



Investigating the Global FinTech Talent Shortage

An Inter-Jurisdictional Review of Industry,
Postsecondary Institutions and Government
Response within London, UK; New York City, USA;
and Toronto, Canada

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EXECUTIVE SUMMARY

Technology is playing a significant role in transforming the financial services sector. However, both the financial services sector and the financial technology (FinTech) industry face mounting concerns related to attracting and retaining skilled talent that is necessary for their firms to sustain and grow now and into the future. Specialized talent that combines financial and digital skills are required to develop innovative and cost-efficient financial technology (FinTech) solutions.

This report examines the current challenges faced by the FinTech industry at global level. The report aims to inform post-secondary education institutions (PSEs) and the FinTech industry about strategies for reducing the talent shortage.

The report is a part of a larger research project, led by various collaborators at Ryerson University, that aims to respond to the financial services talent shortage in the GTA. The project examines how the industry and PSEs can align with each other to address the talent shortage challenge. Through case studies of notable global FinTech hubs, namely London, New York, Singapore, and San Francisco, this report presents a series of suggestions for addressing Toronto's own FinTech talent shortage. These suggestions are presented based on examining three categories of strategies of interventions: Educational Interventions; Incubators and Extra-Curricular Events, and; Government and Policy Interventions.

Suggestions for Educational Intervention:

1. Develop FinTech specialized programs.
2. Align STEM curriculum with current and future FinTech industry's needs through partnership/collaboration with the industry.
3. Promote STEM education and careers to students of all age groups, especially to female students.

Suggestions for Incubators and Extra-Curricular Events:

1. Develop online education programs for FinTech related skills, suitable for both university students and adult learners.
2. Develop FinTech specific incubator programs.
3. Appoint a central 'voice' for the local FinTech ecosystem that is committed to actively growing the industry.
4. Design programs for primary and high school students that are targeted at fostering an early interest and passion in pursuing FinTech-related careers.

Suggestions for Government and Policy Intervention:

1. Investigate the impact of regulatory requirements on the growth of the sector and reviewing outdated policies that directly obstruct local FinTech entrepreneurship.
2. Improve Canadian Visa application processes to attract foreign skilled talent.
3. Develop/improve government-funded initiatives that promote skills development and incentivize universities to integrate STEM-related education into curricula, and develop/improve FinTech incubators.

The suggestions should be validated and assessed by stakeholders within the industry and PSEs for suitability toward Toronto's FinTech ecosystem. This report also recognizes the lack of peer-reviewed resources and acknowledges its reliance on reports written by private sector organizations. The findings and strategies presented are still considered to be valuable as a foundation for addressing the global FinTech talent shortage.

REPORT OVERVIEW	3
INTRODUCTION TO FINTECH	4
UNDERSTANDING THE FINTECH TALENT SHORTAGE	6
METHODOLOGY	8
GLOBAL TRENDS IN RESPONSE TO THE FINTECH TALENT SHORTAGE	10
London, United Kingdom	12
New York City, United States of America	16
Other Notable FinTech Hubs	20
Singapore	20
San Francisco, United States of America	21
Toronto, Canada	22
GAP ANALYSIS - Opportunities for improving Toronto's FinTech ecosystem	25
Suggestions for Educational Intervention	25
Suggestions for Incubators and Extra-Curricular Events	25
Suggestions for Government and Policy Intervention	25
CONCLUSION	26
REFERENCES	27



REPORT OVERVIEW

In a recent survey conducted by PricewaterhouseCoopers (PwC) on Global Banking and Capital Markets (BCM), a vast majority of CEOs (93%) identified technology changes as a key contributor to transforming the sector over the next five years (PwC, 2016). The financial services sector must be able to respond to this transformation and therefore, will require labour talent that combines strong financial and digital skills (PwC, 2016). Through this report, we explore the international financial technology (FinTech) industry to understand how the industry and postsecondary education institutions have responded to the increasing need for the talents.

The fundamental research of this report is threefold; first, the literature establishes the context of the growing FinTech talent shortage and examines the current challenges industry stakeholders are facing. Second, the research turns to a jurisdictional scan of three notable FinTech hubs, namely: London, UK; New York City, USA; and Toronto, Canada. Each case study is explored for insights and best practices regarding the industry and institution's response to the talent shortage. The responses have been categorized into three primary themes:

1. Educational Interventions;
2. Incubators and Extra-Curricular Events; and
3. Government and Policy Interventions.

Additional insights have been drawn from other notable FinTech hubs including Singapore and San Francisco. Finally, the research consolidates and reframes the discussion by acknowledging that multiple opportunities for improvement exist within Toronto's FinTech ecosystem, helping to identify a series of suggestions that could be considered by the local industry and postsecondary education institutions.

This report aims to inform postsecondary education institutions as well as the FinTech industry communities of practice about potential strategies for reducing the FinTech talent shortage. Through this report, we will understand how the industry can collaborate with PSEs and help inform the skills development of postsecondary students to ensure they are well-equipped for securing successful career outcomes. This report also contributes to a larger research project, led by various collaborators within Ryerson University, which examines how industry and universities can align to respond to our fast-changing economy and talent needs.

INTRODUCTION TO FINTECH

KPMG defines FinTech as *technology-based businesses that compete against, enable, and/or collaborate with financial institutions*. This ranges from the creation of software processes that enable financial institutions to enhance their customer experience, streamline their operations and provide opportunities for consumers to fulfil their financial needs (saving, investing, and making payments). The sector encompasses 1) new FinTech start-ups and ventures; 2) the activities and investments in technology innovation from established financial services institutions as well as ICT/technology providers, and; 3) collaboration between these parties or ‘disruptive innovation’ by any of them individually (Pollari, 2016).

The term “*FinTech*” was first coined by a New York banker in 1972. While there is no widely accepted definition of what lies under the term FinTech, companies considered

to belong to that sector provide services including payment options, online marketplace lending, mobile apps, financing, foreign exchange and remittances, investments, distributed ledger tech, digital currencies, mobile wallets, artificial intelligence and robotics in finance, crowdfunding, insurance, and wealth management, with an expanded definition considered to include ancillary technology solutions targeted at financial services, such as digital identity, biometrics, wearables, and technology to assist with Regulatory Compliance (RegTech) (Digital Finance Institute, 2016). As such, the financial services sector has become significantly impacted and influenced by emerging technology-enabled trends that support innovation.

A recent report by Ernst and Young (2016a), *Capital Markets: Innovation and the FinTech Landscape*, identified the following nine technology or technology-enabled trends that, individually or collectively, facilitates current and future FinTech innovations:

1. Cloud technology
2. Process and service externalization
3. Robotic Process Automation (RPA)
4. Advanced Analytics
5. Digital Transformation
6. Blockchain
7. Smart Contracts
8. Artificial Intelligence (AI)
9. Internet of Things

Figure 1 illustrates the interrelated nature and convergence of technology trends. ‘Cloud technology’ and ‘Process and service externalization’ are universal trends that could underpin any and all aspects of innovation.



Figure 1: Nine technology-enabled trends that support innovation (EY, 2016a)
(This diagram is not to scale, and does not depict all possible overlaps.)

EY (2016a) stated that the greatest benefits in the near term will result from innovation based on Advanced Analytics, Robotic Process Automation (RPA), digital transformation, and externalization of processes and services. Blockchain and Artificial Intelligence (AI) could present game-changing opportunities in the longer term.

The benefits of cloud technology are available today, but for many firms, deriving full value from widespread adoption will take some time (EY, 2016a).

The following graph illustrates the benefits trajectory of the above nine enabling technologies over the next two, three to five and five plus years.

