch roles after six months of working there. I was able to make that change by taking initiative, doing a good job on my work, and putting in some extra time with the product management team. That’s really how I got my foot in the door—I needed to show that hands-on experience.”

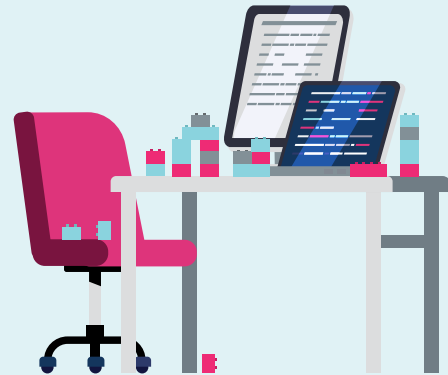
Laura Derksen

Product Manager at Bridgit

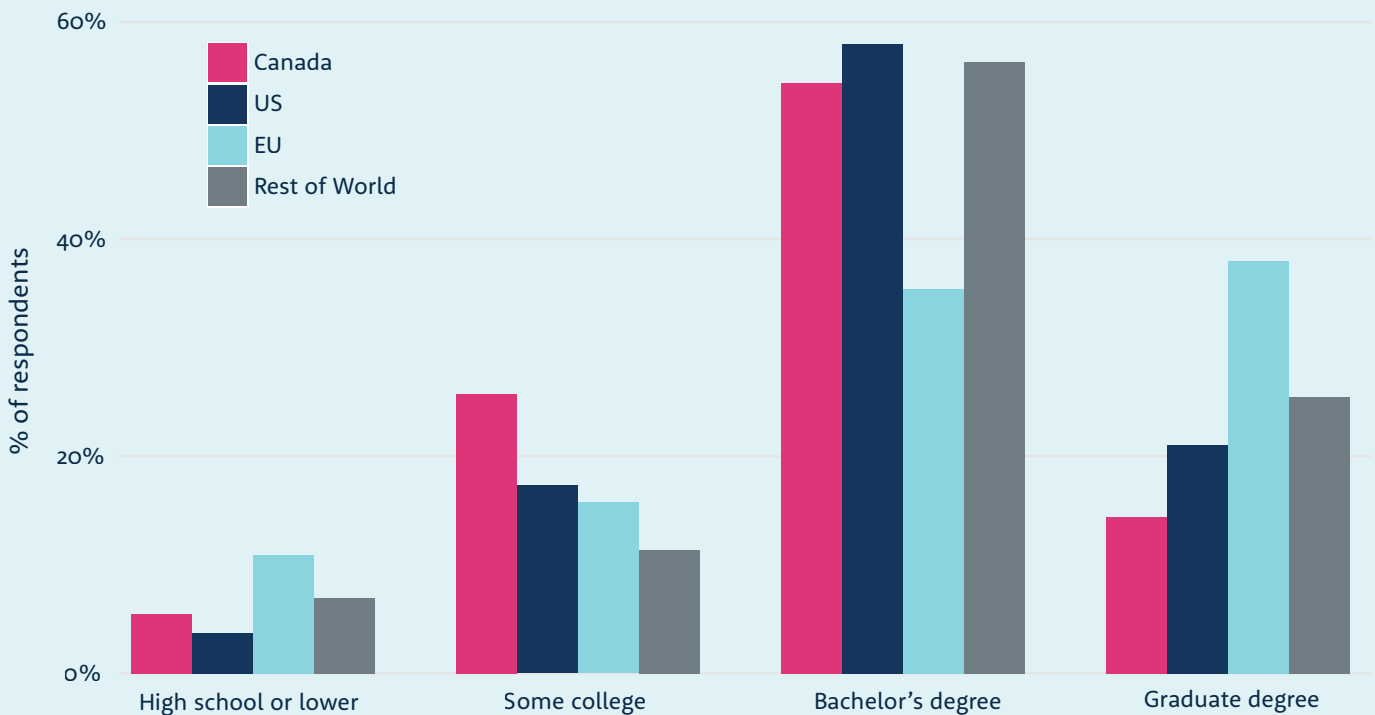
HOW ARE DEVELOPERS BUILDING SKILLS?

Ninety-five percent of professional developers in Canada have at least some college or university education.

Canadian developers are building their knowledge and skills both inside and outside of the office and classroom, with a large segment being at least partially self-taught. This suggests that both formal and informal sources of education may play an important role for developers, helping them compete and stay up to date in today's labour market.



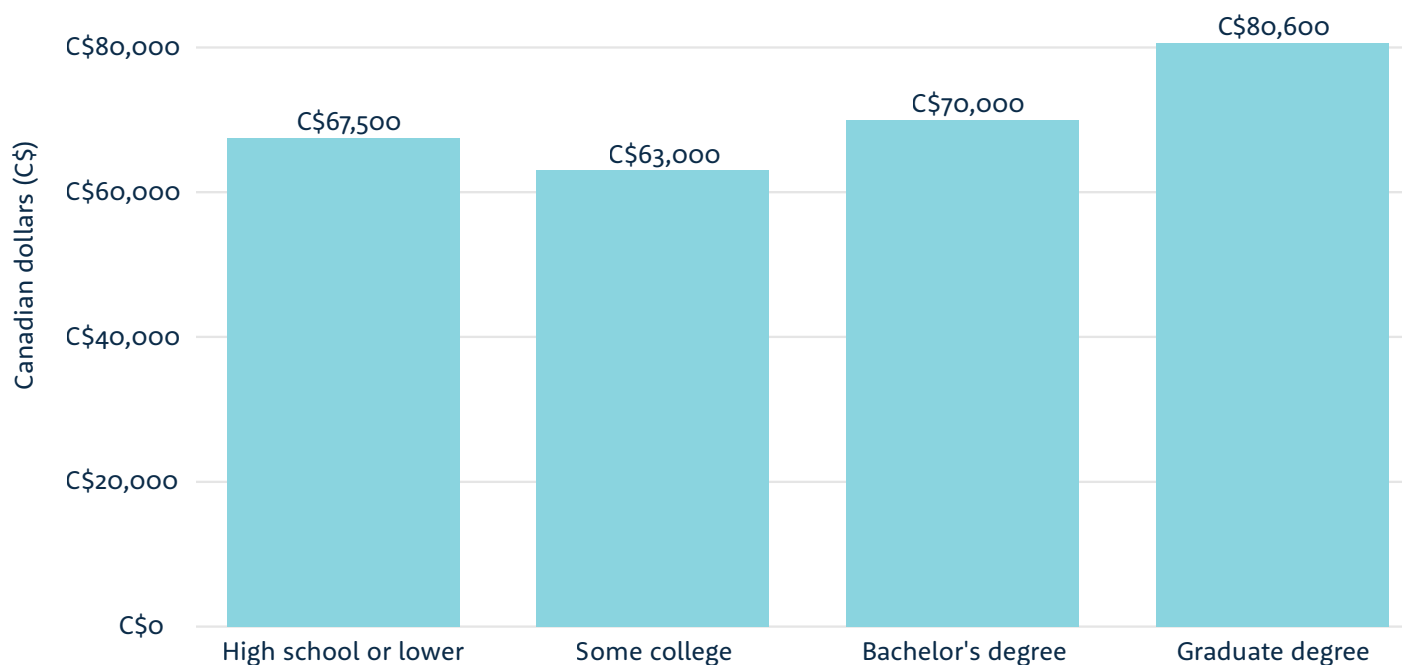
Share of Professional Developers by Highest Level of Formal Education and Country/Region, 2017
 % of survey respondents



Sources: 2017 Annual Developer Survey; BII+E analysis.
 Note: Only professional developers included.

