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Economic Development Journal
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## Building High Calibre City Data
*A Critical Tool to Drive Economic Development and Inclusive Prosperity in Cities*

## Urban Economic Development in a Rural Context
*Preparing for the Future in Orillia*

## Digital Disruption
*Jobs and Social Policy in the New Economy*

## Cultural Economies
*What Are They and How Do We Build Them?*

## Driving a Prosperous Future
*Economic Analysis of the Lasting Impact of Ontario Universities*

## Urban Tech Sector Growth Drives Economic Resilience
*Examining Resilience in the Toronto Tech Ecosystem*

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THE IEDC
# Economic Development Journal

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Kathleen Wynne
*Premier*



# welcome to ontario

Premier of Ontario - Première ministre de l'Ontario

## A Personal Message From The Premier

On behalf of the Government of Ontario, I am delighted to extend warm wishes to all the delegates of the International Economic Development Council (IEDC) Annual Conference.

Ontario is a place where the world meets – to do business, to launch new ideas and to find opportunities. We are leaders in the knowledge economy, with a highly skilled and educated workforce, and have a large and globally connected investor community.

I am pleased to know that IEDC has chosen Toronto as the venue of its first conference outside the United States.

In our increasingly connected world, it is vital that we work toward regional collaboration in order to create opportunities and wealth for our businesses and communities. Conferences such as this bring economic developers, elected officials and public servants, and other stakeholders to exchange ideas on how to build a sustainable prosperity that brings jobs and opportunities to all.

Please accept my best wishes for an informative and productive conference.

Kathleen Wynne
*Premier*

# welcome to toronto

John Tory
*Mayor of Toronto*

## Message From The Mayor

It gives me great pleasure to extend greetings and a warm welcome to everyone attending the International Economic Development Council's 2017 IEDC Annual Conference.

As Canada's largest city with a population of more than 2.8 million, Toronto is a global centre for business, finance, arts and culture and is dedicated to being a model of sustainable development.

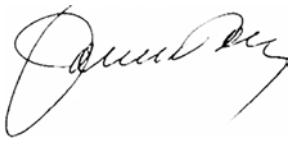
The City of Toronto is honoured to be hosting this conference, IEDC's first outside of the United States.

This conference hosts members of the IEDC, the largest membership organization for economic developers in the world, and presents a wonderful opportunity to gather in a setting designed for professional development and presents an exceptional networking and learning forum.

I welcome everyone to our city and encourage you to enjoy all that Toronto has to offer.

On behalf of Toronto City Council, please accept my best wishes for an informative and enjoyable conference.

Yours truly,



John Tory
*Mayor of Toronto*

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INTERNATIONAL ECONOMIC DEVELOPMENT COUNCIL

# urban tech sector

## GROWTH DRIVES ECONOMIC RESILIENCE

*By Jaxson Khan and Olivia Labonté*

*Jen Lee Koss and Kena Paranjape – Co-Founders of Brika, an online marketplace for crafts*


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**Leaders in the Toronto tech scene appear in all the photos.**

*Note: this article is based on "How Technology Is Changing Toronto Employment," a report by TechToronto.org.*


**Acknowledgements from the TechToronto report, a collaboration between TechToronto, PwC, Emsi, and the Innovation Policy Lab at University of Toronto's Munk School of Global Affairs:**

TechToronto: Alex Norman, Jason Goldlist; PwC: Jesse Albiston, Adam Thorsteinson, Burzin Contractor, Cassandra Ruggiero, Laura Hildebrand; Emsi: Jordan Vukanovich, Brendan O'Neill, Josh Wright; Innovation Policy Lab at University of Toronto's Munk School of Global Affairs: Travis Southin, David Wolfe


### INTRODUCTION

In recent years, technology and entrepreneurship have been promoted as the future of economies. Technology and entrepreneurship are expected to create the prosperity and jobs that major cities, such as Toronto, need to stabilize and grow their economies after the economic crisis of 2008 and anemic economic growth of the last decade. As the economic hub of Canada, Toronto houses major parts of the country's economy, and sectors within it have a growing percentage of technology-driven employees. Recently, Toronto has emerged as having one of the fastest growing technology-driven sectors among cities in the world, in the top 20 of the Compass Global Startup Ecosystem Ranking.

Technology has already transformed the economy. The Internet, mobile technologies, wearables, big data and machine learning are included in technologies that have created thousands of new companies and jobs in Toronto alone. This study demonstrates the impact of technology sector growth on urban economic resilience, as demonstrated by the Toronto economy. Resilience can be defined as an economy's vulnerability to crises and its capacity to absorb and overcome shocks while supporting strong growth (Sunley and Martin, 2014; OECD, 2016). It also suggests ways to help technology ecosystems to prosper and grow. The study defines the Toronto tech ecosystem and measures the ecosystem's resilience, robustness and impact on the economy. The first section provides a quantitative overview of the Toronto economy at large and the growing tech ecosystem within it. The second section outlines policy recommendations and considerations for growth.