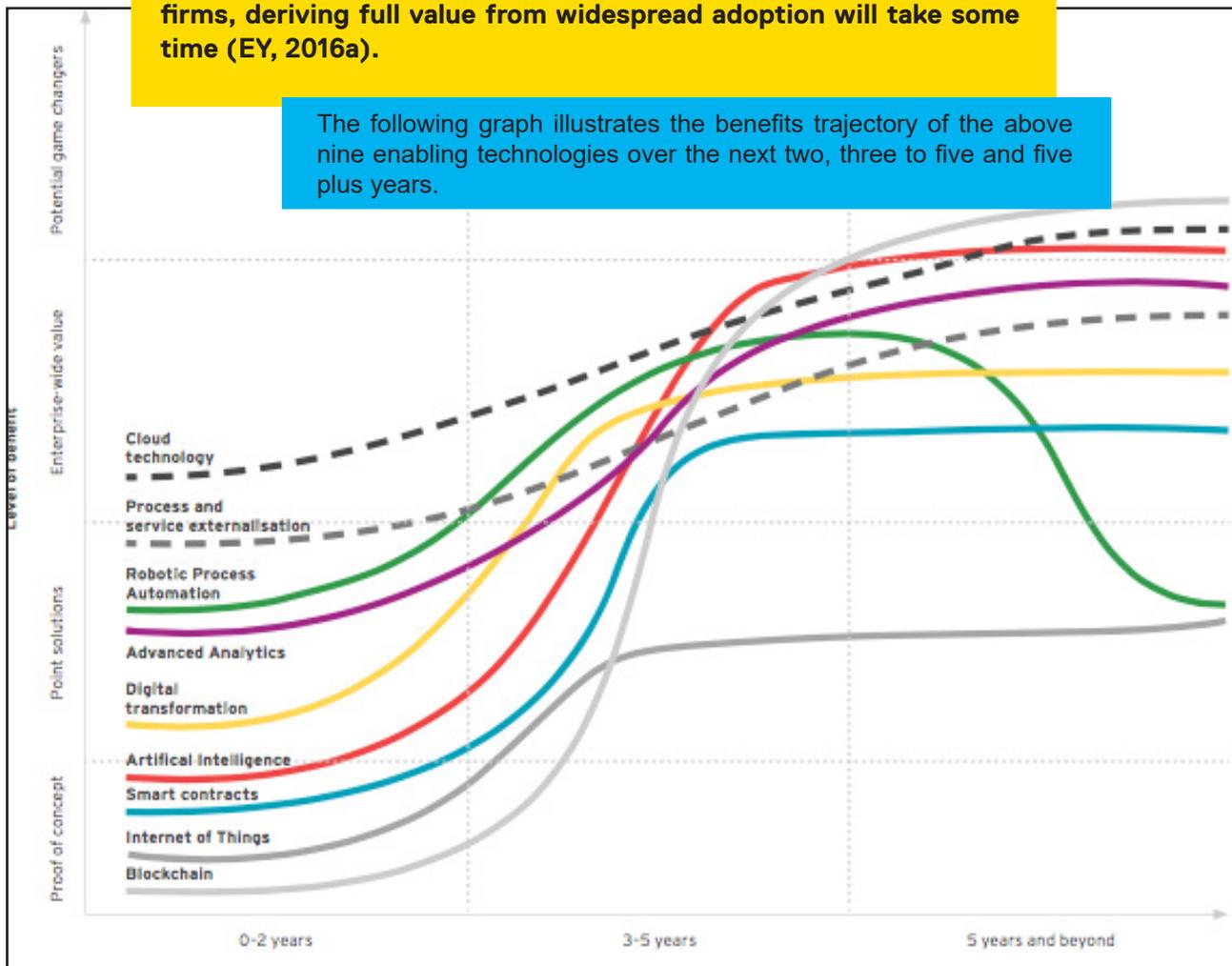


Figure 2: Benefits trajectory for enabling technologies (EY, 2016a)

Considering the rapid expansion of innovative technology pertaining to FinTech in the financial services sector, the sourcing of high quality talent within localized FinTech ecosystems has become a major international concern which will be discussed in the following sections.



UNDERSTANDING THE FINTECH TALENT SHORTAGE

Attracting and retaining high quality talent is repeatedly expressed by stakeholders as one of the most prevalent contemporary challenges faced by FinTech companies (Digital Finance Institute, 2016). International industry reports have recommended that the Government of Canada should intervene, invest, and provide more active support in closing the FinTech talent shortage and support the creation of co-working spaces that facilitate start-up culture (Digital Finance Institute, 2016). The financial services sector realizes that leveraging technology is critical to competitiveness, and creating a sustainable advantage in distribution, efficiency of business processes, and sales and marketing. This presents a systemic challenge as current literature indicates that the shortage of technical talent is directly associated with the growing demand for diverse and increasingly complex software systems, and the demand for technical talent is growing much faster than the educational capacity of current institutions (Digital Finance Institute, 2016). Furthermore, one of the most challenging and underlying issues to address is whether a sufficient supply of graduates is interested and/or is pursuing education that will train them to work within digital technologies across the economy (Wolfe, 2016; Nordicity, 2012). In a foundational paper, *How will the software talent shortage end?*, Barr and Tessler (1997) explore the various reasons why young workers may not be attracted to develop their professional technical skills. These reasons include:

- The vast initial learning curve before they can meaningfully contribute to their company
- The work is not considered of high prestige
- The work is characterized by highly tedious tasks and limited creativity
- The work is extremely intolerant of errors
- Programmers are rarely appreciated for their work within larger industries and sectors

Moreover, industry stakeholders perceive a 'brain drain' of Canadian tech talent; many qualified employees move to the United States of America to work at more notable companies such as Google and Twitter, and Canadian start-ups are being acquired by large American companies (Digital Finance Institute, 2016).

To maintain Canadian talent, postsecondary education institutions need to do more than simply produce a high volume of well-trained graduates; they must also introduce students to career opportunities within the financial technology sector at a much earlier stage of their education (Wolfe, 2016). The *UK FinTech: On the Cutting Edge* report, commissioned by the HM Treasury of the UK Government, discusses that FinTech ‘talent’ is comprised of two distinct factors: ‘Talent Availability’ and ‘Talent Pipeline’. Talent Availability refers to the current availability of technical, financial services, and entrepreneurial talent, whereas Talent Pipeline includes the future sources of both domestic and foreign descent talent (EY, 2016b). Technical talent consists of Engineers, Software Developers, and Computer Programmers, all of whom are required to build and implement FinTech solutions (EY, 2016b). Areas that report high levels of technical talent are typically located near established technology hubs such as the City of San Francisco. Financial services talent includes individuals who have a keen understanding of financial markets, business models, and regulations (EY, 2016b). This type of talent is generally clustered in close proximity to global financial hubs, including London and New York City. Lastly, entrepreneurial talent encompasses skilled workers who have the innate ability to generate new ideas, build businesses from scratch, and identify and acquire customers (EY, 2016b). Entrepreneurial talent is not as easily clustered in specific spatial areas, but rather includes a wide range of creative individuals who have strong leadership skills and enjoy professional risk-taking.

Regarding the talent pipeline, the greatest occurrence of FinTech skill shortage exists within the technical talent sector, as there are lower shares of science and technology graduates. Conversely, financial services and entrepreneurial talent are the strongest (EY, 2016b). Evidence suggests that the talent pipeline into mid-career roles — such as Business Partners and Data Analysis Experts — is drying up. As many junior-level transactional jobs are being moved offshore, the traditional ‘on the job training’ where young employees learn the necessary skills, knowledge, and behaviours at the beginning of their careers, is no longer available. These jobs are ripe for automation and could gradually disappear (Herbert, 2016). Building a sustainable talent pipeline requires strong and adaptive education systems at all levels of schooling, as well as resolving the current inconsistencies between how skilled workers search for jobs and where employers are looking to hire (Herbert, 2016).