Average Salary of Canadian Professional Developers by Formal Education Level, 2017

Median annual salary in C\$ of survey respondents



Sources: 2017 Annual Developer Survey; BII+E analysis.

Note: Only professional developers included.

DEVELOPERS RELY ON A MIX OF FORMAL AND INFORMAL EDUCATION

Ninety-five percent of professional developers in Canada have at least some college or university education according to the 2017 survey, which is slightly less than in the US (96 percent), and greater than in the EU (89 percent) and the rest of the world (93 percent). The prevalence of higher education among professional developers is far higher than in the the rest of the Canadian labour force, where 71 percent had at least some level of postsecondary education in 2016, including a postsecondary certificate, diploma, or degree.²¹

For developers in Canada, higher education is generally associated with higher incomes. While the median salary reported in the 2017 survey by Canadian professional developers with a bachelor's degree (C\$70,000) was only about three percent higher than for those with no more than a high school education, developers with graduate degrees earned 15 percent more—with a median salary of C\$80,600—than those with a bachelor's degree.

INDUSTRY PERSPECTIVES

How did you acquire the necessary skills to do your work?



“I have an [undergraduate] degree in engineering, which provided good experience in programming, software development principles, problem solving, and critical thinking. I was able to learn the specifics of Android development through online tutorials, trial and error, and lots of time with Stack Overflow.”

Phil Shadlyn

Developer at Varage Sale

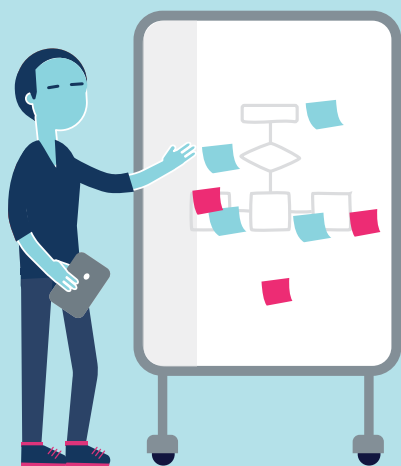


“Early on, my education consisted entirely of tutorials found on the internet. I was a motivated learner and I spent most of my free time working on personal projects. By the time I took my first formal computer science course in high school, I had already acquired most of the skills that were being taught. I applied for a special program that my high school offered which blended art and technology, and this drastically expanded my repertoire by training me in related skills, such as graphic design and animation.

I went on to take computer science at the University of Waterloo, which gave me the deeper programming understanding that I needed to take my skills to the next level. Since then, I have continued improving my skills through online video courses and tutorials.”

Zak Thompson

Lead Web Developer at Bridgit



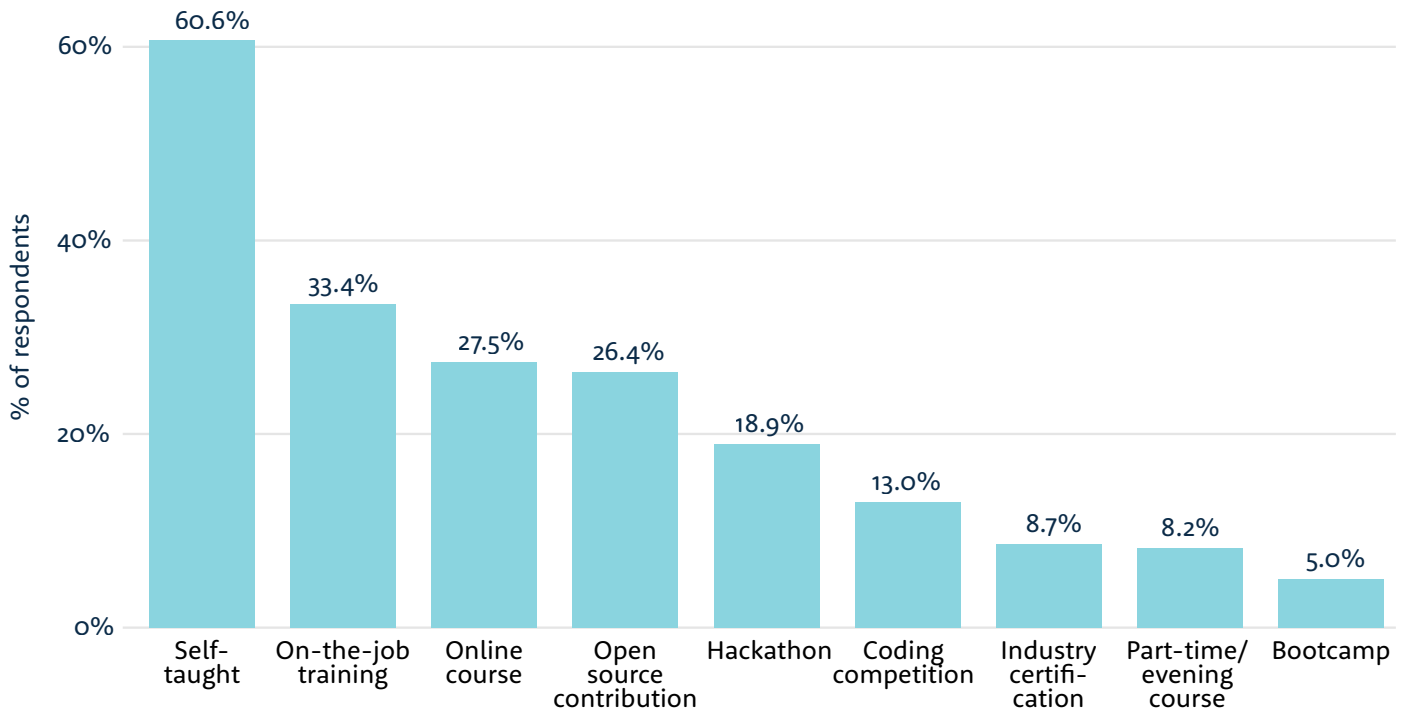
Despite the high proportion of Canadian professional developers with postsecondary education, 60 percent of Canadian professional developers reported they were at least partially self-taught and over one quarter had taken an online course, according to the 2017 survey. This suggests that a large number of Canadian developers are acquiring the necessary skills for their profession through means outside of traditional education, including: massive open online courses (MOOCs) such as those offered through Coursera; coding bootcamps such as Brainstation and HackerYou; open source projects through platforms such as GitHub; and question-and-answer sites such as Stack Overflow.^{22, 23, 24}

Self-driven learning among Canadian professional developers is prevalent across all levels of education attainment.

Self-driven learning among Canadian professional developers is prevalent across all levels of education attainment. About 70 percent of survey respondents with a high school education were partially self-taught. Graduate students were not far behind, with 59 percent reporting being partially self-taught.

Share of Canadian Professional Developers by Informal Education, 2017

% of survey respondents



Sources: 2017 Annual Developer Survey, BII+E analysis.