## EXAMINING RESILIENCE IN THE TORONTO TECH ECOSYSTEM

*The growth of the technology sector is driving economic resilience in urban centres. Toronto is a city that has one of the world's fastest growing technology sectors and its high economic resilience correlates to the growth of that sector. Economic resilience is improved by diversification, decentralization, and proportional income inequality, all factors which are positively influenced by the growth of tech sectors. Toronto's tech sector growth also has strong implications for education and training, including gender/race equality, towards maintaining the velocity of the sector and furthering its economic resilience.*

This report uses data about jobs and industries available from Statistics Canada and through Emsi's Analyst tool to chart the dimensions of the tech ecosystem in Toronto. This study was inspired by the methodology of The New York City Tech Ecosystem Report: Generating Economic Opportunities for All New Yorkers, which included all jobs from tech industries, as well as tech jobs in non-tech industries (HR&A Advisors, Inc, 2014). Using this methodology, the report identifies the ecosystem and shows how it drives a significant part of the economy.

Since 2010, the Toronto tech ecosystem has grown faster than the general economy and tech ecosystem in the rest of the country combined, adding 25,000 jobs beyond what was expected. But this Toronto-centric growth isn't uniform across the entire ecosystem. Since 2010, there's been no growth in the number of non-tech jobs in tech industries, (in fact non-tech jobs in tech industries declined by 1.1 percent). Tech jobs in non-tech industries grew by 15.7 percent, while tech jobs in tech industries saw the largest percentage growth, at 27.1 percent.

## METHODOLOGY

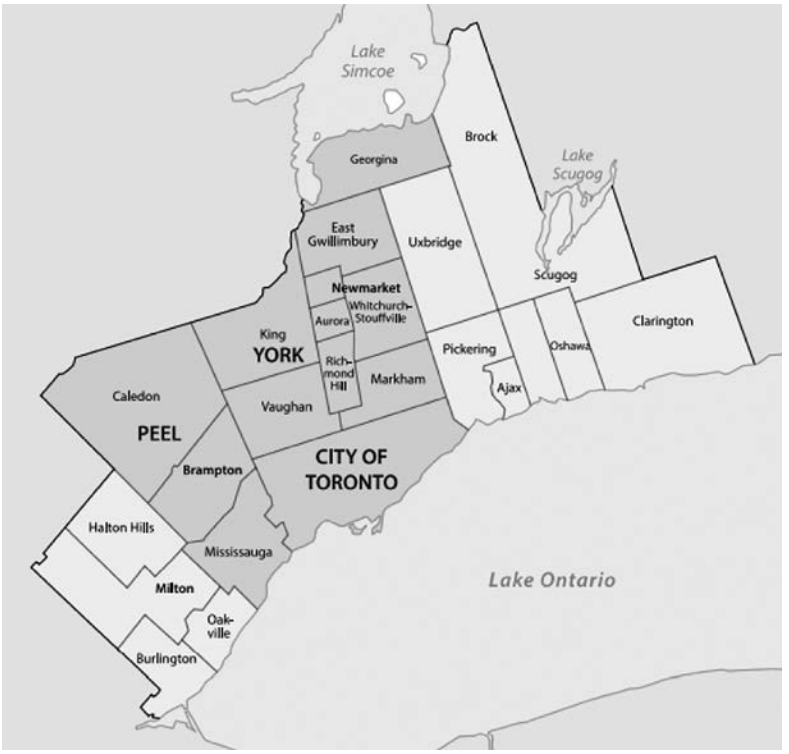
Economies have always been prone to major disruptions. It is within regional, urban, and local economies and communities that such shocks and disturbances work out their effects and consequences. The notion of resilience is highly pertinent for analyzing how regions and localities react to and recover from shocks, and for understanding how such shocks might impact important macroeconomic indicators (Martin and Sunley, 2014). This study combines the literature on economic resilience and its interdependencies to study the possible impacts of the tech ecosystem within the local economy of the city of Toronto.

As of 2015, there were 2.7 million people employed in Toronto (City of Toronto, 2015) (See Figure 1). For the purpose of this study, "Toronto" is defined as comprising the Toronto, Peel, and York census divisions. This region housed a diverse population of 5.4 million people in 2015 – with 49 percent of the population composed of immigrants (Ibid).

A "tech ecosystem" is defined in this study as "a network of organizations that enable the provision of goods or services rather than an isolated, independent industry. For example, a computer systems administrator employed by a hospital's information technology department is directly employed by the healthcare sector but also needs to be considered in evaluating the complete tech ecosystem" (NYC Tech Ecosystem Report, 2014).