Industry partners acknowledge the importance of investing in education that will generate FinTech talent, namely in Science, Technology, Engineering, and Mathematics (STEM) fields. In the context of closing the skills gap, FinTech stakeholders — including Koho, 500 Startups, Women in Payments, NanoPAY, APrivacy, and Remillard Consulting — have expressed the importance of: 1) university engagement; 2) investing resources in FinTech-related research and development, and; 3) flexible curricula which can evolve alongside the emerging technologies (Digital Finance Institute, 2016). To reduce the FinTech talent shortage, industry and universities must leverage their respective expertise and resources to provide support, investment, and innovation towards collaboratively growing their local FinTech ecosystem.



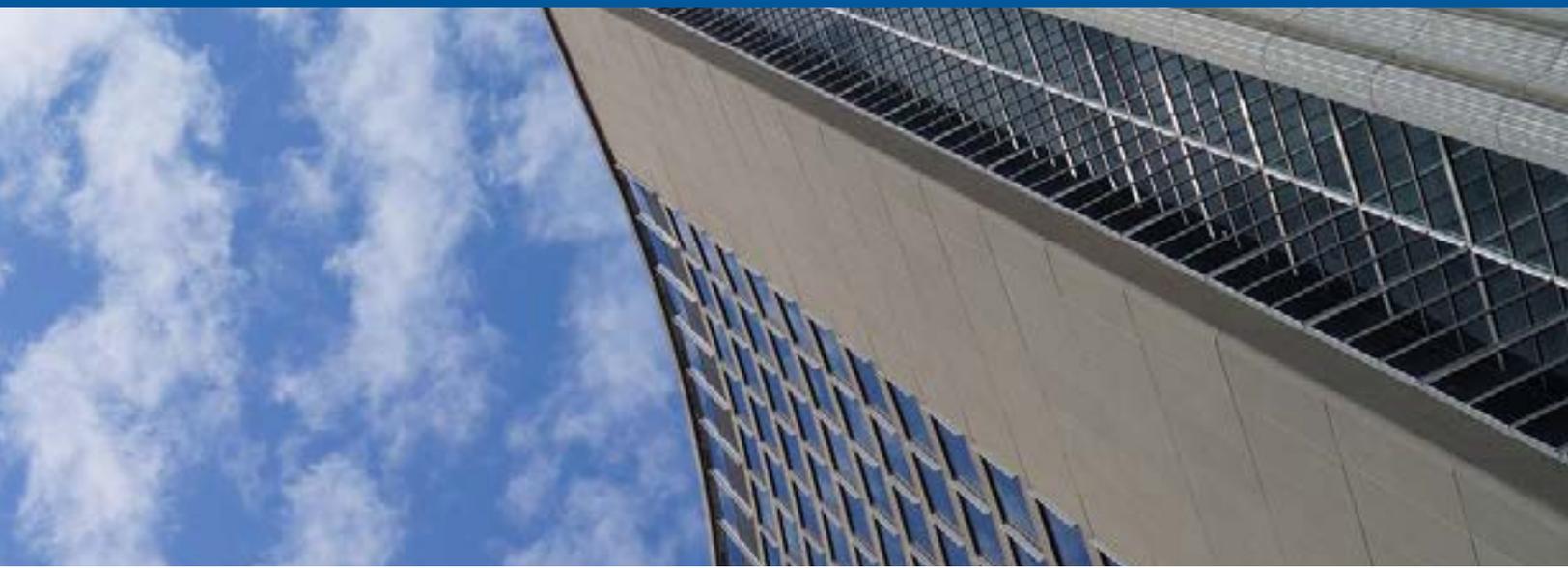


METHODOLOGY

The majority of the resources leveraged in this report were found through online research and publicly available documents, including but not limited to: academic peer reviewed literature, government (local, regional and national) publications and white papers, university websites, financial sector reports, and leading industry program websites. The primary information used in this report relates to the FinTech sector within three global cities: London, New York City, and Toronto. Additional information regarding the growing FinTech sectors in San Francisco and Singapore is also considered.

Based on an extensive literature review of the FinTech talent shortage and the global strategies that have been employed in response to the talent shortage, the following three strategy/intervention categories were developed and employed as a framework for investigation in this report:

Educational Interventions: International postsecondary education institutions have taken multiple approaches towards increasing the interest and competency of students in FinTech-related skills. Universities and colleges are strongly considering the industry need – with respect to employable skills – to ensure that the education being delivered is directly assisting students in gaining the appropriate skills needed to find employment within the FinTech sector. Common university responses to the FinTech skill shortage, which are examined further in this report, include curriculum reviews, inclusion of STEM programming, FinTech specific MBA specializations, and various policy/white papers provided by Ministries of Education and universities.



Incubators and Extra-Curricular Events: Postsecondary education institutions, government, and industry partners have responded to the FinTech talent shortage by financing and promoting various forms of programs and extra-curricular activities to students. These can include hackathons, mentorship programs, independent course offerings for specific skill enhancement, conferences, and both privately-funded and publicly-funded events. Additionally, recent trends in attracting and developing financial technology talent include the establishment of incubators and seed accelerator programs. These programs are meant to accelerate successful venture creation by providing specific incubation services, focused on education and mentoring, during an intensive program of limited duration (Cohen and Hochberg, 2014; Miller and Bound, 2011). This report discusses several incubator programs that have been created in an effort to grow the FinTech industry and reduce the current talent shortage. Each program is diverse in format and purpose, differing greatly based on which sector finances the program. This ranges from private industry, to government, and universities. More specifically, universities have introduced progressive incubator programs and promote them as a means to facilitate student entrepreneurship, provide industry with a direct connection to student start-up innovation and talent, and give recruitment agencies a way to identify employable talent (Pauwels et al., 2015).

Government and Policy Interventions: The rise of recent government and policy interventions has become a prominent response to closing the talent shortage within the FinTech sector. One of the biggest challenges facing the Canadian FinTech ecosystem is the lack of ability to engage with the government and to collaborate at a national level (Digital Finance Institute, 2016). Therefore, purpose-based interventions have been recommended and introduced to directly address the skills gap. These interventions include financial incentives for new graduate start-up networks, streamlined immigration processes meant to attract foreign talent, and various policy papers that illustrate the many opportunities that local, national and regional governments could implement to support the FinTech sector.



GLOBAL TRENDS IN RESPONSE TO THE FINTECH TALENT SHORTAGE

In this section of the report, we provide an overview of three major cities – London, New York City and Toronto – to examine the contributions that each city has made towards lessening the talent shortage within its respective FinTech ecosystem. Understanding techniques used by global jurisdictions will provide a benchmark by which we can compare Toronto's progress and its potential in FinTech. This will also help identify where gaps currently exist and how industry, educational institutions, and levels of government can collaborate to produce well-equipped and suitable employees for the emerging FinTech sector.





London, United Kingdom

Considered the global leader in FinTech, London has excelled in curating a robust and interdisciplinary ecosystem that attracts and retains talent.

Since 2008, the UK has substantially grown the industry—representing £6.6 billion in revenue and £524 million in investment in 2015 (EY, 2016b). Furthermore, the industry reported that 61,000 people were employed in FinTech-related positions in 2015, making up 5% of the total financial services employment sector (EY, 2016b). In 2016, technical talent accounted for the largest segment of UK FinTech employees (40%), followed by financial services experts (30%), and business development, corporate staff, and executive leadership accounting for the remaining 30% (EY, 2016b). Currently, London is the largest FinTech hub in the world by revenue, and second largest in employment: 72% of FinTech employees in the UK are based in the urban capital (London First, 2016; Mandel, et al., 2014). This success is commonly attributed to the ecosystem's closeness and connectedness to a giant financial services hub, comprised of 251 foreign banks and 588 foreign quoted companies (FinTech and the Evolving Landscape, 2016).

