IFI Working Paper

IFI Working Paper No.16 March 2023

Entrepreneurial Ecosystems in the AI Industry:

Waterloo Toronto (WT) vs. Hongo

Michi Fukushima
Guest Researcher, Institute for Future Initiatives, The University of Tokyo
Professor, Graduate School of Economics and Management, Tohoku University

Toshiya Watanabe
Professor, Institute for Future Initiatives, The University of Tokyo

東京大学未来ビジョン研究センター
Institute for Future Initiatives
The University of Tokyo

Entrepreneurial Ecosystems in the AI Industry: Waterloo Toronto (WT) vs. Hongo

【Abstract】

Artificial intelligence (AI) is increasingly being used in all industries and is viewed as a key technology that impacts industrial competitiveness. The United States leads other countries in AI research and commercialisation; however, AI talent is active across countries, and the creation of an ecosystem to attract such talent is a pressing issue for the region. Creating an ecosystem that attracts this talent is a pressing issue in this region. The Waterloo-Toronto (WT) region of Canada is home to pioneers in AI research, including Professor Jeffrey Hinton of the University of Toronto, as well as AI startups and services that support them. Comparing the AI ecosystem in Hongo, Tokyo, the leading AI region in Japan, with that in WT, we found a significant difference in the diversity of human resources between WT and Hongo, and that WT has a dense network of support organisations and startups across regions, whereas Hongo, Tokyo, is home to a large number of support organisations associated with the University of Tokyo. In Hongo, Tokyo, the network between startups and support organisations is localised and fragmented.

Table of Contents

1. Introduction

In the 21st century, advances in information technology have drastically changed industrial structures and business models. In today's Fourth Industrial Revolution, artificial intelligence (AI) and big data are key to industrial transformation. The adoption of AI has been steadily progressing worldwide, and some industries and countries have emerged where the use of AI has become universal. AI will become more familiar to people, and their ability to use it will significantly impact industry competitiveness.

The number of researchers, engineers, and start-ups in the AI industry is increasing; however, they tend to be concentrated in a limited number of regions.

This study aims to examine the ecosystem in the Waterloo-Toronto (WT) area in Canada, a leading region in the field of AI, and compare it with Hongo, Tokyo, a leading AI-advanced region in Japan, to obtain policy implications for the formation of an AI ecosystem in Japan.

2. Toronto's AI Industry

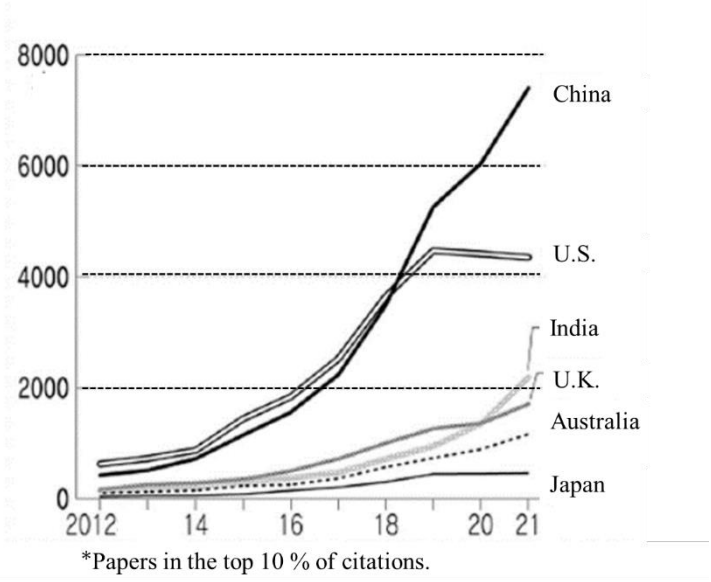
2.1. Global AI Industry

This section provides an overview of the current state of the global AI field in terms of the two stages of research and commercialisation and clarifies WT's position in the global AI ecosystem.

(1) Research and development in AI

The number of papers published worldwide in the field of AI is increasing rapidly. Looking only at papers that have attracted attention, the number of papers has increased rapidly from around 2010, with the United States (U.S.) and China continuing to compete for top positions. However, China began to move away from the U.S. around 2018 and has consistently maintained its top position since then (Figure 1). Additionally, the number of papers from India has increased rapidly since approximately 2010 and is expected to surpass that of the United Kingdom (U.K.), Germany, Japan, France, and Canada by 2020.

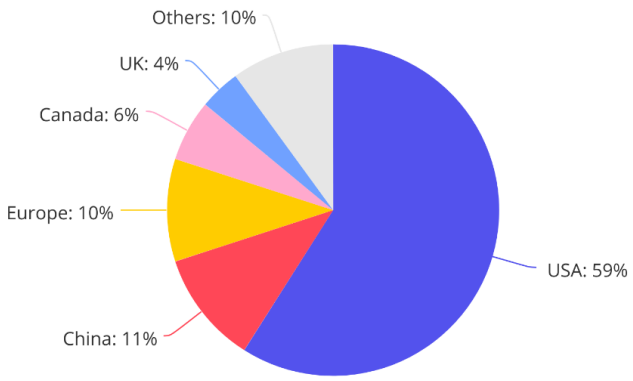
Figure 1 Number of spotlighted papers on Artificial Intelligence (AI) by country



Source: Nihon Keizai Shimbun (16 January 2023)

However, according to a study conducted by the Global AI Talent Tracker using data from the authors of papers accepted in 2019 at NeurIPS, a leading international conference in the field of AI, the U.S. is where most AI researchers work, accounting for 60% (Figure 2) followed by China with 11%, Europe with 10%, and Canada with 6%.