An ecosystem for the purposes of this article is classified by the amount of employment and economic benefits which are generated within a specific region. Furthermore, "Tech" is defined in the same manner by both The New York City Tech Ecosystem Report (Ibid) and other similar analyses which define "tech" as the collection of techniques, abilities, and processes that are employed in the production of goods or services or in the accomplishment of goals.

**FIGURE 1 - Map of Toronto and Surrounding Area**




Source: City of Toronto (2015)

Additionally, this study was facilitated in part by Emsi, which collects and reports on over 12 data sources from Canada. Other data sources collected for this report include Statistics Canada, the City of Toronto, and Toronto-related reports.

Table 1 shows the criteria used to determine whether an industry should be classified as tech.

If all factors are confirmed, then the industry/occupation is qualified as "tech" in this study. It is important to note that both employed and self-employed labour markets were included in this study, as was done in The New York City Tech Ecosystem Report (Ibid) to better capture the breadth of the tech ecosystem.

The use of the North American Industry Classification System (NAICS) codes used in Canada, as approved by Statistics Canada, allowed a thorough categorization

**TABLE 1 – Tech Industry and Occupation Classification Criteria**

| | |
|---|---|
| Industry factor (1) | Is this industry enabled by tech? |
| Industry factor (2) | Does this industry produce tech? |
| Occupation factor (1) | Does this occupation directly produce tech? |
| Occupation factor (2) | Does this occupation facilitate the use of tech by others? |
| Occupation factor (3) | Would this occupation cease to exist without the presence of tech? |

Source: NYC Tech Ecosystem Report, 2014

## TABLE 2 – Tech Industry and Occupation Classification

### NAICS for Toronto Used in Report

| Description | NAICS |
|---|---|
| Computer and peripheral equipment manufacturing | 3341 |
| Communications equipment manufacturing | 3342 |
| Semiconductor and other electronic component manufacturing | 3344 |
| Navigational, measuring, medical and control instruments manufacturing | 3345 |
| Other electrical equipment and component manufacturing | 3359 |
| Software publishers | 5112 |
| Wired telecommunications carriers | 5171 |
| Wireless telecommunications carriers (except satellite) | 5172 |
| Satellite telecommunications | 5174 |
| Other telecommunications | 5179 |
| Data processing, hosting and related services | 5182 |
| Other information services | 5191 |
| Computer systems design and related services | 5415 |
| Scientific research and development services | 5417 |

### NOCS for Toronto Used in Report

| Description | NOCS |
|---|---|
| Architecture and science managers | 0212 |
| Computer and information systems managers | 0213 |
| Data entry clerks | 1422 |
| Electrical and electronics engineers | 2133 |
| Chemical engineers | 2134 |
| Industrial and manufacturing engineers | 2141 |
| Aerospace engineers | 2146 |
| Computer engineers (except software engineers and designers) | 2147 |
| Other professional engineers, n.e.c. | 2148 |
| Information systems analysts and consultants | 2171 |
| Database analysts and data administrators | 2172 |
| Software engineers and designers | 2173 |
| Computer programmers and interactive media developers | 2174 |
| Web designers and developers | 2175 |
| Chemical technologists and technicians | 2211 |
| Biological technologists and technicians | 2221 |
| Forestry technologists and technicians | 2223 |
| Civil engineering technologists and technicians | 2231 |
| Mechanical engineering technologists and technicians | 2232 |
| Industrial engineering and manufacturing technologists and technicians | 2233 |
| Electrical and electronics engineering technologists and technicians | 2241 |
| Electronic service technicians (household and business equipment) | 2242 |
| Industrial instrument technicians and mechanics | 2243 |
| Aircraft instrument, electrical and avionics mechanics, technicians and inspectors | 2244 |
| Architectural technologists and technicians | 2251 |
| Industrial designers | 2252 |
| Computer network technicians | 2281 |

| Description | NOCS |
|---|---|
| Information systems testing technicians | 2283 |
| Medical laboratory technologists | 3211 |
| Medical laboratory technicians and pathologists' assistants | 3212 |
| Respiratory therapists, clinical perfusionists and cardiopulmonary technologists | 3214 |
| Medical radiation technologists | 3215 |
| Cardiology technologists and electrophysiological diagnostic technologists, n.e.c. | 3217 |
| Other medical technologists and technicians (except dental health) | 3219 |
| Library and public archive technicians | 5211 |
| Film and video camera operators | 5222 |
| Broadcast technicians | 5224 |
| Audio and video recording technicians | 5225 |
| Other technical and co-ordinating occupations in motion pictures, broadcasting and the performing arts | 5226 |
| Graphic designers and illustrators | 5241 |
| Customer and information services supervisors | 6314 |
| Customer services representatives - financial institutions | 6551 |
| Contractors and supervisors, electrical trades and telecommunications occupations | 7202 |
| Industrial electricians | 7242 |
| Electrical mechanics | 7333 |
| Electronics assemblers, fabricators, inspectors and testers | 9523 |
| Assemblers and inspectors, electrical appliance, apparatus and equipment manufacturing | 9524 |
| Assemblers, fabricators and inspectors, industrial electrical motors and transformers | 9525 |
| Mechanical assemblers and inspectors | 9526 |
| Machine operators and inspectors, electrical apparatus manufacturing | 9527 |