In 2016, an evaluation of the UK ecosystem's productivity concluded that the average revenue per FinTech employee is £108,200, which is greater than global competitors based in New York City (£98,300) and California (£63,500) (EY, 2016b). Moreover, the London FinTech hub has grown in productivity due to several factors, including:

- its access to an international pool of talent that is globally sparse,
- a strong demand and willingness to embrace new technology in the UK,
- access to capital to finance and support start-ups (helped by FinTech-supportive UK tax policies), and
- an adaptive regulatory environment provided by progressive regulators (London First, 2016).

Despite recent threats to the industry relating to the contemporary 'Brexit' political landscape, the UK government has remained strongly in favour of expanding and nurturing the FinTech industry (London First, 2016). Conversely, industry leaders have expressed concerns that the FinTech skills shortage will likely grow in the coming future as technical talent from the European Union (EU) will choose to stay within EU borders in order to avoid the associated expenses and difficulty of visa applications to work in the UK (London First, 2016). While current trends demonstrate stable productivity and growth of the UK FinTech sector, the ecosystem faces a persistent talent shortage. Recent research suggests that the UK will need to fill 766,000 new technology jobs by 2020, and this demand will require training approximately 2.3 million skilled workers (O2, 2015). Royds (2014) stated that London is experiencing a shortage of talented technical talent, including coders, web developers, product managers, and data scientists. Furthermore, the 2014 Scale Up Report on UK Economic Growth, concluded that challenges associated with recruiting skilled technical talent are the primary reasons why companies cannot scale up in the UK (Coutu, 2014). To address this challenge, many private financial technology firms have started investing in the recruitment of foreign talent (Coutu, 2014). The Organisation for Economic Co-operation and Development (OECD) regards the UK as one of the most flexible labour markets in the developed world (Portes, 2013). This disruption of free movement and mobility could have significant implications for the talent pipeline and talent availability – potentially compromising London's leadership position as the global hub for FinTech.



Educational Interventions

London has a high density of top ranked postsecondary education institutions, including four of the top 30 ranked universities in the world (World University Rankings, 2016).

To strengthen the FinTech talent pipeline, many universities have promoted STEM programs as well as specific FinTech education within universities through specialized course programs, apprenticeships, and sponsored work placements (EY, 2016b). The UK expressed similar support towards STEM education as the United States, actively integrating web development and coding into curricula as part of national innovation programs (EY, 2016b). The national government has also expressed interest in extending participation in STEM classes to industry professionals, encouraging the current skilled workforce to improve upon and expand their technical skills (EY, 2016b).

The Department for Business, Innovation, and Skills (2015) wrote a STEM policy paper entitled *2010 to 2015 Government Policy: Public Understanding of Science and Engineering*. The paper was a response to the contemporary understanding that science and research are major contributors to national prosperity, and that the government has a significant role to play in ensuring the UK workforce is adequately equipped and skilled for employment. One key outcome of this paper was to integrate STEM education into all schools. To achieve this, a UK-wide organization named STEMNET (Science, Technology, Engineering, and Mathematics Network) was established and financed by the Department of Business, Innovation, and Skills and the Department of Education to encourage students to enroll in STEM courses.

STEMNET is comprised of three primary programs:

1. **STEM Ambassadors:** 28,000 volunteers who support teachers to deliver STEM curricula;
2. **STEM Clubs Network:** various clubs that inspire students to explore STEM subjects outside of their formal school curricula, and;
3. **Schools STEM Advisory Network:** 45 UK organizations that offer objective advice to schools pertaining to encouraging students to further their STEM education and employment (Science, Technology, Engineering, and Mathematics Network, 2017)

The Department for Business, Innovation, and Skills, in partnership with the UK Resource Centre, promotes the WISE Campaign (Women into Science and Engineering). This initiative is meant to directly inspire and encourage women to pursue science, technology, engineering, and mathematical careers by offering various scholarships, workshop resources, and professional opportunities including the prestigious Chief Scientific Officer's WISE Fellowship Programme (WISE Campaign UK, 2017). Additionally, the 'Your Life' initiative, launched by the UK national government in 2014, includes a three-year STEM campaign to ensure the future UK workforce has the necessary skills to succeed in the expanding technology industries (Your Life- STEM Skills Gap, 2017). This campaign collaborates with businesses and institutions to create more than 2,000 jobs and apprenticeships, seeking to increase the number of young people enrolled in STEM education by 50% by 2018 (Bateman, 2014). "Your Life" offers educational institutions career-focused STEM curricula that integrate engagement activities with the purpose of bringing industry into the classroom. It also encourages employers to recruit and retain future talent (Your Life – STEM Skills Gap, 2017).

In light of the talent shortage in the technology sector, the UK government has undertaken specific steps towards improving education curricula to align more closely with the needs of industry employers. In 2013, the Department of Education conducted a national review of ICT (Information and Communications Technology) curriculum to improve the education of students. The review modified the ICT curriculum by replacing outdated courses and introducing new course material related to computer science and computer programming (EY, 2016b). Additionally, the Department for Business, Innovation, and Skills undertook the ‘*Shadbolt Review*’ in 2015 following the publication of the Government’s Science and Innovation Strategy in 2014. This was meant to gain a deeper understanding of how the current accreditation process for computer science degrees could be reformed and adapted to improve the employability of ICT graduates (Shadbolt, 2016). The review was conducted through: 1) evaluating the data collected by the Higher Education Statistics Agency to establish figures pertaining to graduate employment in the technology workforce; 2) consulting with stakeholders to understand current supply and demand in the industry, and; 3) measuring the skills gap, and gathering insights on the accreditation process (Shadbolt, 2016). The final report developed after the review presented ten recommendations for national government, including *ensuring graduates’ foundational knowledge and their ability to adapt, improving graduates’ soft and work readiness skills, developing a clearer view of the requirements of start-up technology companies, and horizon scanning for future demand for skills* (Shadbolt, 2016).

Incubators and Extra-Curricular Events

To attract and grow the skills of available talent within the UK FinTech ecosystem, multiple institutions and organizations have developed FinTech-related programs and events.

Tech City UK, a publicly funded organization established in 2010 to accelerate the growth of the UK digital economy, directly supports the FinTech ecosystem by responding to the sector’s need for skills through various programs (Tech City UK, 2017). In 2014, the organization launched the Digital Business Academy, an online education program that teaches participants specific skills in starting, growing or joining a technology-based business (EY, 2016b). To ensure relevancy and establish credibility, the online program was developed in partnership with University College London and Cambridge University (EY, 2016b). The program comprised of eleven courses, all of which are free and can be taken separately or together as a complete module. The courses

include: *Size Up Your Idea, Set Up a Digital Business, Develop and Manage a Digital Product, Make a Marketing Plan, Build a Brand, Understanding Digital Marketing Channels, Run a Digital Marketing Campaign, Master Finance for your Business, How to Track Performance in Early Stage Start-ups, How to Manage Customers, and How to Use Social Media for Business* (Courses Available -Digital Business Academy, 2017). Similarly, the ELITE Programme, established in 2014 by the London Stock Exchange Group, works in collaboration with the Imperial College Business School to provide the FinTech workforce with education, mentorship, and potential financing for business development (EY, 2016b). The Imperial College Business School is regarded as one of the world’s pre-eminent science-based universities, offering transformational research at the intersection of science, technology, engineering, and business (ELITE - Imperial College Business School, 2016).

In 2015, the Open University collaborated with Innovate Finance to develop *FinTech 101*, an online course that teaches participants the significance of disruptive technology and its impact on the financial services industry (EY, 2016b). The course covers topics such as big data, alternative finance, cybersecurity, creative disruption, and the digital banks of the future (FinTech 101- Open University, 2017). The Open University and Innovate Finance partnered to create this course in response to the current FinTech talent shortage, stating that 44% of firms believe sourcing talent will be a challenge in the coming years (FinTech 101 Course - Open University, 2017). FinTech 101 contributes to producing a highly skilled workforce for the UK FinTech industry by familiarizing participants with key financial and technology concepts, sharing with them the skills needed to innovate within their organization, and helping them develop a broad understanding and knowledge of how the financial services sector is continually evolving.