Figure 2 Countries where top researchers work

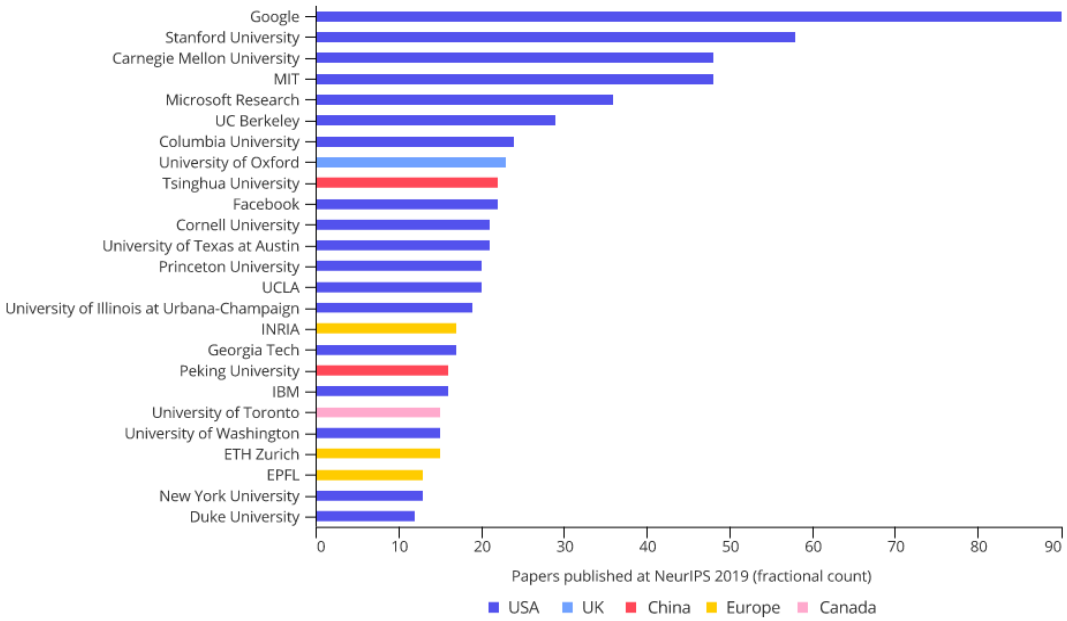


Source:https://macropolo.org/digital-projects/the-global-ai-talent-tracker/

In terms of the number of research publications by the organisation, Google dominates others with a commanding presence. Notably, the top seven AI research organisations are located in the U.S.

(Figure 3).

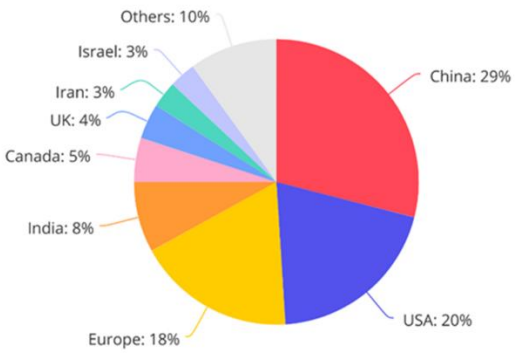
Figure 3 Organizations with the highest number of AI research publications



Source: https://macropolo.org/digital-projects/the-global-ai-talent-tracker/

Next, looking at the origins of the top researchers, 29% were from China, 20% from the U.S., 18% from Europe, 8% from India, and 5% from Canada (Figure 4). In other words, only 20% of the top researchers were born in the U.S. Combined with the above figures, this suggests that most papers on AI are produced by foreign students and researchers who have come to the U.S. for study or employment, and by immigrants who are employed by US research institutions or companies after graduation.

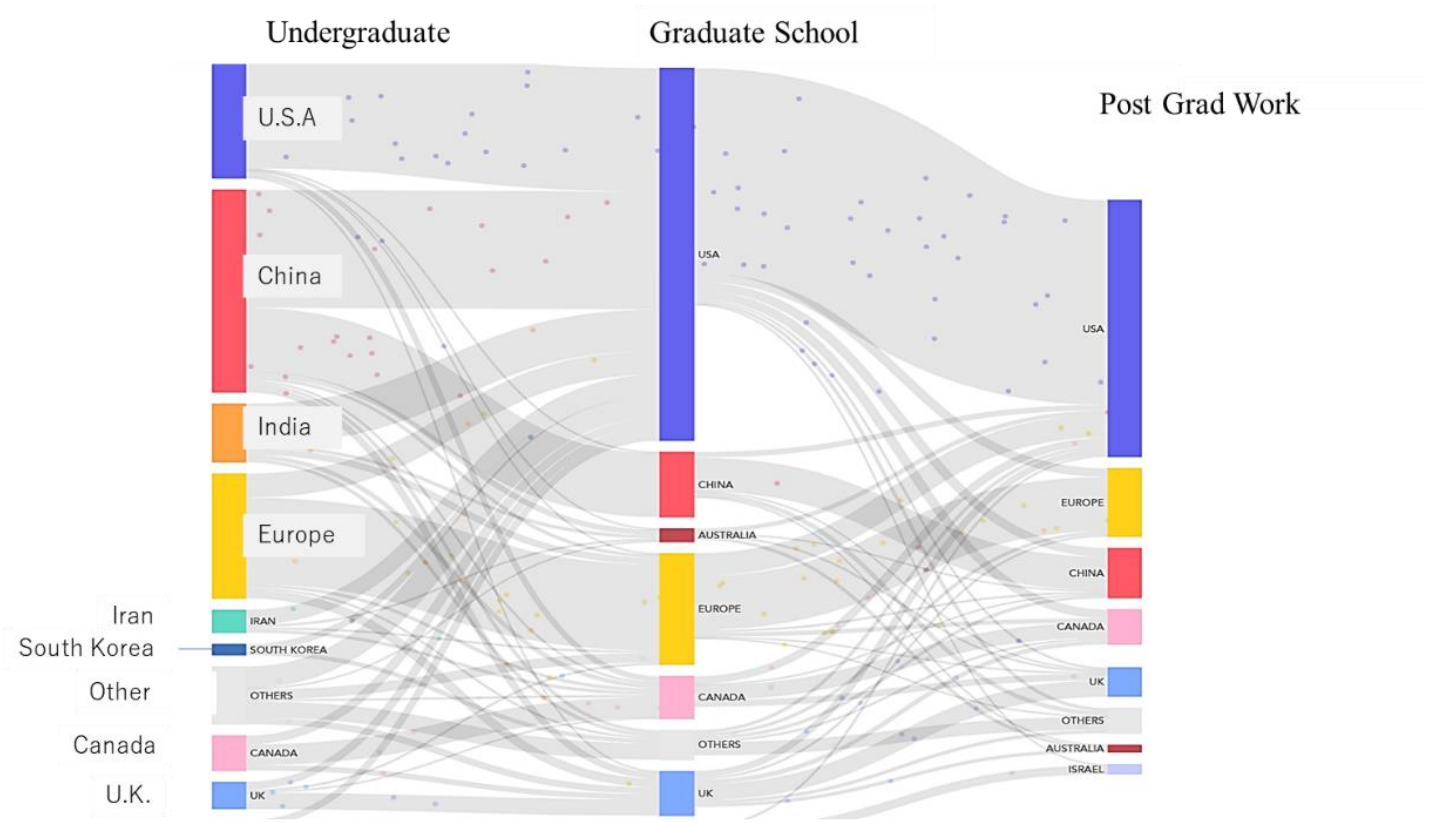
Figure 4 Country of origin of top researchers



Source: https://macropolo.org/digital-projects/the-global-ai-talent-tracker/

Finally, Figure 5 presents the results of a survey that tracked the career paths of top AI researchers. Most researchers who received their undergraduate education in China studied in the U.S. in graduate school and stayed in the U.S. after receiving their degrees. Researchers who studied in the U.S. and returned to China after their postdoctoral fellowships comprised only a small percentage.