Source: Statistics Canada (2016) and NOCS (2011)

of all industries beyond the use of the established criteria. The use of the NAICS allows the identification of all employees in an industry class, using publicly available data. For example, a company that falls in the NAICS class of Software Publishers would be included in the total count for the tech ecosystem. In this research, 14 tech industries were selected in Toronto that support 170,000 jobs in tech companies that include both tech and non-tech jobs but are all part of the tech ecosystem (Statistics Canada, 2016).

The North American Industry Classification System (NAICS) is the standard used by federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing and publishing statistical data related to the Canadian business economy. The National Occupational Classification System (NOCS) 2011 is the authoritative resource on occupational information in Canada. Thousands of people use it daily to understand the jobs found throughout Canada's labour market.

Table 2 identifies how tech industries and occupations were classified in the study, using both classification systems – NAICS and NOCS.

All tech jobs in Toronto were identified using the National Occupational Classification System (NOCS) for Canada, which is used to categorize jobs. A specific position, such as a computer programmer or interactive media developer, can now be counted across all industries, whether in a tech industry or not. The full list of jobs considered as tech in Toronto (outlined below) enables the identification of all tech jobs from all industries.

The NOCS determined 329,000 tech jobs in Toronto. A cross-reference of the NAICS (170,000 jobs found in tech industries) and the NOCS (329,000 jobs in tech jobs) removed the overlap, as the count of tech jobs in tech industries is included in both. The total count of tech jobs within tech industries was located, or the tech NOCS within the tech NAICS (the breakdown is shown in Table 3). An overlap of 98,000 jobs was identified. An overlap example would be a computer programmer in a tech company. Experts in HR, economics, and demographic data analysis were consulted to confirm findings and methodology for this report.

Table 3 encompasses the most common jobs from all tech jobs in the tech industry e.g. Computer Programmer at Nascent Digital, all non-tech jobs in tech industries e.g. Sales Representative at SoapboxHQ, and all tech jobs in non-tech industries e.g. Technical Support job at RBC.

Another indicator used in this report is the Economic Complexity Index (ECI). The metric developed by Cesar Hidalgo of MIT and Ricardo Hausmann of Harvard University in 2014 uses data about a country's diversity of exports to assess the sophistication of its economy. This study applies it analogously to assess the sophistication of a city's economy by examining the diversity of industries it employs. Roughly speaking, a city has a more complex economy if it employs not only a diverse range of industries, but also industries that are relatively rare when compared to other cities in the country.

To measure the ECI of Toronto, the study examined 2015 industry employment data from Emsi's Analyst tool for all 33 Census Metropolitan Areas in Canada, broken down by 4-digit NAICS code. Each city is measured by diversity through counting the number of industries employed at levels above national averages. Then, the commonality of industries across the country is taken into account by calculating their ubiquity (a count of how many cities employ this industry).

Both values – diversity and ubiquity – are used to mutually correct one another. For each city, the average ubiquity of the industries that it employs is calculat-

*Virginia Block – President of Amego Electric Bikes, an electric bicycle retailer.*

**TABLE 3: The Most Common Jobs in the Tech Ecosystem**

| NOCS | Description | Employed in industry Group 2015 | Median Hourly Earnings |
|---|---|---|---|
| 2171 | Information Systems Analysts & Consultants | 26,980 | $34.99 |
| 2174 | Computer Programmers & Interactive Media Developers | 22,146 | $38.77 |
| 2173 | Software Engineers & Designers | 8,510 | $47.00 |
| 0213 | Computer & Information Systems Managers | 6,423 | $47.97 |
| 2281 | Computer Network Technicians | 4,408 | $30.88 |
| 2175 | Web Designers & Developers | 4,181 | $38.21 |
| 2147 | Computer Engineers (except software engineers and designers) | 2,986 | $16.01 |
| 9523 | Electronics Assemblers, Fabricators, Inspectors & Testers | 2,881 | $32.52 |
| 2172 | Database Analysts and Data Administrators | 2,082 | $28.12 |
| 2242 | Electronic Service Technicians (household & business equipment) | 1,980 | $26.49 |

Source: Statistics Canada (2016) and NOCS (2011)

*Ray Reddy – Founder of Ritual, a mobile app for restaurant loyalty.*

ed, then the average diversity of the cities that employ those industries, and so on, until the numbers converge to a final value. These final values for each city are then adjusted so that their mean is 0 and their standard deviation is 1. The adjusted final value becomes the city's ECI.