The prominence of FinTech accelerators within London, as well as other urbanized regions of the UK, has played a significant role in attracting and retaining progressive start-up talent. The London Innovation Lab and Level39 are primary examples of leading accelerators that are responding to the global technical talent shortage (Digital Finance Institute, 2016). Level39, established in 2013 by the Canary Wharf Group, is currently Europe’s largest technology accelerator space for finance companies (About Level39, 2017). It provides seed funding, mentoring, and skill development to approximately 130 members (About Level39, 2017). To build upon the emerging network of FinTech accelerators, the EY Report, *UK FinTech: On the cutting edge* (2016) recommends that the UK government creates regional Centres of Excellence across the UK, which would allocate dedicated physical space to train talent. This would also create an active collaboration network between academia and FinTech industry leaders that would foster a stronger and more globally-focused ecosystem (EY, 2016b). Manchester, UK – an emerging city with a large student

population – has begun the process of establishing deeper connections between the local FinTech industry and its universities. The Manchester Metropolitan University has recently launched two FinTech related initiatives, *The Shed* and *Innospace*, which were specially designed for students to experiment with new technology (EY, 2016b). The Shed is home to many of the city's technology events and serves as the venue for the Manchester Metropolitan University's Digital Innovation Initiative (About Us- MMU Digital Innovation, 2017). Innospace, a business incubator for start-ups, offers a direct link between the FinTech industry and the University. The incubator works closely with the University's Career Services and faculties to assist the most talented students and graduates in finding placements and employment. (Manchester Metropolitan University, 2017).

From 2013-2016, the London Business School has been hosting an annual three-day FinTech hackathon named HackLBS. The event, organized by the University's entrepreneurship club, is supported by industry leaders including the Deloitte Institute of Innovation and Entrepreneurship at Balderton Capital (LBS Hackathon - About, 2016). The 48-hour hackathon aims to connect emerging technical talent within the London Business School with the greater FinTech community in London. HackLBS has been beneficial in addressing the FinTech talent shortage by teaching and inspiring students to develop innovative FinTech products, providing an opportunity for students to present projects to industry leaders and local FinTech accelerators, as well as creating meaningful mentorship connections between specific FinTech firms (Startupbootcamp, IBM Design, Circle Pay) and students to grow their interest in the industry (LBS Hackathon - About, 2016).

The UK FinTech ecosystem has also responded to the talent shortage by targeting technical skill promotion at school-age children. The National Science and Engineering Competition was launched in 2008 and is organized by the British Science Association on behalf of the UK Department for Business, Innovation, and Skills and Engineering UK (National Science Engineering Competition, 2016). This annual event recognizes and rewards young student achievement in all areas of STEM – generating creative projects from young students across the UK and encouraging students to become interested in technical careers. Furthermore, The Big Bang UK Young Scientists & Engineers Fair is the largest celebration of STEM education for young people in the UK (About us- The Big Bang, 2017). Overall, the Fair aims to exhibit exciting opportunities within the STEM industry – including FinTech – to young people, inspiring them to form networks and develop the necessary skills to build meaningful careers within the sector.

Government and Policy Interventions

Creating a progressive, open-minded and internationally focused regulatory scheme is critical to attracting and retaining FinTech talent and fulfilling industry demand.

London's success as a global FinTech hub is highly reflective of the country's world-leading policy environment, including the combination of strong regulatory and tax incentives with progressive government programs (London First, 2016; EY, 2016b). The supportive regulatory regime – Financial Conduct Authority (FCA) – provides a range of tax incentives including Enterprise Investment Scheme, Seed Enterprise Investment Scheme, and Research & Development credits for companies with less than 500 employees (Tech City - For Investors, n.d.; London First, 2016). In addition, the FCA introduced 'Project Innovate' as a means to identify and remedy outdated policies and programs within the regulatory system that obstruct innovation (Walport, 2015). This program was later built upon in 2015 when the Government Office for Science announced it would begin exploring the integration between regulatory requirements and technology as *RegTech* (Project Innovate and Innovation Hub, 2016).

In 2015, the Tech Nation Visa Scheme for Tier 1 Exceptional Talent was introduced to accelerate application procedures for international talent recruitment (EY, 2016; Digital Finance Institute, 2016; Tech City, 2016). The visa allows prospective entrepreneurs to easily enter the UK and launch a start-up, contributing to the growth of the greater ecosystem. In order to be considered Tier 1 Exceptional Talent and become eligible for the Tech Nation Visa Scheme, applicants must demonstrate they are or can become a world leader in the field of digital technology and have the necessary business and technical skills to grow and scale-up technology companies (Tech City, 2016). Additionally, the Graduate Entrepreneur Visa was established in 2012 to enable graduates who are identified as either 'world-class talent' or as having a credible business idea by a UK university to remain in the UK after they have finished their education (EY, 2016b). Both of these schemes are highly welcomed by the FinTech industry as they provide direct opportunities for foreign technical talent to work in London, maintaining the region's position as a globally competitive hub for financial technology and innovation.



New York City, United States of America

New York City continues to be a strong contender as one of the world's leading FinTech ecosystems.

In 2016, the sector reported a market size worth \$6,835,920,000 USD (EY, 2016b). Nearly \$1 billion was invested specifically in FinTech in 2014 (Accenture, 2014). Arguably, FinTech was first introduced to the New York financial services landscape in 1981 when Michael Bloomberg launched Bloomberg LP, realizing that financial institutions would pay for innovative technology-based solutions (Accenture, 2014). The ecosystem has since matured into a productive industry, reporting a 21% increase in financial technology employment since 2006; close to double the national average of 12% (Partnership for New York City, 2014). The US's success in cultivating FinTech hubs, such as New York City, is attributed to the country's position as a leading global financial centre, its close proximity to a large customer base of financial products, and the openness of banks and capital market firms towards the benefits of FinTech. In addition, New York City has an existing financial technology workforce and a flourishing venture capital network (Strategy&, 2015). New York City's success is also due to its closeness to vast financial market expertise, networks of first-generation entrepreneurs, and a stable pipeline of technical and innovative talent that is attracted to FinTech employment (EY, 2016; Accenture, 2014).

In December 2012, *Start Up City: Growing New York City's Entrepreneurial Ecosystem for All*, reported that 'Talent Shortage' was the top area of concern for business leaders from the local technology sector (Kalloch, 2012). The report describes New York City's financial technology firms as particularly struggling in recruiting talent to fill low-to mid-level jobs in computer programming, marketing,

and high-tech engineering positions (Kalloch, 2012). This built upon a previous report from 2009, *Building New York City's Innovation Economy*, where researchers argued that universities in New York City have not adequately partnered with local industry in the financial technology sector (Centre for an Urban Future, 2009). The report concluded that the city is far behind competing regions in this regard, and that New York City was experiencing a significant missed opportunity for economic development and employment growth (Centre for an Urban Future, 2009). By 2014, New York City reported 150,000 existing technology jobs, and many industry leaders were encouraging the emergence of more technical skilled graduates from local universities (Accenture, 2014). As reported in 2016, 57,000 of these positions were specifically related to the FinTech ecosystem (EY, 2016b).

Educational Interventions

New York City has taken a leading role in university-industry collaboration and engagement with the FinTech sector (EY, 2016b).

Michael Bloomberg launched 'Applied Sciences NYC' in 2010, a program meant to address the technology talent shortage by funding and creating world-class science and engineering campuses throughout New York City (Accenture, 2014). This initiative seeks to expand the talent capacity within the applied sciences and the FinTech industry, maintaining New York City's global competitiveness as a revenue-generating and employment leader (Applied Sciences NYC, 2016). To encourage local universities to



embrace this initiative, the local government of New York City offered city-owned land, seed investment, and the full support of their administration throughout implementation (Applied Sciences NYC, 2016).