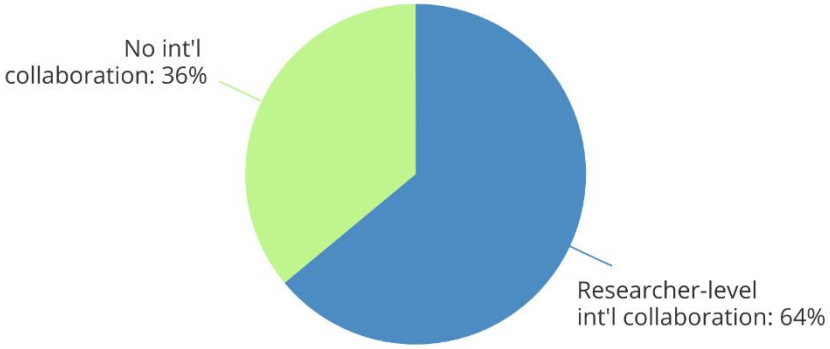
Figure 5 Careers of top AI researchers



Source: https://macropolo.org/digital-projects/the-global-ai-talent-tracker/

Let us now examine the international co-authorship of papers. In AI, 64% of all the papers had international coauthors. Co-authorship between China and the U.S. is the most common. These data indicate that, in the field of AI, cross-national research activities are actively conducted through the movement of people and international co-authorship (Figure 6).

Figure 6 Ratio of international coauthored papers



Source: https://macropolo.org/digital-projects/the-global-ai-talent-tracker/international-collaboration/

(2) Research and development in the field of AI in Canada

Six percent of the world's researchers work in Canada is followed by the U.S., China, and Europe (Figure 2). The University of Toronto ranks 20th as the organisation in which top researchers work (Figure 3). The top researchers whose country of origin was Canada accounted for 5% of the total, indicating that a certain number of top researchers were born and worked in Canada (Figure 4).

A closer look at the careers of Canadian AI students and researchers reveals that approximately 70% of Canadian AI bachelor's degree graduates attend graduate school in Canada and approximately 30% attend graduate school in the U.S. However, Canadian graduate schools enrol not only Canadian students but also many students from other countries, including those from the U.S., China, India, Europe, and Iran (Figure 5).

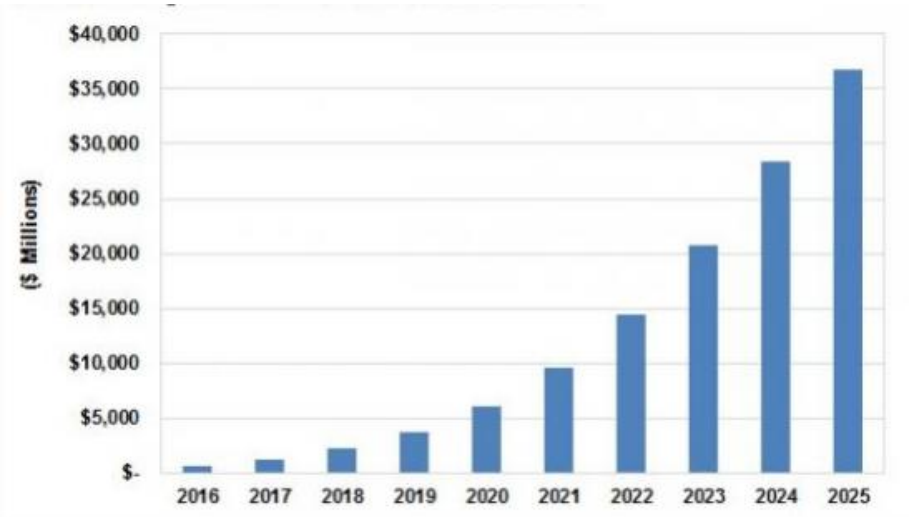
Furthermore, after completing doctoral studies at Canadian graduate schools (postdoctoral fellows), approximately one-third remained in Canada, but many moved to the U.S. and the U.K., and a small number moved to China (Figure 5).

(3) Commercialization of AI field

Next, we examine trends in the AI industry from the perspective of commercialisation. In the previous section, we learned that the U.S. is attracting AI talent from Japan and abroad. Why can the U.S. attract such talent? One factor is ease of commercialisation.

As the penetration rate of AI technology increases each year, the global AI market has grown at an average rate of 63.5% in the past year and is expected to grow further. According to a 2016 forecast by the U.S. research firm Tractica, the AI market will reach $36.8 billion in annual global sales by 2025 (Figure 7).

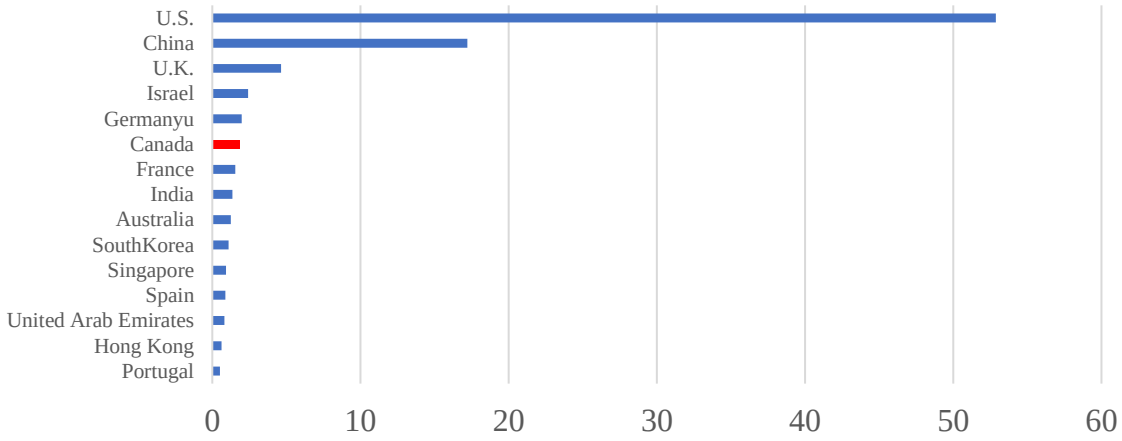
Figure 7 Global AI market (Revenues)



Source: Tractica (2016)