Another important indicator used in this study is the Gini coefficient. It is important to note that since individuals in the tech ecosystem are by definition employed, when calculating the Gini coefficient for Toronto overall, this study only included the employed population for a more meaningful comparison. The overall Toronto Gini coefficient would have been higher if the unemployed population had been included as well.

Gini coefficients are calculated using the average annual income per occupation, which obscures inequality slightly because it averages out some of the income variance within jobs. Gini coefficients would likely have been slightly higher had the values not been averaged. All of this being said, when these values are considered relative to one another they can still be used for a meaningful comparison.

Compensation and GDP are great indicators of economic performance, but the recent financial crisis and recession have demonstrated that scale is not the only important metric. The resilience of an economy is a measure of growing importance to business owners and policy makers.

## KEY ECONOMIC/FISCAL IMPACTS

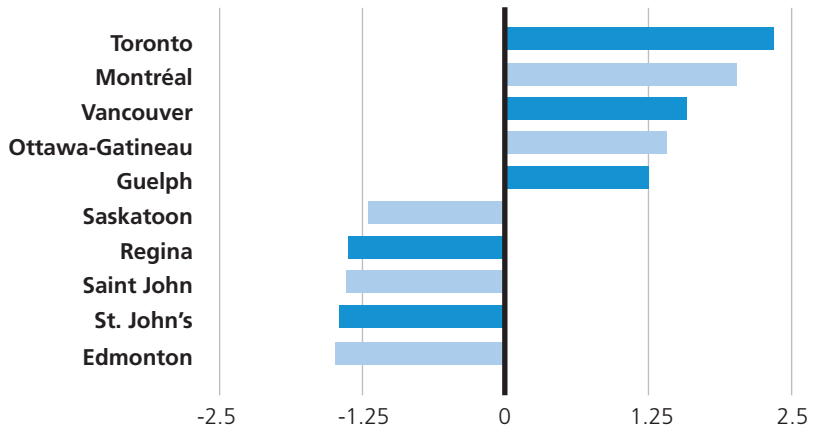
This section elaborates on the key impacts of a vibrant tech sector on improving the resilience of an urban economy. It highlights three factors and their relation to the tech sector. The first is diversification, which is recognized as the existence of jobs across multiple industries, which increases economic resilience by avoiding overreliance on a single or few industries. The second is decentralization, which entails the existence of innovation across multiple companies and institutions. This improves the chances that technology will continue to grow in an area, for example if a company moves. The last factor is low or proportional income inequality, a significant factor and marker of economic resilience. A relative balance of wealth improves the durability of an economy and the ability of citizens, especially the middle class, to create new ventures and generate new sources of wealth.

### Diversification

One of the key findings of this study is the impact of the tech sector on diversification. Diversification is defined as the degree to which jobs are spread out across multiple industries. An economy where jobs are spread across multiple industries carries less economic risk. Conversely, when jobs are heavily concentrated in a few sectors, then the economy is more susceptible to booms and busts in these industries and is thus quite fragile. For example, Detroit demonstrated this phenomenon through over-reliance on a single industry – the auto sector. It failed to diversify, while "places such as Chicago and Pittsburgh relied on other areas – like banking or education – beyond the industries that started their success" (New York Times, 2013). This section looks at the diversity of Toronto's economy overall and explores the role that tech plays in diversified economies.

In order to better gauge the diversity of Toronto's employment profile, it is important to first establish a robust measure. This study uses the Economic Com-

**FIGURE 2 – Top and Bottom Five Canadian Cities by Diversification**




Source: Hausmann et al, 2011

plexity Index (ECI) as a way to measure the economic diversity of a city in the context of the entire country. It counts the number of industries in a city and assesses the uniqueness of the city's industry profile in comparison to other regions.

An ECI above zero is a sign that a city employs a diverse range of industries, including ones that are relatively rare when compared to other regions. An ECI below zero suggests that a city employs relatively few industries, tending towards ones that are more common across regions. ECI is a strong predictor of future GDP-per-capita growth (Hausmann et al, 2011). At 2.36, Toronto has the highest ECI of all cities across Canada (See Figure 2) which argues that the city has a relatively diverse and unique employment profile.