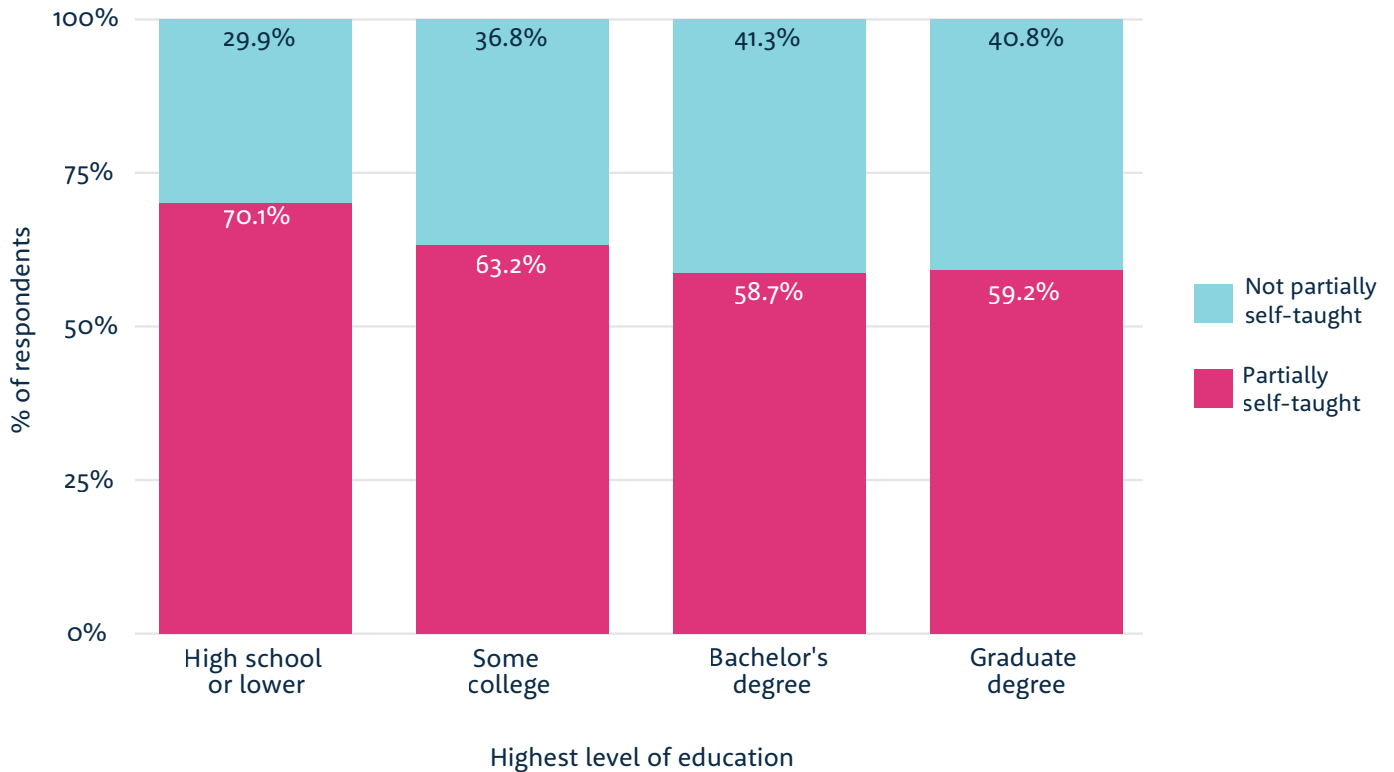
Note: Only professional developers included. Non-responses to the informal education survey question were included.

While bootcamps are becoming increasingly prevalent in the developer community, Canadian developers are more likely to use them to acquire new skills and stay abreast of the latest trends as opposed to using them to become newly employed as a developer. Over half of Canadian respondents to the 2017 survey had a developer job prior to

enrolling in a bootcamp. In fact, based on insights from recent employer roundtable consultations, bootcamps alone are not regarded by tech startups as providing the credentials or experience they are looking for in new hires, as compared to, for example, prior experience in a large company.²⁵

Share of Canadian Professional Developers Partially Self-Taught At Each Level of Formal Education, 2017

% of survey respondents per formal education level



Sources: 2017 Annual Developer Survey, BII+E analysis.

Note: Only professional developers included. Non-responses to the informal education survey question were included.

INDUSTRY PERSPECTIVES

What credentials/experience/skills do you look for in developers you hire?



“Friendliness, approachability, and humility, first of all. We don’t require post-secondary, but understanding the guts and theory of computer science is necessary at a senior level. We also need people who are curious and eager to learn new languages and tools, but can evaluate them critically, not just go with trends.”

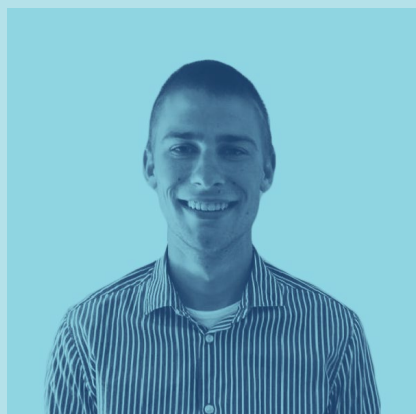
Florencia Herra-Vega
CTO at Peerio



“[We have] no preference for specific degrees. We look more at outside interests than what program they were in: What did they spend their free time doing? Learning more? Leading groups? We’re interested in softer skills development areas that can give us insight into their interests.”

Megan Hall
Head of People and Culture, Smile.io

What is the value of informal education (such as bootcamps or online courses)?



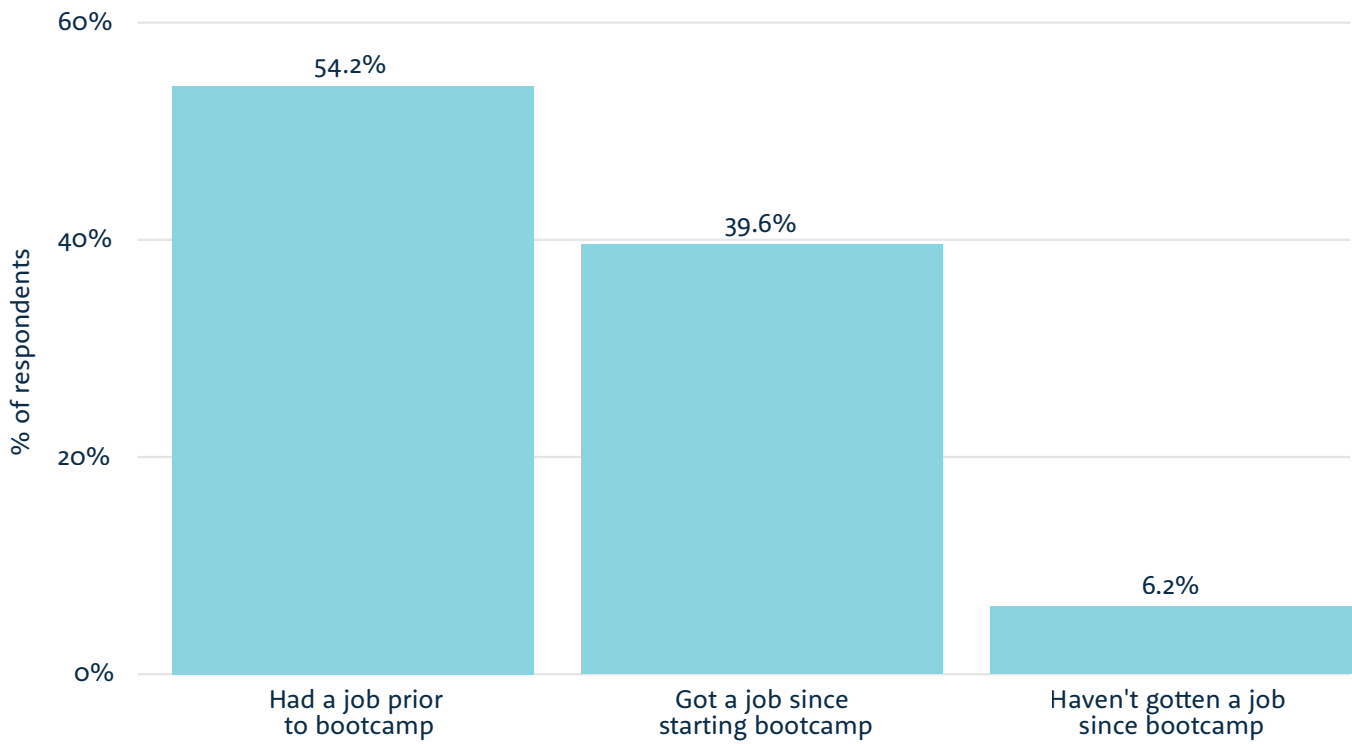
“Bootcamps are a great way to get started on a topic that you don’t know how to dive into.