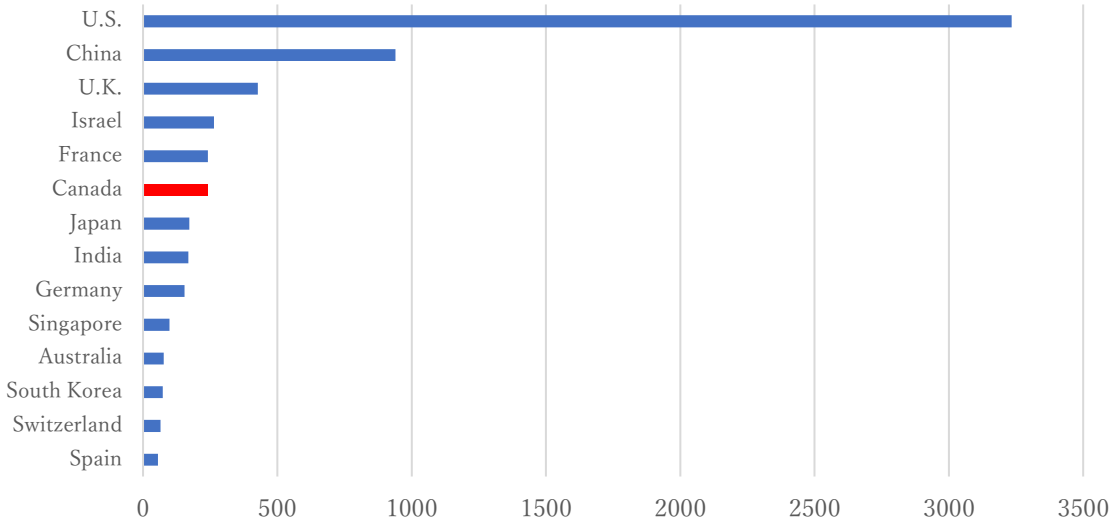
Looking at investment in the AI industry by country, the cumulative private investment from 2013 to 2021, and the number of companies that received investment, the U.S. overtook all other countries to receive the most investment, followed by China. Next is the U.K., followed by India and the rest of the world (Figures 8 and 9). The U.S. leads the pack in terms of ease of receiving private investment. Canada ranks sixth in terms of the amount of private investment and in terms of the number of companies that have received investment.

Figure 8 Private investment in AI by geographic area in 2013–2021 (in billions of U.S. Dollars)



Source: Stanford University, Human-Cantered-Artificial Intelligent (2022)

Figure 9 Number of newly invested AI firms (2013–2021 cumulative)



Source: Stanford University, Human-Cantered-Artificial Intelligent (2022)

These data suggest that, in terms of commercialisation, the global AI ecosystem is structured with the U.S. leading the world, followed by China, the U.K., India, Israel, and Canada (Figure 10).

Figure 10 Global AI ecosystem

Source: StartusInsights, Global Startup Heatmap Artificial Intelligence
https://www.startus-insights.com/innovators-guide/ai-trends/

2.2 AI Industry in WT

The previous chapters looked at global trends in the AI field. Below, we will examine the characteristics of the WT region and its position in the global AI field.

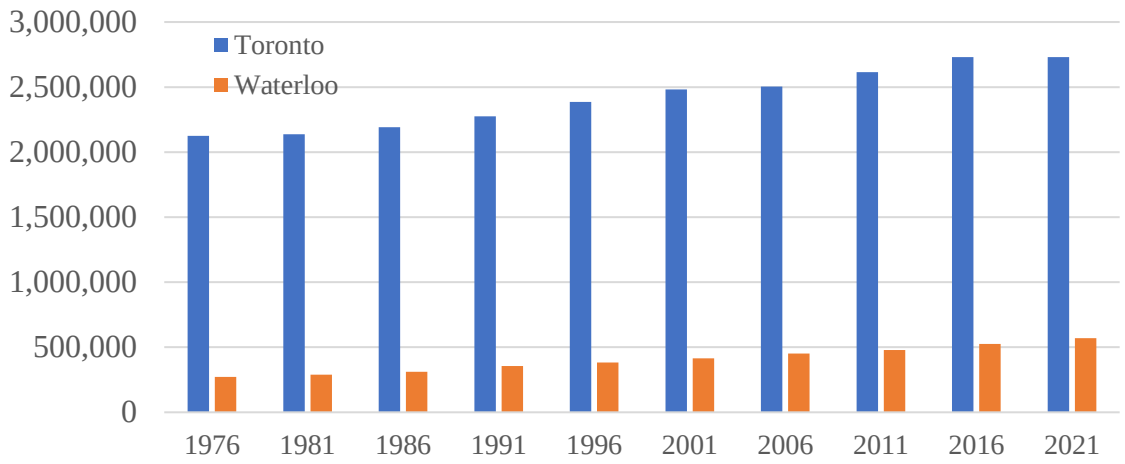
(1) Outline of WT

①Population

Toronto is the fourth largest city in North America, with an area of 630.2 km², which is roughly the same size as Tokyo's 23 wards (627.6 km²). The total population of the Toronto metro area is approximately 6,202,225, with 275,931 people living alone (Figure 11). Over the next 25 years, the urban and metro areas are expected to grow by 32% and 42 %, respectively.

Waterloo is 112 km from Toronto (approximately an hour away). Waterloo has a population of 121,430, whereas Waterloo-Cambridge-Kitchener, which is considered an economic region, has a population of 586,000 (Figure 11).

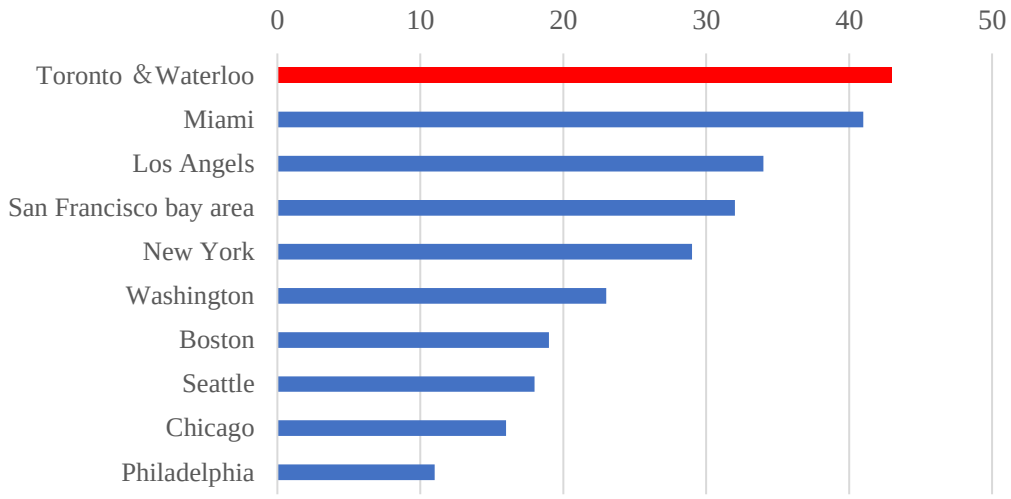
Figure 11 Population trends in Waterloo and Toronto



Source: Census Canada (2016)

Canada as a whole has a high percentage of immigrants, with a quarter of the population being immigrants; in Toronto, the percentage is even higher, with almost half of the population being immigrants. In the WT, there were 230 nationalities and 180 spoken languages. The percentage of foreign-born population in WT is higher than major cities in the U.S. (Figure 12). This is largely because of the Canadian government's immigration policies.