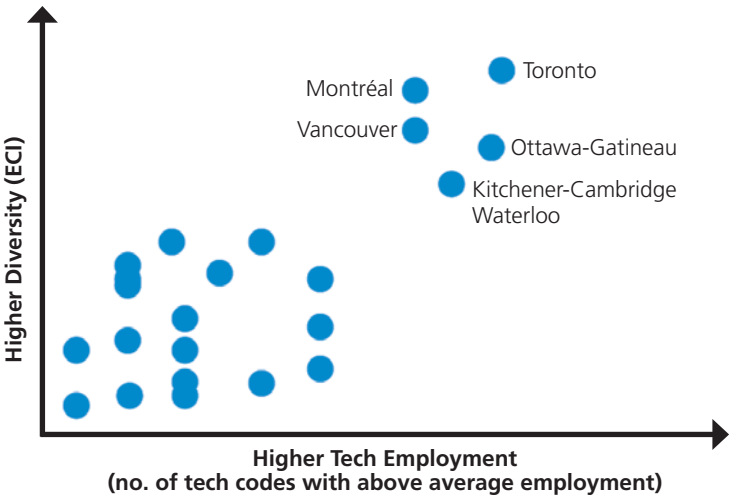
ECI analysis can also demonstrate that the tech industry is likely strongly associated with diverse city economies (Hausmann et al, 2011). For example, Canadian cities with above-average levels of tech industry employment tend to have a much higher ECI. The average ECI of cities with high tech employment is 1.68, while cities with lower tech employment have an average ECI of -0.30. According to many authors, economies more reliant on natural resources and primary industries tend to have lower ECIs, whereas economies weighted towards complex products and services tend to have higher ECIs (Hausmann et al., 2011; Martin and Sunley, 2014). Interestingly, while the ECI is calculated using industry diversification, the metric can also be seen as an indicator of the amount of knowledge embedded in a society due to the strong linkages between knowledge and diversification of the economy. Figure 3 demonstrates the diversity of a city's residents relative to its tech employment.

### Decentralization

Another key finding is the impact of decentralization on the tech industry. In this study, decentralization is defined similarly to diversification but narrows the scope to look at specific industries. To determine a city's decentralization, the concentration of companies within a single industry is observed. For example, if an industry has only one company, then this industry is highly centralized and not particularly resilient. If that company were to fold, be acquired or leave town, then the industry's economy would be decimated. A multitude of organizations of different sizes and complexities make for an industry that's more adaptable to change and more robust to failure. Toronto as a tech ecosystem, based on the number of companies and types of industries, is already relatively decentralized (Figure 4).

The spread of tech into non-tech industries is highly beneficial for the resilience of the ecosystem. There are no less than 18 different incubators and accelerators across Toronto's universities and colleges, so there will be continued opportunities for young entrepreneurs if any one of them were to enter a crisis (City of Toronto, 2015). The wide range of startups, mid-sized, and large enterprises is a sign that Toronto's economy can support tech organizations at scale. But there are some red flags

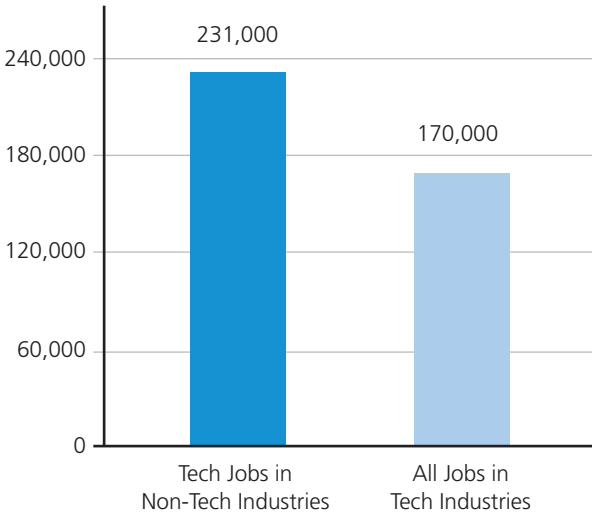
**FIGURE 3 – Diversity vs. Tech Employment by City**




Source: How Technology Is Changing Toronto Employment, 2016

*Lily Tse – Founder of ThinkDirty, a skincare product comparison app.*

**FIGURE 4 – There Are More Tech Jobs Outside of the Industry Than There Are Within It**




Source: How Technology Is Changing Toronto Employment, 2016

in the Toronto economy when it comes to centralization. Government support is being disproportionately concentrated into large organizations (Report of the Expert Panel Examining Ontario's Business Support Programs, 2016).