In my opinion they aren’t a complete experience, but they’re a great starting point!”

Clayton Passmore
Software Engineer at Smile.io

Share of Canadian Developers by Employment Status Relative to Participating in a Bootcamp, 2017

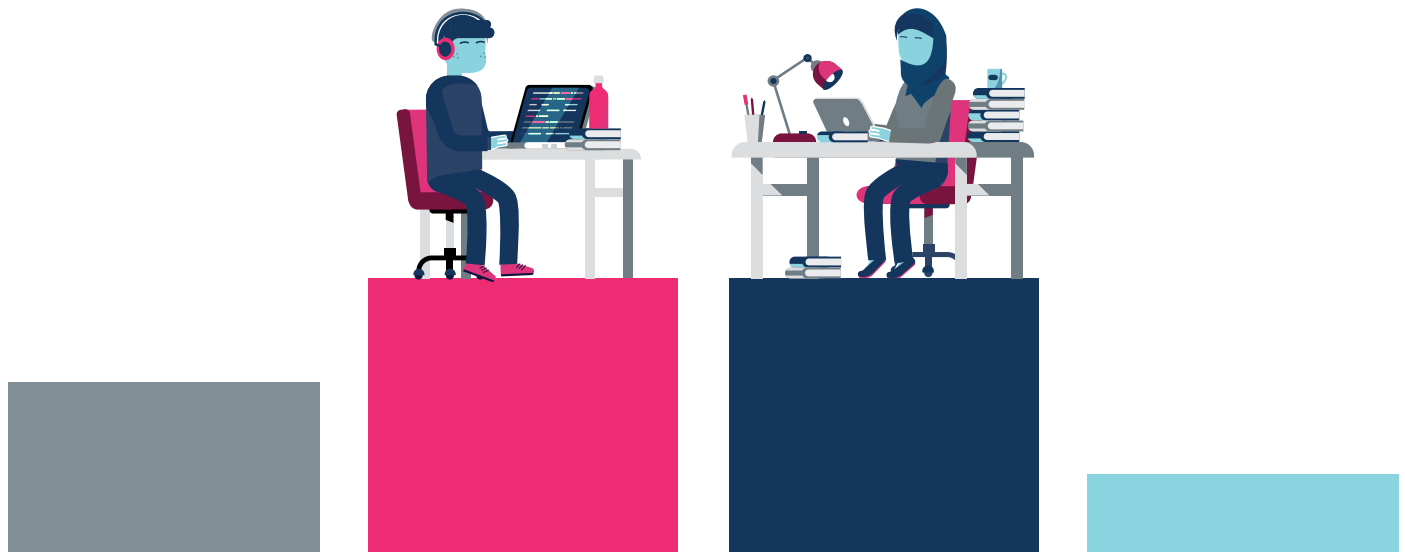
% of survey respondents



Sources: 2017 Annual Developer Survey; BII+E analysis.

96 responses

Note: Non-responses omitted.



WHO ARE CANADA'S DEVELOPERS?



This segment of our labour market continues to lack gender, ethnic and racial diversity.

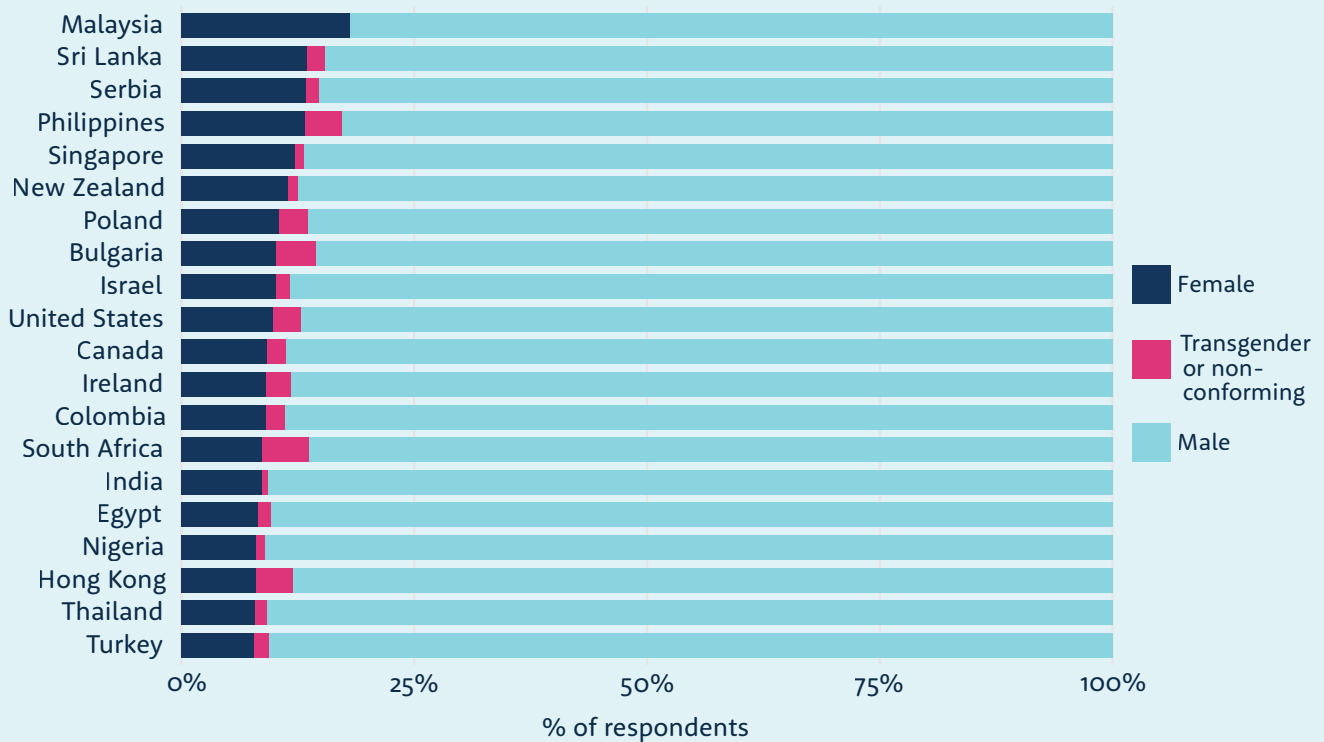
Despite the increasing number of software developers in Canada, this segment of our labour market continues to lack gender, ethnic, and racial diversity.