Figure 12 Percentage of foreign-born population in WT (%) (2016)

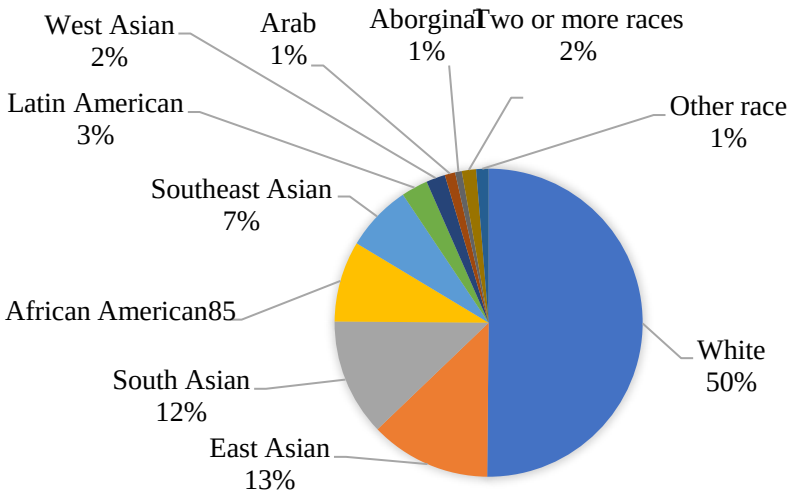


Source: Statistics Canada (2016)

②Racial Composition of WT

Let us examine the racial compositions of Toronto and Waterloo, separately. Toronto's racial composition is half Caucasian, with the remainder being East Asian, South Asian, African American, and Southeast Asian (Figure 13). In recent years, the percentage of immigrants from India, Bangladesh, and other South Asian countries has increased rapidly.

Figure 13 Racial composition of Toronto

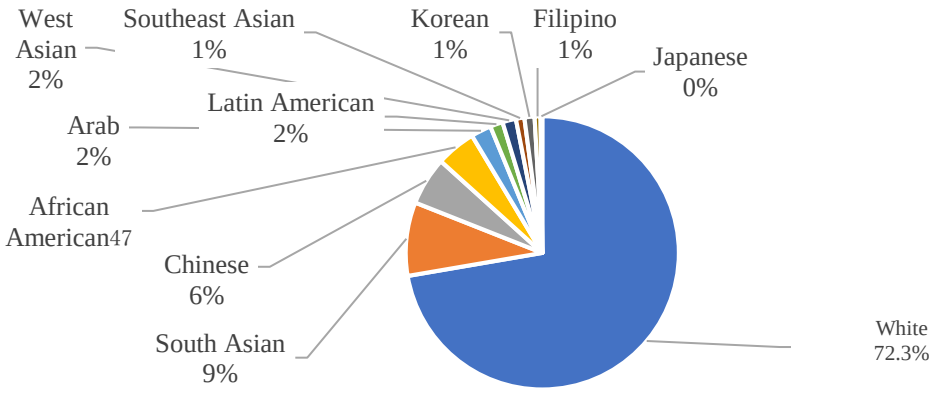


Source: Statistics Canada (2016)

In contrast, Waterloo's minority population is only 9.3%, broken down as follows: 9% South Asians (East Indians and Pakistanis), 6% Chinese, 5% African Americans, and 2% Middle Eastern (Figure

14). Although racial diversity is less than in Tolonto it is more diverse than in other countries. In particular, the rapid increase in South Asians immigrants over the past decade has been remarkable, with an influx of more than 10,000 people over the past decade.

Figure 14 Racial composition of Waterloo



Source: Statistics Canada (2016)

③Toronto Waterloo Corridor

Historically, Toronto and Waterloo have been considered economic regions, known as the 'Toronto Waterloo Corridor' (see Figure 15 for the geographic relationship between the two regions). The region is home to 15,000 technology companies, 5,000 start-ups, and 300,000 people, and two-thirds of all employees are 'tech workers', such as programmers and developers. The city is comparable to Silicon Valley and Boston in terms of density of tech workers. Additionally, there is a concentration of universities and other educational institutions, with 423,000 students.

Of course, Toronto and Waterloo differ in terms of population size and resulting start-up environments. Toronto is strong in fintech and life sciences/health, whereas Waterloo is strong in hardware, such as advanced manufacturing and robotics. However, from the perspective of human resource mobility, several startups move back and forth between Toronto and Waterloo entrepreneurial support organisations or use both; it is safe to say that these regions are regarded as a single economic zone by startups.

Figure 15 Location of Toronto Waterloo

Source: Waterloo EDC (https://www.waterlooedc.ca/blog/what-is-toronto-waterloo-corridor)

(2) History of AI industry in WT

①Prof. Jeffrey Hinton on the scene

In 1956, the AI Research Institute was established at the University of Toronto. However, it experienced two booms and winter periods from the 1960s to the 1980s. During this period, grants from the provincial and federal governments were granted to fund research, but no special measures were taken for AI research.

Professor Jeffrey Hinton, often called the father of AI research, is a professor at the University of Toronto, where he led the research activities of the first research program ‘AI, Robotics and Society’ at the Canadian Institute for Advanced Research (CIFAR), which was established in 1982. He led research activities in the first research program, ‘Artificial Intelligence, Robotics and Society’, at the CIFAR.

In 2006, Professor Hinton published a revolutionary paper on a fast-learning algorithm for Deep Belief Nets. This has significantly impacted academic communities.

Subsequently, an international contest for computerised image/object recognition accuracy (ImageNet Large-Scale Visual Recognition Challenge, ILSVRC) was held in 2012 and organised by Professor FeiFei Lee of Stanford University. The University of Toronto team led by Professor Hinton used a model based on an algorithm called ‘convolutional neural network (CNN72)’, a type of deep neural network, to demonstrate recognition accuracy significantly exceeding existing methods. This

team shocked researchers worldwide by demonstrating recognition accuracy.

Professor Hinton was also keen on the practical application of his technology: in 2012, he founded 'DNNresearch Inc.', with his protégé. The following year, Google acquired the company, and Professor Hinton became a research fellow at Google. In March 2017, Professor Hinton became the chief scientific advisor of the Vector Institute (see below), which was established at the MaRS to lead cutting-edge AI research.

As Hinton's achievements became well known, major IT companies (GAFA) began to establish AI-related research institutes in Toronto, and the Canadian government began to develop a 'Pan-Canadian AI Strategy' with a research budget of $600 million. Support organisations within universities and the private sector have also gradually begun to emerge. The existence of Toronto's AI ecosystem was further made known to the world by Shivon Alice Zilis, a Canadian VC with expertise in AI and high-tech, who wrote an article on 15 December 2015 titled 'The current state of machine intelligence 2.0' (https://www.oreilly.com/radar/the-current-state-of-machine-intelligence-2-0/). This study focuses on the AI industry in Toronto.