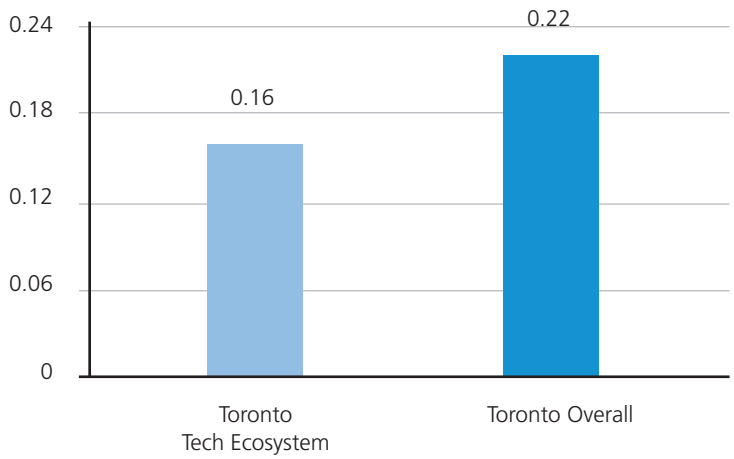
### Income Inequality

The average 2015 salary for Toronto tech ecosystem employees was $61,000. This figure is 11 percent higher than the average Toronto salary of $55,000 (City of Toronto, 2015). Tech jobs in tech industries have the highest average hourly wage in the ecosystem at $36.79 per hour. The lowest average wages in the ecosystem go to non-tech jobs in tech industries at $29.35. But all of these are higher than the average Toronto wage of $25.66. In total, the tech ecosystem in Toronto paid out over $24 billion in salaries. This represents 17 percent of all the compensation paid in the city in 2015, compared to 15 percent of the city's employment (City of Toronto, 2015; Statistics Canada, 2016).

Income equality is the final measure of economic resilience that is considered in this study as income inequality is intrinsically linked to resilience. The more equal a region's distribution of economic resources, the more cohesive and widespread the response can be to a disturbance (Cutter et al., 2010). If a crisis were to strike a city's economy but only the elite could afford to weather the storm, then the overall economy would struggle to recover. A population with more balanced wealth is more adaptable. Societies with more equal income distributions tend to have more durable growth (IMF, 2011).

The most common measure of income inequality is the Gini coefficient. Ranging from zero to one, a Gini coefficient of zero represents perfect equality, where every citizen earns the exact same amount, while a Gini coefficient of one represents extreme inequality, where all of the wealth is concentrated into a single individual.

**FIGURE 5 – Gini Coefficients in Toronto**




Source: How Technology Is Changing Toronto Employment, 2016

Meeting this significant demand for ICT workers will require policy action in increasing and diversifying enrollment in tech-related post-secondary education. Supporting Toronto's tech workforce are the city's many prominent universities, including the University of Toronto, York University and Ryerson University.

When we compare the Toronto tech ecosystem to the broader Toronto economy, we see lower levels of inequality within tech. This means that average salaries within tech are more evenly distributed, and this is a good thing when considering the resilience of the ecosystem (Figure 5).

But it's important to note that this analysis only scratches the surface of income equality. The wage gap between men and women has increased since the recession, with women now earning only 72 percent as much as men for the same type of work – and this issue persists across all industries, including tech (Lambert and McInturff, 2016).

## CHALLENGES FOR THE FUTURE

The following section highlights avenues of further research, including the need to give further consideration to gender and minority representation within the tech ecosystem.

### Education and Training

While this report has shown that Toronto's tech sector workforce is large and dynamic, research indicates that demand will continue to grow significantly. A 2015–2019 labour market outlook by the Information and Communications Technology Council surveyed over 1,000 firms and found that by 2019, Toronto will experience cumulative hiring requirements (combination of employment growth and replacement requirements) of 52,741 (24 percent) above 2015 levels of ICT workers. Toronto's ICT workforce demand accounts for much of provincial and national requirements, with Toronto's growth expected to account for 69 percent of Ontario's expected hiring requirements of 76,263 and 29 percent of Canada's expected hiring requirements of 182,700.

Meeting this significant demand for ICT workers will require policy action in increasing and diversifying enrollment in tech-related post-secondary education. Supporting Toronto's tech workforce are the city's many prominent universities, including the University of Toronto, York University and Ryerson University. These universities have more than 470 faculty members in teaching and research positions in ICT and related technologies programs such as computer sciences, includ-

*Mike Katchen – Founder of Wealthsimple, an automated investment platform.*

**TABLE 4 – STEM Education and Employment in Canada By Gender, Immigrant Status, Aboriginal Identity, 2011**

| | Total | Women % of Total | Immigrants % of Total | Aboriginal % of Total |
|---|---|---|---|---|
| Population aged 25-54 | 14,044,940 | 51.1% | 24.5% | 3.9% |
| Post-secondary credential | 9,340,495 | 52.5% | 26.1% | 2.5% |
| Post-secondary credential in a STEM field | 1,814,075 | 29.6% | 39.9% | 1.4% |
| Post-secondary credential in a STEM field and employed in a STEM-intensive occupation | 606,520 | 18.9% | 37.5% | N/A |
| % of those with a STEM credential employed in a STEM-intensive occupation | 38.9% | 26.9% | 39.1% | N/A |