In fall 2016, the New York University (NYU) Stern School of Business announced the introduction of a FinTech specialization within the Master of Business Administration (MBA) program (NYU Stern - FinTech, 2016). NYU Stern is the first postsecondary institution to integrate a FinTech specialization into course curricula, and encourages enrollment of professionals interested in investment banking, international finance, social entrepreneurship, sales and trading, information technology, and product management (Pulcini, 2017). The course offerings have been designed to fluctuate and evolve as the financial technology advances globally. Its core courses, however, include: FinTech Analytics, Financial Information Systems, Robo Advisors and Systematic Trading, Dealing with Data, Risk Management for FinTech, Application in Entrepreneurial Finance, FinTech Personal Finance and Payments, and lastly, Digital Currencies, Blockchains, and the Financial Services Industry (NYU Stern - FinTech, 2016). Following the program's inception, NYU Stern hosted its first FinTech conference to promote discussion and collaboration among researchers, business practitioners, alumni, and students (FinTech - NYU MBA Conference, 2016).

Incubators and Extra-Curricular Events

In an attempt to attract FinTech talent to New York City, the industry introduced and invested efforts into multiple incubator programs.

Notably, the FinTech Innovation Lab was created to support emerging FinTech entrepreneurs in engaging with industry leaders (Fintech Innovation Lab, n.d.; Strategy&, 2015). This mentoring program coaches participants on customer issues which are a concern to financial institutions; raising millions of dollars in financing to launch start-ups. This has facilitated the success of a start-up acquisition worth \$175 million USD in 2014 (Accenture, 2014).

Cornell University launched a FinTech incubator program in 2014 for recent PhD students who are interested in launching a technology company in New York City (EY, 2016b). Once accepted into the program, participants receive a package of \$175,000 USD for their salary, housing allowance, research budget, and access to workspace, technology, and equipment (Runway Startup Postdocs, 2017). The program begins with a four-week intensive business and entrepreneurship curriculum, followed by opportunities to create start-up strategies with other Master of Business Administration, Engineer, and Law students (Runway Startup Postdocs, 2017). Additionally, Startupbootcamp Fintech – a leading accelerator focused on financial innovation – offered participants seed funding, office space, and mentorship with a vast network of industry partners and local FinTech companies (FinTech New York, n.d.).

New York City (continued)

To keep the industry connected and competitive, Empire Startups – a community of FinTech entrepreneurs and innovators – hosts meetups, open mic nights, workshops, webinars, panel discussions, as well as summits for entrepreneurs to share knowledge, learn from FinTech experts, and bridge the gap between emerging talent and the established investment community (NY FinTech Meetups, 2017). The group also organizes an annual conference that encourages attendees to discuss new trends within FinTech, connects service providers to start-ups, and offers a range of diverse and compelling keynote speakers, panels, and demonstrations from leading industry leaders (New York 2017 - Empire FinTech Conference, 2017).

Government and Policy Interventions

In direct response to the national technical talent shortage, the US Federal Government launched 'TechHire' in 2015.

This initiative was aimed at expanding the local technology sector by building new talent pipelines through accelerated training programs (Tech Hire Initiative, 2016). The national implementation of TechHire had three primary components: 1) over 300 employer partners provided pilot training strategies with over 50 communities; 2) private-sector companies and national organizations provided the necessary tools to support the TechHire communities and; 3) the federal government allocated \$100 million USD in grant funding for the program (Tech Hire Initiative, 2016). To ensure a better future for Americans and meet the talent needs of financial technology companies, the initiative addresses the growth and development of the following employment opportunities: cybersecurity, network administration, computer programming, project management, UI design, and data analytics (Tech Hire Initiative, 2016).

As a participating TechHire community, the New York City local government launched the 'NYC Tech Talent Pipeline' program to better prepare students for careers in the technology sector (Accenture, 2014). This novel program is supported by a \$10 million USD industry partnership and seeks to train and deliver quality talent to New York businesses, particularly FinTech companies. Recent advancements in the state program include connecting over 100 college students within the University of New York (CUNY) system to paid internship opportunities at local technology companies. This was accomplished through various programs including: CUNY Tech Prep, Tech Talent Pipeline Residency @ Queens College, and the Brooklyn Tech Triangle Internship Program (Accenture, 2014).

In 2013, the state government of New York launched 'START-UP NYC' to accelerate entrepreneurial job creation (EY, 2016b). The initiative partners with local universities to attract global start-ups, venture capital, new business, and investment (EY, 2016b). START-UP NY offers ten years of tax-free operations for new or existing businesses that are located near eligible universities and colleges (START-UP NY: New York State, n.d.), with the hopes that through partnerships with higher education institutions, businesses will have access to advanced research laboratories and students will have access to industry experts (Governor Cuomo, 2014).



Other Notable FinTech Hubs

Singapore

Singapore's FinTech ecosystem has grown significantly over the last decade.

In 2016, the local industry reported a market size of £0.6 billion and £44 million of investment (EY, 2016b). Singapore is considered the preferred gateway into the Asian FinTech market due to the ease of doing business and high levels of English proficiency (EY, 2016b). Furthermore, Singapore ranks second in talent pipeline due to world-class access to foreign talent and a supportive immigration regime, resulting in over 7,000 employees who work specifically in FinTech (EY, 2016b). This growing ecosystem and consistent talent pipeline is attributed to the progressive Monetary Authority of Singapore (MAS), which has established a dedicated team for creating public/private partnerships for FinTech. MAS committed \$225 million USD

of public sector funds towards developing a Smart Financial Centre to facilitate connections between financial institutions and universities (Digital Finance Institute, 2016; EY, 2016; KPMG, 2017). MAS has publicly recognized the need to attract top talent in hopes of filling demands and growing the industry, as well as acknowledging the difficulty of recruiting and retaining the right talent (Boon, 2016). In response, Singapore has created the most supportive immigration regime to promote foreign talent, including facilitating the steps required to process skilled worker visas, creating longer term residency options, and removing quotas that restrict the inflow of foreign skilled workers (EY, 2016b). Moreover, MAS has taken additional steps towards attracting foreign talent including the development of a regulatory sandbox, introduction of a fund to facilitate collaboration between FinTech companies and financial institutions, and launching a major international FinTech conference (KPMG, 2017).

San Francisco, United States of America

Within the United States, San Francisco is a recognized leader in FinTech investment, employment, and ecosystem connectedness.

In 2015, the California FinTech workforce reached 74,000 people – with a majority that worked directly in the City of San Francisco (EY, 2016b). The maturity of the ecosystem is commonly attributed to the community of entrepreneurial talent, plethora of financial and technology institutions, and the culture of progressive and forward-thinking employees attracted to San Francisco's start-ups (Australian Trade and Investment Commission, 2017; EY, 2016b). As such, FinTech investment in San Francisco equaled \$3.7 billion USD in 2015 (KPMG, 2017), and the region accounted for 34.4% of equity capital invested in online lending (Pitchbook, 2016).

San Francisco attracts high quality FinTech talent due to its close proximity to internationally renowned postsecondary education institutions. The University of California, Berkeley's Master of Business Administration program includes multiple courses that prepare students for the FinTech industry including: Introduction to Management of Technology, Innovation Strategies for Emerging Technologies, Strategy for the Information Technology Firm, and Opportunity Recognition: Technology and Entrepreneurship in Silicon Valley (University of California Berkeley, 2017). Furthermore, the StartX Accelerator program was launched in partnership with Stanford University in 2014, to support and develop the university's top entrepreneurs through customized education programs and access to unlimited financing (EY, 2016b). StartX accepts applicants from multiple sectors and is not solely focused on FinTech; the program is also dedicated to connecting the accelerator community with over 200 compatible experts, and promises to offer unconventional and tailored education to meet the career needs of each participant (StartX, n.d.).