Several researchers have worked with Professor Hinton. Among them were Yann Lecan, Joshua Bengio, and Richard Sutton. There are three AI talent pools in Canada: Montreal, Edmonton, and Toronto. In Montreal, Hinton's student Joshua Bengio is at the Montreal Institute for Learning Algorithms (MILA), Richard Sutton is at the Alberta Machine Intelligence Institute (Amii), and Professor Hinton is active, mainly at the Vector Institute (Figure 16).

They are actively involved in the industry, with Yann Lecan becoming the head of Facebook's AI lab and Joshua Bengio taking a position as a professor at the University of Montreal, while collaborating with IBM and NEC. Other Hinton students, known as the Canadian Mafia, are also active in the AI industry.

Figure 16 Concentration of AI talent in Canada

Source: https://thoughtleadership.rbc.com/ai-for-good-battling-bias-before-it-becomes-irreversible/

②Canada's AI Promotion Policy

In 2015, shortly after Liberal Prime Minister Justin Trudeau took office, the government declared that it would promote economic growth through research and innovation. Then, in 2017, he established 'Innovation Canada' in the Ministry of Innovation, Science and Economic Development, and in March 2017, he announced the Pan-Canadian AI Strategy (Pan-Canadian Artificial Intelligence Strategy) as a measure to promote the AI industry. Thus, the Canadian government became the first country to position the AI industry as a key industry in its national strategy, and in response, the combined federal and provincial governments began providing C$125 million in support.

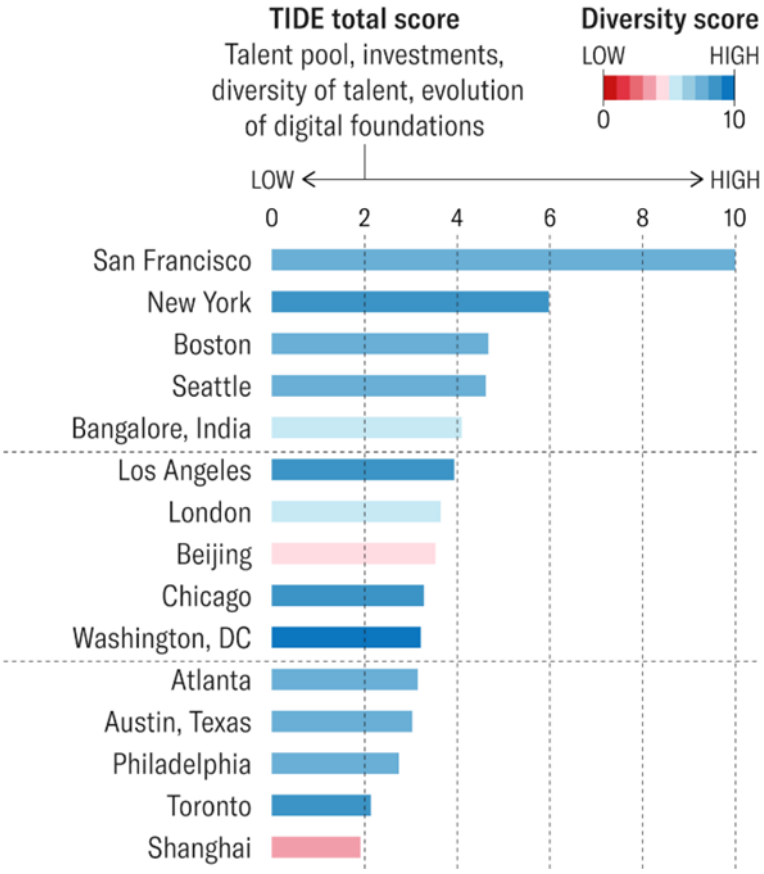
③Establishment and increase of support organizations

Regarding the establishment of organisations to support startups in Waterloo, the movement began in the late 1990s, with the launch of Communitech in 1998 and the Acceleration Centre in 2006. In Toronto, organisations supporting startups surged following the publication of Professor Hinton's Shock Paper in 2006. In 2010, NEXT Canada, a non-profit organisation, began working to develop young talent for future Canadian innovation and startups. In 2012, universities in particular began to actively offer incubator and accelerator programs. For example, the DMZ was established at Toronto Metropolitan University (then Ryerson University), and accelerators such as the Creative Destruction Lab (CDL)and University of Toronto Early Stage Technology (UTEST) were established at the University of Toronto in 2012 (see below). Some of these were not only established in a top-down manner by the university but also started spontaneously by individuals within the university.

(3) Global positioning of WT's AI human resources

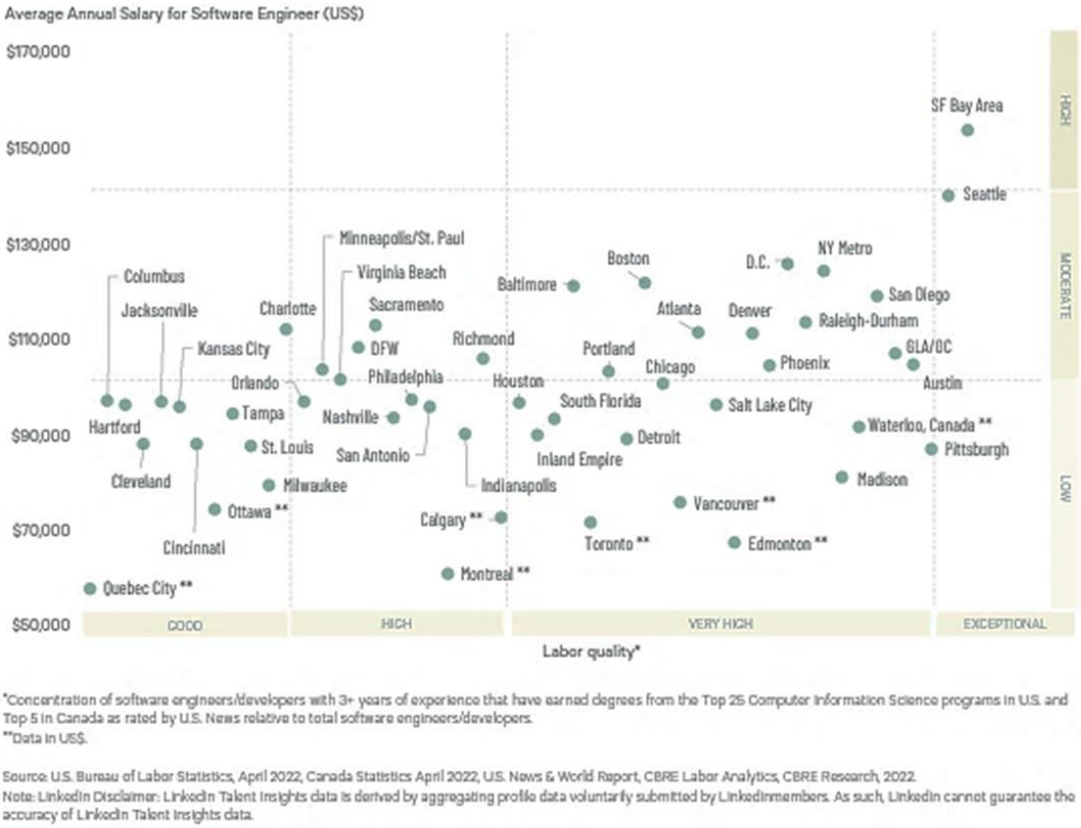
Figure 17 shows the TIDE (Talent pool; Investments; Diversity of talent; Evolution of the country's digital foundations)total score, which measures the global AI industry in terms of talent pool, investment, diversity of talent, and evolution of digital infrastructure, and the diversity score, which shows the diversity of talent in different regions, as published in the *Harvard Business Review* by Chakravorti et al. (2021). This indicates that San Francisco has an outstandingly large pool of AI talent. In addition, except for Bangalore and Beijing, the top cities are all in the United States. Toronto, on the other hand, ranks 14th in the world in terms of talent pool size, and while it inevitably lags North American cities in absolute numbers, it is highly rated for its diversity.