CANADA'S DEVELOPER TALENT POOL IS PREDOMINANTLY MALE

Over 88 percent of Canadian respondents to the 2017 Annual Developer Survey identified as male, while only 9 percent identified as female.*²⁶ Notwithstanding the preponderance of male developers, Canada had the 11th highest proportion

Share of Developers by Gender Among Top 20 Most Female-Represented Countries, 2017

% of survey respondents



Sources: 2017 Annual Developer Survey; BII+E analysis.

65 countries in sample

Note: Non-responses omitted. Minimum 50 respondents per country.

of female developers internationally (among countries with at least 50 survey respondents), ranking just behind the US.

The share of Canadian female respondents has grown over the past two annual surveys, with the ratio of males to females dropping from roughly 17 to 10 males per female between 2015 and 2017. However, this trend may not have substantial bearing on real shifts in the underlying gender composition of the developer population over time given Stack Overflow's concerted efforts (particularly in North America) to recruit female participants in the 2017 survey.

In addition to being underrepresented, female professional developers in Canada earned less than their male counterparts on average in 2017. They reported a median salary of C\$65,000, seven percent below the median salary of \$70,000

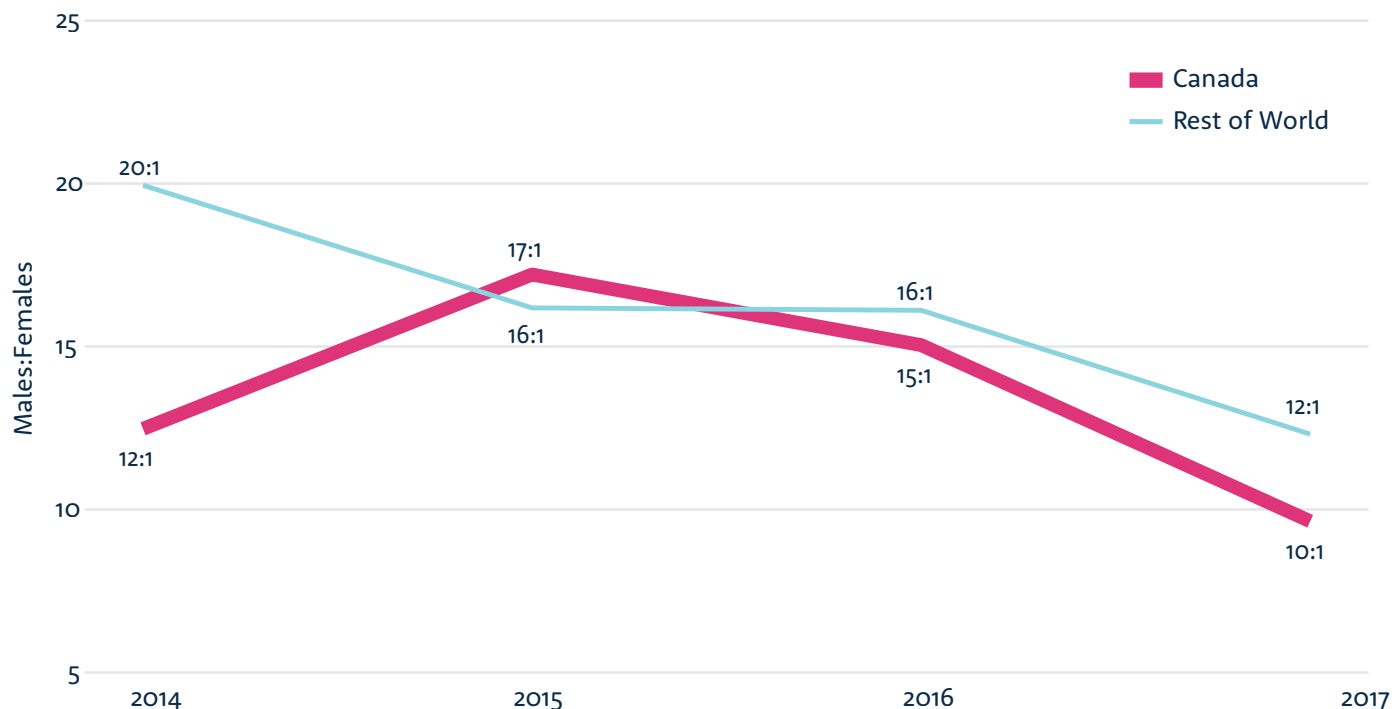
reported by males. Canada's gender wage gap was more than three percentage points narrower than other countries with large developer populations, such as the US, France, and the UK.

Female developers generally reported having fewer years of professional programming experience than males. Fifty-five percent reported having programmed for under five years as part of their jobs compared to 41 percent among males, according to the 2017 survey. At the other end of the spectrum, 22 percent of males reported having over 15 years of experience—more than double the share among females.

*The 2011 National Household Survey (99-012-X2011033) indicates a slightly more balanced gender split than Stack Overflow's survey, with men and women accounting for 78.3 percent and 21.7 percent of the developer population, respectively, as defined by the Statistics Canada NOC codes related to developers.

Ratio of Male to Female Canadian Developers Over Time, 2014–2017

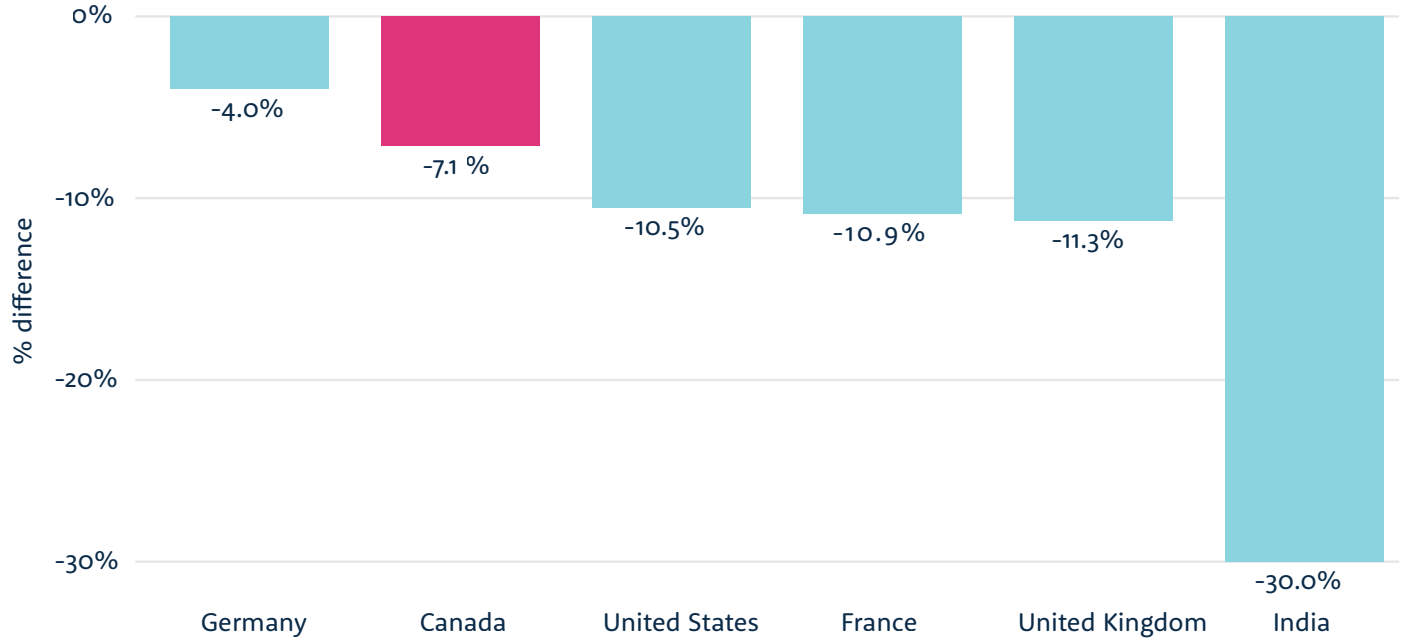
Number of male survey respondents to female respondents