In 2015, Draper University and Hero City partnered to create the FinTech Connection incubator program (EY, 2016b). This invite-only initiative complements Draper University's unconventional approach towards business education, and seeks to align emerging technical talent with leading financial institutions (Draper FinTech Connection, n.d.). Similarly, Wells Fargo, a San Francisco-based bank, launched an in-house start-up accelerator program that directly focuses on start-ups and talent with innovative ideas to reinvent and progress the financial services sector (Wells Fargo Startup Accelerator, 2017).

At the state level, California initiated a STEM task force to improve teaching and access to STEM-related courses and careers for primary and high school students (EY, 2016b). The task force was created to specifically address the following key areas in STEM education:

- 1. Curriculum and Instructional Practices:** review current STEM education and identify ways to improve it and engage more students;
- 2. Resources:** identify existing STEM resources and recommend the creation of new relevant resources for dissemination;
- 3. Professional Learning:** recommend professional learning opportunities to educators and teachers of STEM courses;
- 4. Student Testing:** recommend state and local level STEM assessments to measure applied learning and identify what constitutes high quality STEM education; and
- 5. Community and Business Partnerships:** review how partnerships with the greater community and industry can support and engage students in STEM education (STEM Task Force, 2016).



Toronto, Canada

Canada has recently experienced a record of high investment and revenue in the FinTech industry (KPMG, 2017).

Currently retaining approximately 60,000 FinTech employees (Toronto Financial Services Alliance, n.d.), Canada clearly demonstrates that it has the necessary criteria to become a global FinTech cluster. This includes a stable banking system, leading universities, and a growing community of financial innovators who are releasing technology solutions to the market (Digital Finance Institute, 2016).

Ontario is home to one of the largest information technology clusters in North America, including 13,000 tech companies that are primarily based in Toronto (Australian Trade and Investment Commission, 2017). Moreover, Toronto is one of the largest employers within the financial services sector, recently reporting 350,000 employees (University of Toronto, n.d.).

Banks across Canada are acknowledged as the largest players in the Canadian FinTech sector as many of these banks are developing their own financial technology solutions (Digital Finance Institute, 2016). Banks are also acquiring promising start-ups and investing in potential opportunities to remain relevant and attract highly-skilled talent. Employment in traditional financial services roles is becoming less common within the major banks.

Recently, the Bank of Montreal (BMO) announced an organizational restructuring that will eliminate 1,850 jobs due to technology advancements (Digital Finance Institute, 2016). Canadian banks will need fewer office towers and in turn, will invest in developing information technology

centres with open co-working spaces that align closely with local universities (Digital Finance Institute, 2016). For instance, Scotiabank recently responded to the FinTech boom by announcing the launch of an in-house 'Digital Factory' that will create 350 technical jobs and emulate the working environment of a smaller FinTech start-up (Frasier-Nelson, 2016).

Canadian FinTech firms have historically received less investment than US firms on a per capita basis. However, investment is expected to grow substantially over the next five years (KPMG, 2017). Recent advancements, such as 'The Corridor' campaign, highlight the region between Toronto and Waterloo as a global centre for talent, growth, innovation, and diversity, as well as housing the second highest density of start-ups in the world (The Corridor, n.d.). This growth and entrepreneurial spirit is commonly attributed to the leading postsecondary education institutions around Toronto, including the University of Toronto, Ryerson University, York University, OCAD University, and the neighbouring University of Waterloo. In recent years, the University of Toronto has collaborated with over 200 student-led start-up teams through various incubator programs, creating jobs for more than 700 student entrepreneurs, attracting \$18 million CAD in investment, and generating \$2.4 million CAD in sales (University of Toronto, n.d.).

Canada has an opportunity to create innovative programs that build high-quality technical talent, offsetting the imminent job losses of traditional financial sector roles (Digital Finance Institute, 2016). To progress and build upon this opportunity, the Digital Finance Institute launched The FinTech Association of Canada in 2016 to serve as the global voice for stakeholders within the sector— creating partnerships and alliances, as well as promoting the



ecosystem internationally to attract talent and investment (About Us - FinTech Association of Canada, n.d.; Digital Finance Institute, 2016). Moreover, the Association seeks to support research in FinTech innovation, participate in emerging digital finance market areas, and build a global ecosystem that is vibrant and inclusive to both start-ups and financial institutions (About Us - Digital Finance Institute, n.d.).

Educational Interventions

Local Toronto universities and education institutions have responded to the FinTech talent shortage by developing and training highly skilled new graduate students.

The combined efforts that Ryerson University, the University of Toronto, and York University support significantly contribute to Toronto's technology community, reporting a total of 2,559 full time students enrolled in computer science degree programs in 2012 (Tech Toronto, 2016).

To align with the progressive technology industry, Ryerson University has introduced a Master of Business Administration in the Management of Technology and Innovation program. This program merges business practicality with technology, seeking to better equip students in understanding and communicating technical processes (Ryerson University, 2017). Students enrolled in the program are offered several courses that are directly related to the FinTech industry, including: Global Markets and Tech Trends and Research and Communication for Business Start-ups

(Ryerson University, 2017). Comparably, the University of Toronto's Rotman School of Management launched a specialization for Innovation and Entrepreneurship within the Master of Business Administration program. This specialization directly speaks to the process of launching an entrepreneurial venture as well as managing and financing a technology-driven business (Rotman School of Management, 2017). Relevant courses to the FinTech industry include: Economics of Innovation and Intellectual Property, Business Strategy by Firms Based in Emerging Market Economies, and Creative Destruction Lab Course (Rotman School of Business, 2017).

With respect to high school students, the City of Toronto Start-up Ecosystem Strategy identified a need to partner with business incubators and the Toronto school boards to share programming and start-up success stories (Tech Toronto, 2016; City of Toronto, 2015). This recommendation seeks to inspire students about STEM fields for their postsecondary education, and to continue a career within the emerging technology sectors (Tech Toronto, 2016; Digital Finance Institute, 2016). Furthermore, the Toronto FinTech ecosystem has created a demand for private computer programming schools that offer opportunities for individuals to enhance their technical skills. Lighthouse Labs and Bitmaker Labs are examples of such schools that are seeking to transform the way technical education is delivered and to produce higher quality talent for the Toronto ecosystem (Tech Toronto, 2016).

Incubators and Extra-Curricular Events

The growth of FinTech in Toronto has been attributed to the vast diversity of incubator programs that attract, grow, and retain technical talent in the city (City of Toronto, 2015).

Currently, Toronto boasts a strong network of university-based, public and private incubator programs, many of which directly relate to FinTech. With respect to university-based incubators, the Province of Ontario created a publicly funded program named the – Ontario Network of Entrepreneurs (ONE) – which includes the Ontario Centres of Excellence’s Campus-Linked Accelerator Program (Tech Toronto, 2016; Campus-Linked Accelerators, 2017). This initiative provides funding to postsecondary institutions for creating and sustaining a culture of entrepreneurship among students. Funding is also used to connect education institutions with investors, stakeholders, and the greater technology industry (Campus-Linked Accelerators, 2017). As of 2016, 24 out of 37 of the Campus-Linked Accelerators were located in the Greater Toronto Area (Tech Toronto, 2016).