Data Source: StatCan (2013a, 2013i, 2014n) and Panel calculations
Source: Some Assembly Required, Council of Canadian Academies

ing computer systems and game design. (The Information and Communications Technology Council, City of Toronto, 2015). As for postsecondary education in Toronto, 85 percent of Toronto students are enrolled in undergraduate programs, 7 percent in master's programs, and 8 percent in doctoral programs (Toronto Employment, 2016). In addition, Toronto's four colleges – Seneca College, Humber College, Centennial College, and George Brown College – had 5,935 students in the 2011/2012 academic year in programs such as software systems, computer engineering, health informatics technology, computer animation, and enterprise database management. (The Information and Communications Technology Council, City of Toronto, 2015)

### Gender/race equality

Despite the region's strength in postsecondary education, groups such as women and aboriginals remain underrepresented in the tech labour force. Women (51 percent of the population) represent just 29.6 percent of individuals with a post-secondary science, technology, engineering and mathematics (STEM) credential and 26.9 percent of those employed in a STEM-intensive occupation. Aboriginals (3.9 percent of the population) represent just 1.4 percent of individuals with a post-secondary STEM credential (Ibid) (See Table 4).

The Information and Communications Technology Council views these types of early outreach programs as essential to addressing the labour shortage and diversity problems in the ICT workforce. Similarly, the Council of Canadian Academies' Expert Panel of STEM Skills for the Future concluded that "support for early interventions that build on children's informal knowledge" and the development of "strong foundations in STEM literacy (enabled by effective teachers, research-based pedagogical methods, and engaging instruction and curricular materials)" is essential to preventing future labour supply bottlenecks. (Ibid, Council of Canadian Academies)

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*Evgeny Tchebotarev – Founder of 500px, a global photography community.*

## CONCLUSION

The growth of the technology sector is driving economic resilience in urban sectors. Toronto's technology sector is rapidly growing and advancing a strong urban economic resilience. This technology sector growth is diversifying Toronto's industries, decentralizing its centers of innovation, and increasing average wages. While the sector's growth has been strong, in order to maintain its positive effects and spread them across the broader populace, inclusive STEM-focussed education and training must be offered to people of all backgrounds, including marginalized groups. Cities seeking to improve economic resilience should invest in the inclusive growth of their technology sectors, of which Toronto's case study is a prime example.

Toronto's technology sector is rapidly growing and advancing a strong urban economic resilience.

## REFERENCES


City of Toronto. May 9, 2013. Backgrounder: 2011 national household survey. https://www1.toronto.ca/city_of_toronto/social_development_finance__administration/files/pdf/nhs_backgrounder.pdf. Retrieved September 13, 2016.

Council of Canadian Academies. Some Assembly Required. 2015.

Government of Ontario. Report of the Expert Panel Examining Ontario's Business Support Programs. April 6, 2016.

Hausmann, Ricardo, César A. Hidalgo, et al. October 2011. The atlas of economic complexity: Mapping paths to prosperity. Harvard and MIT. http://atlas.cid.harvard.edu/media/atlas/pdf/ HarvardMIT_AtlasOfEconomicComplexity.pdf. Retrieved September 6, 2016.

HR&A Advisors, Inc. The New York City tech ecosystem: Generating economic opportunities for all New Yorkers. http://www.hraadvisors.com/wp-content/uploads/2014/03/NYC_Tech_

Lambert, Brittany and Kate McInturff. March 2016. Making women count: The unequal economics of women's work. Canadian Centre for Policy Alternatives and Oxfam Canada. https:// www.policyalternatives.ca/sites/default/files/uploads/publications/National%20Office/2016/03/Making_Women_Count2016.pdf. Retrieved September 6, 2016.

Martin, Ron, and Peter Sunley. "On the notion of regional economic resilience: conceptualization and explanation." Journal of Economic Geography (2014): lbu015.

Organisation for Economic Co-operation and Development. Economic resilience. http://www.oecd.org/economy/growth/economic-resilience.htm. Retrieved September 6, 2016.

Padnani, Amy. "Anatomy of Detroit's Decline." The New York Times. The New York Times, 16 Aug. 2013. Web. 30 Jan. 2017.

Statistics Canada: CANSIM. http://www5.statcan.gc.ca/cansim/a01?lang=eng&p2=11.

The Information and Communications Technology Council. 2015. The Smart Economy Shaping Canada's Workforce: Labour Market Outlook 2015-2019. http://www.digcompass.ca/ wp-content/uploads/2015/07/Labour-Market-Outlook-2015-2019-FINAL.pdf Retrieved September 6, 2016