Sources: 2014–2017 Annual Developer Surveys; BII+E analysis.
 Note: Non-responses omitted.

Salary Gap Between Male and Female Professional Developers Among Developer-Populous Countries, 2017

% difference between median female and male respondents' salaries



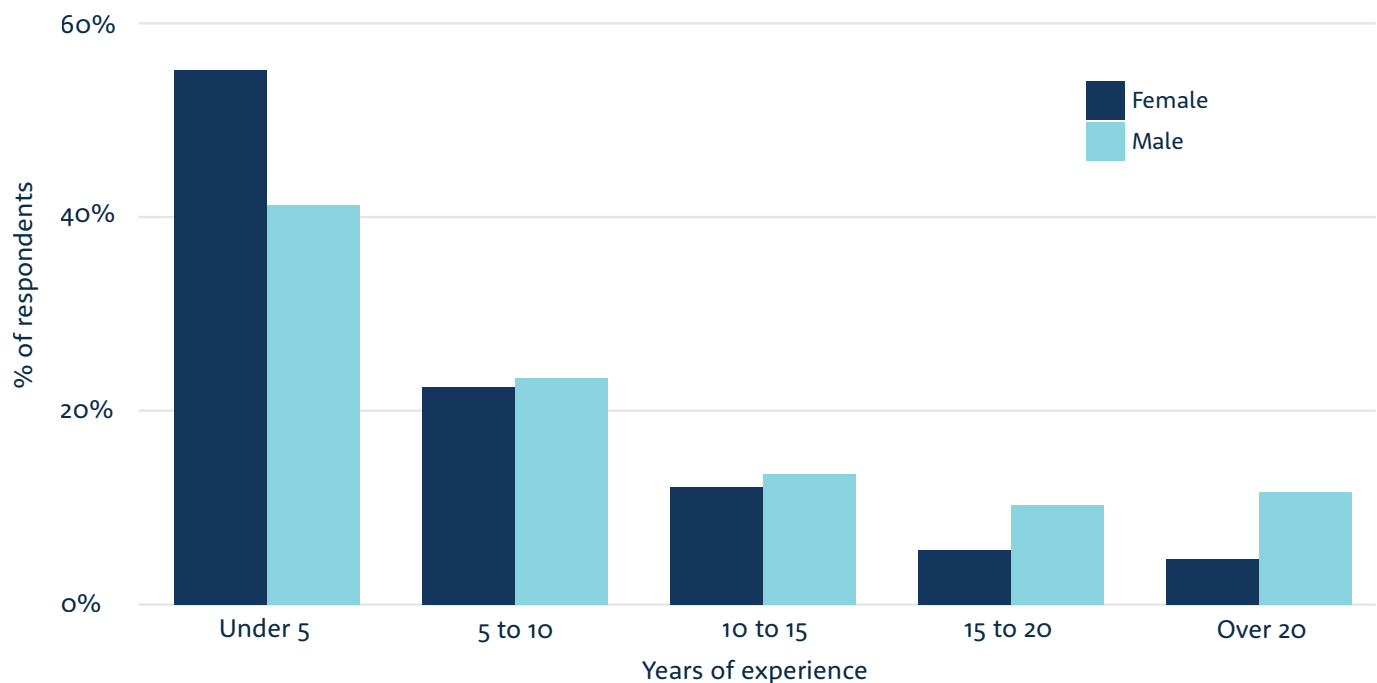
Sources: 2017 Annual Developer Survey; BII+E analysis.

Note 1: Only professional developers included.

Note 2: Minimum 20 salary responses from each of males and females per country.

Share of Canadian Professional Developers by Years of Experience and Gender, 2017

% of survey respondents



Sources: 2017 Annual Developer Survey; BII+E analysis.

Note: Only professional developer included.

DEVELOPERS LACK ETHNIC AND RACIAL DIVERSITY

The vast majority (83 percent) of Canadian developers responding to the 2017 survey identified as white (or of European descent). East and South Asian developers accounted for the second and third largest shares respectively, and collectively accounted for 11 percent of survey respondents. Meanwhile, developers who identified as black or of African descent accounted for the lowest share at just under two percent.

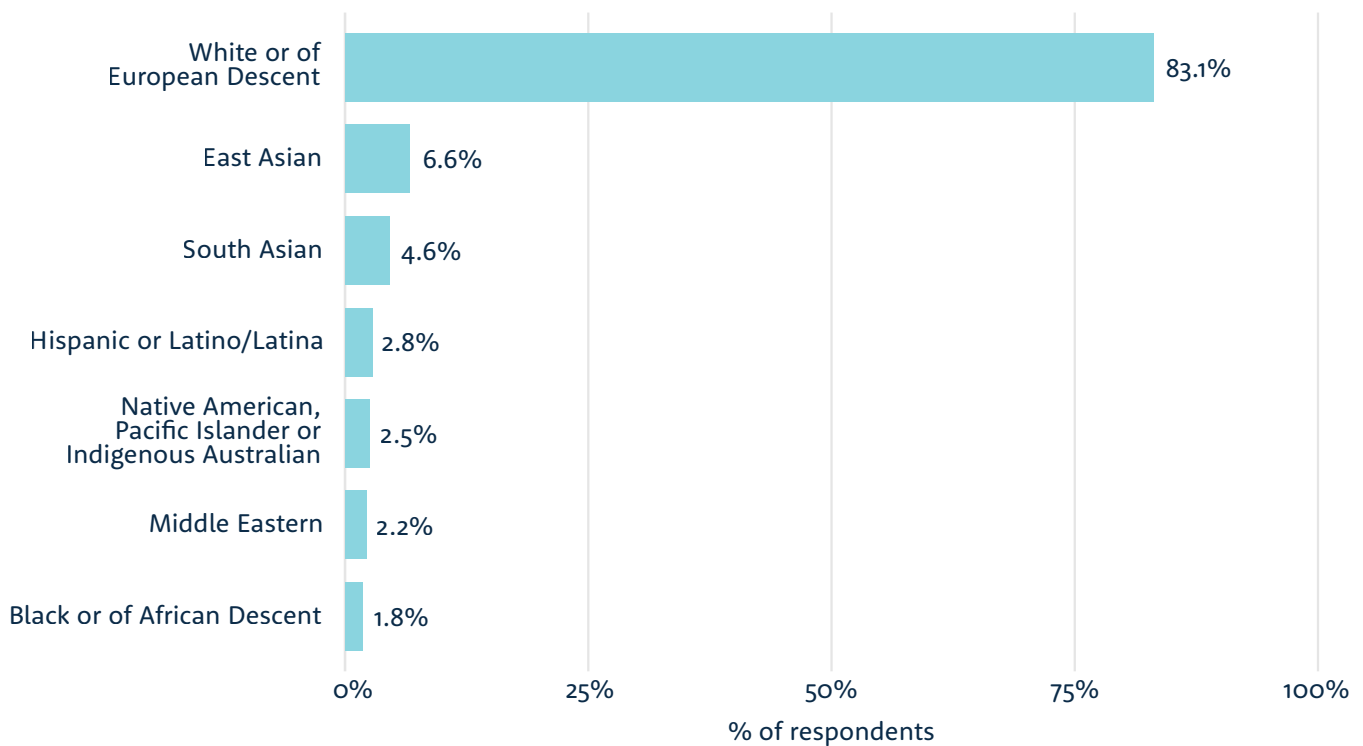
This lack of diversity could be the result of multiple factors, including divergences in who chooses to engage in—or has access to—relevant education and training opportunities, as well as differences in personal networks. This suggests that more attention should be paid to encouraging and equipping Canadians from across gender, ethnic,