Figure 17 Global AI hotspots and their Variety



Source: Chakravorti et al. (2021) partially revised by the author

Figure 18 Quality of human resources and distribution of average annual salary in each region



*Concentration of software engineers/developers with 3+ years of experience that have earned degrees from the Top 25 Computer Information Science programs in U.S. and Top 5 in Canada as rated by U.S. News relative to total software engineers/developers.
**Data in US$.

Source: U.S. Bureau of Labor Statistics, April 2022, Canada Statistics April 2022, U.S. News & World Report, CBRE Labor Analytics, CBRE Research, 2022.
Note: LinkedIn Disclaimer: LinkedIn Talent Insights data is derived by aggregating profile data voluntarily submitted by LinkedIn members. As such, LinkedIn cannot guarantee the accuracy of LinkedIn Talent Insights data.

Source: https://www.cbre.com/insights/books/scoring-tech-talent-2022

Figure 18 further analyzes Toronto's tech talent in terms of 'average annual earnings' (vertical axis) and 'quality of software engineers' (horizontal axis). Compared to other regions in North America, Toronto is positioned as a region where average annual earnings are not so high, despite the high quality of labour. This suggests that Toronto's talent pool is attractive to major technology firms, including GAFA.

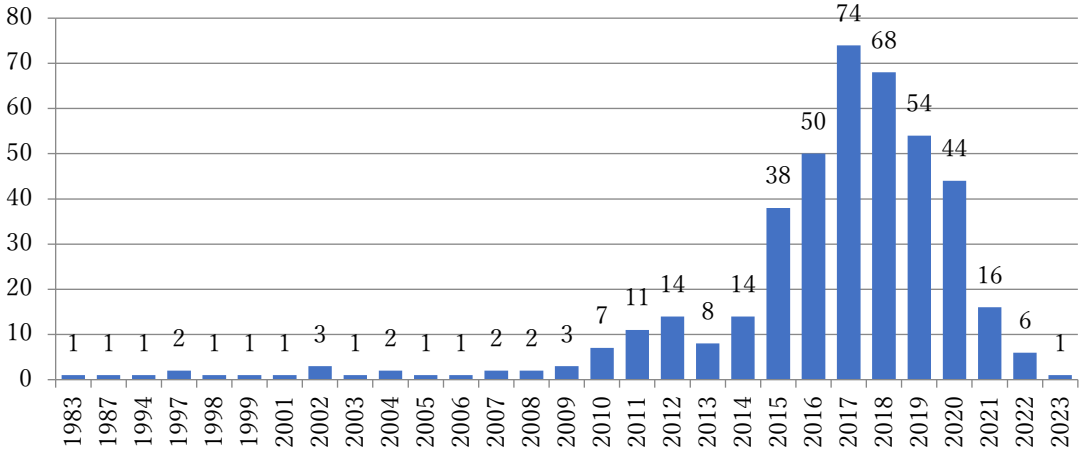
However, as shown in Figure 5, Canadian AI talent leaves Canada for North America in search of higher salaries. There is a shared sense of urgency in WT to create an ecosystem in which such talent can remain, which is reflected in the increase in the number of support organisations.

(4) AI startups in WT

As of 2022, startups such as ApplyBoard in Edtech (education), AI-based genetic drug discovery Deep Genomics, GaN Systems in clean tech, and 1 Password in password management services are among those that have attracted investors' attention. The number of startups has increased since 2010 peaking in 2017 (Figure 19). The main technology used by the startups are machine learning, software, and information technology (Figure 20). Majority of the startups are at the seed stage, followed by

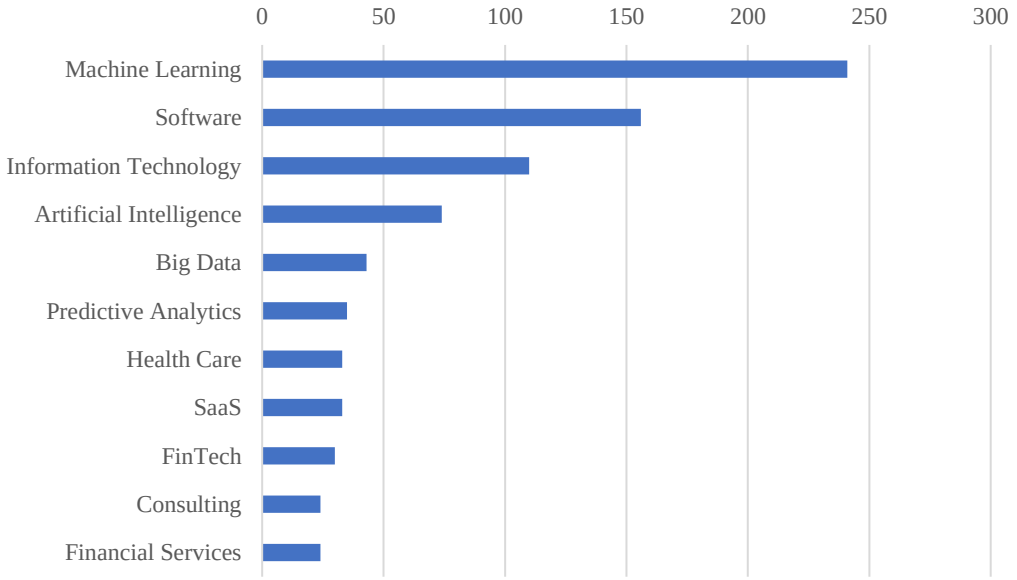
M&A and early stage (Figure 21).