The Digital Media Zone (DMZ), launched by Ryerson University as part of the Campus-Linked Accelerator initiative, is currently the leading university-based incubator for tech companies in North America (Digital Finance Institute, 2016; About- The DMZ, 2017). The DMZ fosters a culture of innovation and entrepreneurship by connecting students and start-ups to industry experts. Since 2010, the accelerator has graduated 276 start-ups, raised \$283 million CAD in seed investment, and generated more than 2,600 jobs in the technology sector (About- The DMZ, 2017). Comparably, the University of Toronto launched the Creative Destruction Lab that hosts a nine-month program for scaling technology start-ups through the mentorship of industry leaders and established corporations (Program - Creative Destruction Lab, n.d.). Furthermore, the University of Toronto announced that it will partner with the Royal Bank of Canada to launch ‘ONRamp’ – the university’s second incubator program dedicated to growing the technology ecosystem and workforce (Galang, 2015). These accelerator programs encourage highly skilled talent to relocate to Toronto and launch their start-ups within the local technology ecosystem. Other notable FinTech related incubators within Toronto include INcubes, OneEleven, HIGHLINE, Brightspark Ventures, Multiplicity, DRIVEN Accelerator Group, and the MaRS Discovery District FinTech Cluster (Tech Toronto, 2016; KPMG, 2017; City of Toronto, 2015; Digital Finance Institute, 2016).

To grow interest in the FinTech sector and attract a highly skilled workforce to the Toronto ecosystem, various conferences and events have been organized by stakeholders. The 2017 CONNECT IT conference was held at the MaRS Discovery District in partnership with local universities, namely Ryerson University, University of Toronto, University of Ontario Institute

of Technology, and York University (Connect IT Conference, 2017). The conference heavily focused on bridging the gap between students and the industry, offering various speaker panels, a technology firm fair, networking sessions, and a case competition (Connect IT Conference, 2017). Furthermore, Empire Start-ups hosted an annual FinTech conference in Toronto meant to build relationships within key players in the FinTech ecosystem and to create opportunities for emerging talent (Toronto 2017 - Empire FinTech Conference, 2017).

Government and Policy Interventions

Toronto consistently faces challenges when attempting to recruit and retain foreign talent due to Canada’s complicated and lengthy immigration processes.

The Express Entry System, introduced in 2013, requires employers to submit a Labour Market Impact Assessment (LMIA) to demonstrate why they were unable to fill the position with a Canadian employee (Tech Toronto, 2016). Foreign talent recruitment processes can take upwards of six months, making Canada less attractive for highly skilled talent, and thus, contributing to the growing skills shortage (Tech Toronto, 2016). The current immigration procedure presents a significant challenge for technology companies that are in desperate need of technical talent. Recently, a Toronto start-up stated that Canada needs to fill 18,200 information technology positions by 2019, and this will not be accomplished if the immigration process is not accelerated or improved upon (Tech Toronto, 2016).

In June 2016, the Government of Ontario responded to the growing technical talent shortage by releasing the *Building the Workforce of Tomorrow: A Shared Responsibility* report. This report presents several recommendations that are directly applicable to the FinTech sector, namely:

- Building stronger partnerships between educators and employers (through the development of a new Planning and Partnership Table);
- Promoting both traditional and non-traditional career paths (increase student exposure to arts, science, technology, skilled trades, and entrepreneurship careers); and
- Closing gaps in skills and competencies (developing training programs for underrepresented groups and identifying new ways to teach students relevant technical skills) (Government of Ontario, 2016).

At a national level, the Government of Canada has recently released the federal budget plan for 2017, entitled “Building a Strong Middle Class”. Budget 2017 proposes new funding to help Canadians prepare for the economy of tomorrow by promoting the development of STEM skills and digital literacy, particularly for women, girls and underrepresented groups (Government of Canada, 2017).

GAP ANALYSIS

Opportunities for improving Toronto's FinTech ecosystem

Upon consideration of the global industry and institutional responses to the FinTech talent shortage, this research identified various opportunities that could be considered for improving Toronto's FinTech ecosystem. To amend inconsistencies and build upon internationally demonstrated strategies in developing and attracting high quality talent, this report presents the following suggestions for strengthening Toronto's position as a global leader in FinTech.

Suggestions for Educational Intervention

Suggestions for Incubators and Extra-Curricular Events

Suggestions for Government and Policy Intervention

1. Toronto universities may consider developing and introducing a FinTech specialization or more clearly integrate FinTech-specific content within university programs such as a Master of Business Administration (MBA) program. These programs could include courses and topics such as: FinTech Analytics, Financial Information Systems, Robo Advisors and Systematic Trading, Dealing with Data, Risk Management for FinTech, Application in Entrepreneurial Finance, FinTech Personal Finance and Payments, and lastly, Digital Currencies, Blockchains, and the Financial Services Industry.
 2. Toronto universities may need to take specific steps (such as improving collaboration and partnership with FinTech organizations) towards improving education curriculum (especially in STEM fields) to align more closely with the needs of FinTech employers.
 3. Toronto stakeholders (government, educational institutions and industries) may need to establish a STEM task force that is mandated to develop teaching material and resources to improve education, foster a STEM education network, and organize STEM promotion campaigns.
 4. Toronto's stakeholders (government, educational institutions and industries) may need to consider developing and improving initiatives to directly inspire and encourage women to pursue STEM careers.
1. Toronto's stakeholders may consider developing and disseminating online education programs that are designed to build program members' awareness of FinTech related skills. These courses should be appropriate for both adult learners and current students, and could potentially be recognized as a credible career-enhancing certificate.
 2. Toronto's stakeholders should continue to establish and develop more FinTech-specific incubator programs and integrate more financial content into current technology incubator programs.
 3. Toronto's stakeholders should determine and maintain a central 'voice' for the local FinTech ecosystem, ensuring the identified leading organization is vibrant, relevant, and committed to actively growing the industry. The organization may, for example, facilitate civic FinTech hackathons, as well as promoting national and/or regional career and networking fairs for students.
 4. Toronto's stakeholders should design programs for primary and high school students that are targeted at fostering an early interest and passion in pursuing a FinTech-related career.
1. Toronto's Government may investigate the impact of regulatory requirements on the growth of the sector, and review outdated policies that directly obstruct local FinTech entrepreneurship.
 2. Toronto's Government should encourage the federal government to maintain and improve a flexible and accelerated visa application process to attract foreign skilled talent.
 3. Toronto's Government may consider developing/improving government-funded initiatives that promote skills development and incentivize universities to integrate STEM-related education into curricula, and develop/improve FinTech incubators.

CONCLUSION

This report is an investigation of industry and postsecondary education institutions' response towards the current FinTech talent shortage. The findings provide an overview of how global FinTech hubs are innovating and leveraging expertise to attract and train high quality talent, revealing multiple opportunities for improvement for the Toronto region. To analyze each case study, the authors categorized the multiple response strategies into three major themes:

1. Educational Interventions;
2. Incubators and Extra-Curricular Events; and
3. Government and Policy Interventions.

Within Educational Interventions, the findings demonstrate how postsecondary institutions have taken progressive steps towards enhancing the technical skill set of students. Noteworthy strategies included curriculum reviews, promotion of STEM-related education and careers (especially within female students group), and the integration of FinTech into university programs like MBA programs. The second theme, Incubators and Extra-Curricular Events, outlines how FinTech stakeholders have developed skill enhancement programs for postsecondary students, adult learners, and start-up entrepreneurs. Multiple programs aimed at growing local technical and financial talent, and encouraged students to pursue FinTech related careers. These programs include: hackathons, start-up accelerators, independent course offerings, and industry/university conferences. The last theme addressed Government and Policy Interventions. Notable strategies from the case studies included financial incentives for new graduate start-up networks, immigration process reform, and mobilizing policy papers directly addressing the chronic skill shortage.

As FinTech is a relatively new phenomenon, and the talent shortage is only beginning to gain international attention, response and interest, limitations to this research include a lack of peer-reviewed sources and a heavy reliance on recent reports that were written by private sector companies.

This research offers multiple suggestions for improving and developing Toronto's FinTech ecosystem. This research also pinpoints particular opportunities that local stakeholders could adopt in order to attract and develop high quality FinTech talent. To validate these suggestions, stakeholders (Toronto's government, the industry and postsecondary institutions) should conduct a rigorous assessment of each and provide feedback regarding the suitability towards the Toronto FinTech ecosystem.

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