The vast majority (83 percent) of Canadian developers responding to the 2017 survey identified as white (or of European descent).

racial, and other divides to build the skills required to be a developer, and to ensuring that pathways to employment exist through, for example, mentorship programs or worker-employer matching platforms. As technology becomes more and more pervasive across sectors, digital skills are likely to grow in importance. While the profession of the developer is only one among many that will be relevant in Canada's changing economy, the lack of diversity within this profession may be indicative of broader digital education and skill divides.

Share of Canadian Developers by Ethnicity, 2017

% of survey respondents



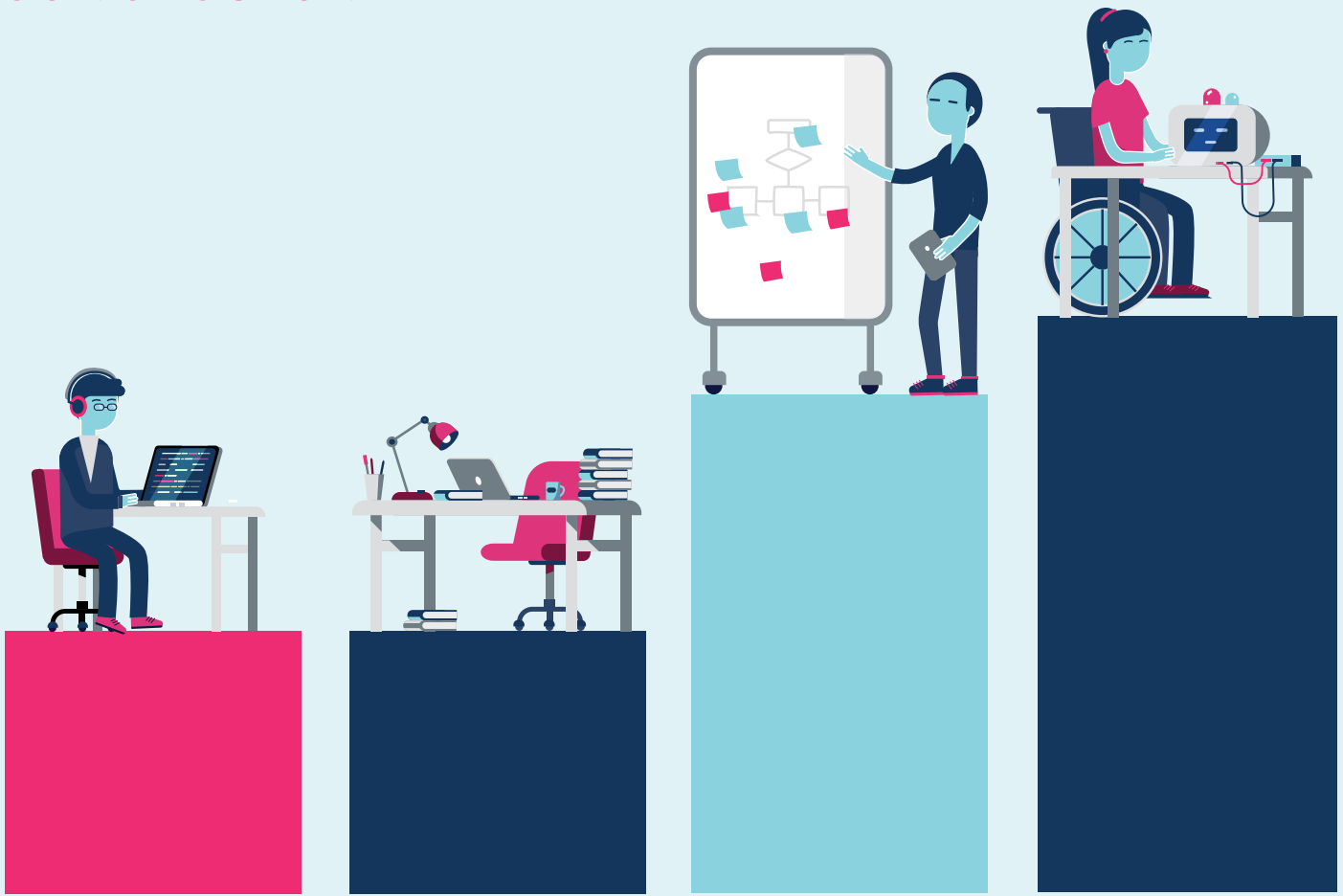
Sources: 2017 Annual Developer Survey; BII+E analysis.

1,536 responses

Note 1: Non-responses omitted.

Note 2: Respondents could select more than one option.

CONCLUSION



Software developers play a central role in Canada’s expanding tech sector and in the diffusion of technology throughout the economy. They exemplify the growing need for digital skills in today’s rapidly evolving labour market, particularly as technology becomes more pervasive in our work and daily lives.

This report has sought to take a closer look at this crucial segment of Canada’s labour force using the highly granular and current survey results and web traffic datasets provided by Stack Overflow. Our analysis has shown that Canada is home to a dynamic and globally competitive pool of developer talent—one that is expanding across sectors, commanding high wages, and using informal skills development opportunities to build on formal education and stay current in a changing economy. Despite its growth and dynamism, however, this segment of the Canadian labour market remains unrepresentative of Canada’s diverse population.

Providing all Canadians with opportunities to gain digital—including developer—skills from a young age has been identified as a priority by governments across the country. This report underlines the value of such investments to continue to grow our developer talent pool, increase the diversity of a key segment of the labour market, and help Canadians gain skills that are becoming more and more relevant in an increasingly digital economy.

We will continue to build off of these initial findings to further our understanding of how the developer landscape in Canada is evolving.

INDUSTRY PERSPECTIVES

What is your “wish list” for developers in Canada? How do you see government supporting?



“Subsidies to help startups hire that first developer when the company is not yet profitable would help drive innovation, [rather than] tax credits that still have an impact on cash flow.

[I’d also like to see] an educational system that also teaches resilience, and communication of abstract concepts.”

Sherif Zaroubi

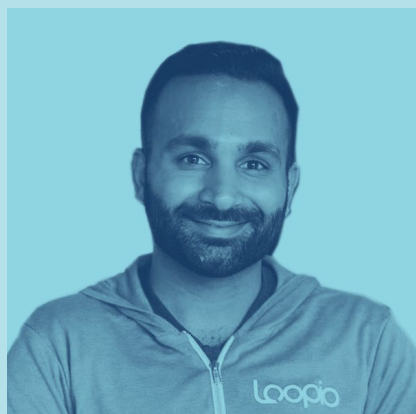
Founder and CTO of BidSettle



“I’d love to see more educational models that mix academic and apprenticeship approaches. On a different note, [I’d like to see] more education for employers on navigating the bureaucracy for hiring skilled workers from abroad. It’s hard for small companies to wrangle, but we constantly get applications from highly qualified people who’d like to come to Canada.”

Florencia Herra-Vega

CTO at Peerio



“Just keep funding, supporting, and providing the right incentives for emerging tech companies. If we fuel the ecosystem, the rest will come.”

Zakir Hemraj

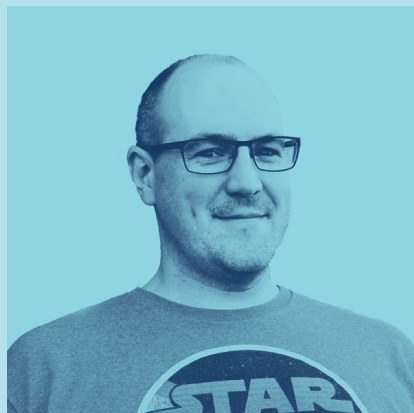
CEO at Loopio



“There seem to be a lot of large companies hiring developers who take advantage of research and development tax credits to pay them the salary they expect. It would be nice if there were similar programs to help smaller companies hire/train developers who have recently graduated in any field and need experience to be valuable to companies like ours.”

Suzanne Dergacheva

Cofounder at Evolving Web



“The government can help by making it a little bit easier to get a degree or diploma in the field. Whether that’s through grants or funding for postsecondary [education] or adding technology and basic development skills to earlier levels of education.

Canada’s economy has been dependent on our natural resources for a very long time. I think we’re starting to see [a shift] toward our tech resources, but we have more to do. The government can help by making it easier to start, run, and maintain companies that pertain to technology. It could be something as simple as improving internet connectivity—fostering competition on infrastructure like this could help tech companies compete with those in other countries.

When it comes to tech talent, Canada has all the right ingredients to rise to the top. We just have to get past ourselves. We tend to be pretty risk-averse. If there are ways for the government to make it less risky to get into tech, or stay in tech [they should be considered].”

Andrew Lockwood

Director of Development at Bridgit



APPENDIX : DEVELOPER ROLES

Developer Role	Focus
Android mobile developer	Developing mobile apps for the Android platform.
iOS mobile developer	Developing mobile apps for Apple's iOS devices.
Back-end web developer	Developing the back-end infrastructure for web applications, such as APIs, database servers, data validation and security, and integrating disparate internal services together.
Front-end web developer	Developing the front-end user interfaces for web applications.
Full-stack web developer	Developing both the front- and back-ends of web applications.
Desktop developer	Developing applications that run on desktop operating systems such as Windows or Mac OS.
Embedded developer	Developing code that runs on chips embedded into industrial equipment, consumer appliances, automobiles, smart homes, etc.
Graphics programmer	Developing high-performance graphics for computer games or scientific applications.
Data scientist	Analyzing data using a combination of statistical techniques and programming skills.
Machine learning specialist	Applying machine learning algorithms to large datasets.
Database administrator	Building and maintaining databases to support applications.
Systems administrator	Building and maintaining the overall infrastructure to support applications, including servers and network infrastructure.

ENDNOTES

1. Lamb, C., and Seddon, S. (2016). [The State of Canada's Tech Sector, 2016](#). Brookfield Institute for Innovation+ Entrepreneurship.
2. Stack Overflow. (2017). [Developer Survey Results](#).
3. The World Bank. (2016) <https://data.worldbank.org/indicator/SP.POP.TOTL>.
4. [IMF World Economic Outlook](#). (2017). Gross domestic product valued at purchasing power parity exchange rates.
5. Statistics Canada. (2017). [Table 282-0088](#). Labour force survey estimates (LFS), employment by North American Industry Classification System (NAICS), seasonally adjusted and unadjusted monthly (persons x 1,000), CANSIM.
6. Three largest cities by population in 2016—Toronto, Montreal, Vancouver—from CANSIM 051-0056. CANSIM 282-0135 for employment data.
7. The Financial Times Limited. (2017). [Helsinki: Feeling the Nokia effect](#).
8. Ghosh, S., Pandey, A., and Rocha, E. (2014). [BlackBerry's meltdown sparks start-up boom in Canada's Silicon Valley](#). Thomson Reuters.
9. Stack Overflow. [JavaScript](#).
10. Stack Overflow. [Structured Query Language \(SQL\)](#).
11. Diakopoulos, N. and Cass, S. (2017). [Interactive: The Top Programming Languages 2017](#). IEEE Spectrum.
12. Sourceforge. [Advantages of Visual Basic](#).
13. Diakopoulos, N. and Cass, S. (2017). [Interactive: The Top Programming Languages 2017](#). IEEE Spectrum.
14. Holderness, S. (2016). [Why python?](#) Code School Blog.
15. Polovets, L. (2014). [Which Technologies Do Startups Use? An Exploration of Angellist Data](#). Coding VC.
16. Ibid.
17. McConnell, J. (2017). [Canada takes its \\$3 billion video game industry seriously as it pushes sector to new levels](#). Financial Post.
18. Nordicity. (2015). [Canada's Video Game Industry in 2015](#).
19. Statistics Canada. (2011). [National Household Survey](#).
20. Statistics Canada (2017). [Table 282-0074](#). Labour force survey (LFS), wages of employees by job permanence, union coverage, sex and age group, annual (current dollars unless otherwise noted), CANSIM. (Median weekly wage multiplied by 52 weeks a year for permanent employees.)
21. Butler, S. (2015). [How Google and Coursera may upend the traditional college degree](#). Brookings Institution.
22. Statistics Canada. (2017). [Table 282-0004](#). Labour force survey estimates by educational attainment, sex, and age group, CANSIM.
23. Burt, J. (2014). [How to become a software developer without a degree](#). The Guardian.
24. Thornton, J. and Lamb, C. (2017). [21st-Century Workforce Survival Guide](#). Brookfield Institute for Innovation + Entrepreneurship.
25. Brookfield Institute for Innovation + Entrepreneurship. (2017). Palette employer roundtables.
26. Stack Overflow. (2017). [Developer Survey Results](#).

SPECIAL THANKS

This report would not have been possible without the help and support of our friends at Stack Overflow.

We would also like to thank Samantha Clark at Communitel and the developers, designers, CTOs, and founders that shared their insights on this increasingly important profession.

Finally, we'd like to express our gratitude to our communications team, including Lauren Clegg, Coralie D'Souza, Erin Hesselink, and our designers Annalise Huynh, Lindsay Smail and Vivian To, who were invaluable in the creation and roll-out of this report.

Elements of this report are designed by iconicbestiary / Freepik.