Figure 19 AI startups in WT (year established)



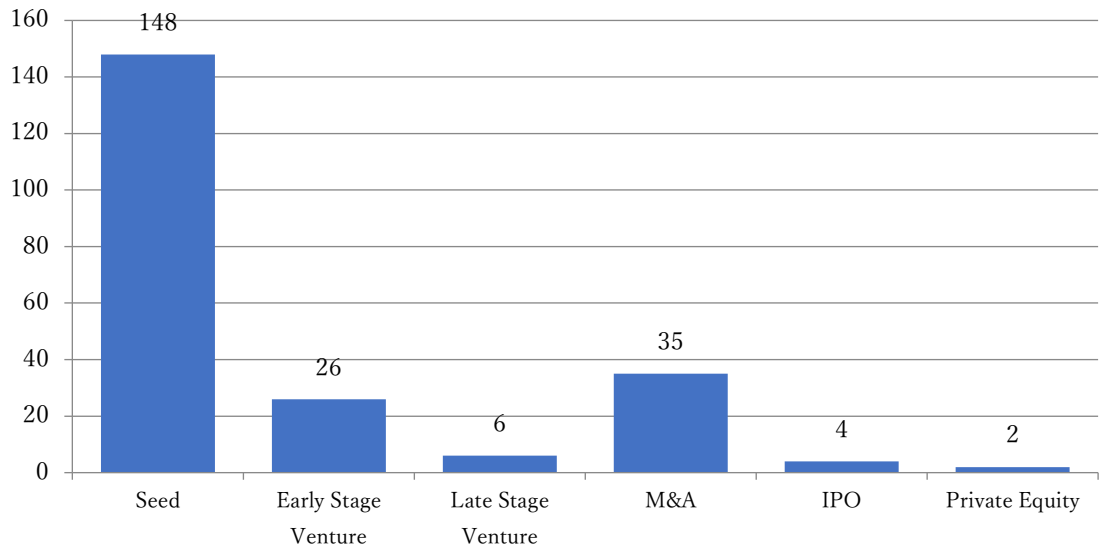
Source: Compiled from Crunchbase.

Figure 20 Type of technology (business)



Source: Compiled from Crunchbase.

Figure 21 Investment stages



(5) Summary

- Professor Jeffrey Hinton's research at the University of Toronto, a mecca for AI research, led to the creation of the Canadian AI Industry. The development of the AI industry began when Professor Hinton's 2006 paper and his victory in the 2012 AI competition attracted worldwide attention.
- WT's strength is its ability to hire high-quality personnel at a low cost. Silicon Valley companies took notice of this and expanded their operations to Toronto. However, researchers and engineers left Canada for higher salaries in North America.
- The crisis of AI researchers and engineers being drawn to North America around 2000 led to an increase in startup support in Canada. Canadian Government support began in 2017.
- The number of startups has increased annually since 2010, peaking in 2017. Since then, the number of startups has declined.
- To date, 460 AI startups have been established in Canada. The primary AI business fields include machine learning, software, and IT. Some start-ups have begun to go public or acquire knowledge.

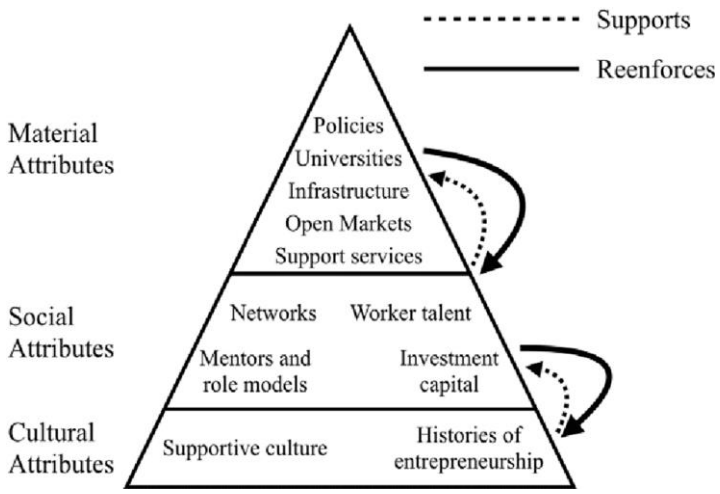
3. Entrepreneurial ecosystem (EE) in WT

3.1 What is the Entrepreneurial Ecosystem?

The concept of an ecosystem is analogous to that in biology, showing how entities in a system are organically interconnected to form a single system. The diagram (Figure 22) presented by Spigel (2017) as a framework for visualising ecosystems illustrates the essence of ecosystems.

According to Spigel's (2017) framework, an ecosystem is a three-tiered structure with cultural attributes at the bottom, social attributes in between, and physical characteristics stacked at the top. The key to this framework is that cultural attributes at the bottom influence the upper layers. Let us examine EE in the WT based on this framework.

Figure 22 Ecosystem concept



Source: Spigel (2017, p. 57)

3.2 EE in Toronto

(1) Cultural and historical characteristics

The city of Toronto was established in 1787, when the British purchased 250,000 acres of land from the Mississauga Indians for 1,700 pounds to counter the threat posed by the U.S. In 1867, when Canada became a self-governing territory after gaining independence from Great Britain, Toronto became the capital of the Ontario Province, which prospered as a wheat-gathering centre.

During the 50 years from the beginning of the 20th century to World War II, Toronto experienced great commercial development, and in addition to the British, many immigrants came from Europe, including Jews, Italians, Macedonians, and other immigrants. After the Second World War, many

immigrants came from Europe, including Italy, Ukrainians, and Hungarians, following the Hungarian uprising in 1956. Then, with the Canadian government's change in immigration policy in 1967, there was a large influx of Asian, Caribbean, and Latin American immigrants, resulting in the Anglophone population falling into the minority and Catholics surpassing Protestants (Nishihara, 2009).

Today, approximately half of Toronto's population comprises immigrants, and as a city, there is a tolerance for different cultures. This has been nurtured throughout Toronto's history and forms the foundation of Toronto's innovation.

(2) Social and physical characteristics (key supporting industries)

Toronto has seen the emergence of several incubators and accelerators in the AI industry since 2012, when Professor Hinton's AI research attracted attention. Toronto currently has 60 coworking spaces, 136 accelerators, and incubators (Startup: Toronto, https://startupheretoronto.com/).

These organisations come in various forms, including 1) those created as university-affiliated institutions (incubators affiliated with Metropolitan University of Toronto (DMZ)), CDL, UTEST, and others (accelerators at the University of Toronto); 2) those created as non-profit organisations, such as MaRS Discovery District, Vector Institute, NEXT Canada, NEXT 36, NEXT AI, NEXT Founder, and Mitacs; and 3) those created by local entrepreneurs (One Eleven, etc.).

①DMZ (incubator affiliated with the Metropolitan University of Toronto)

It is a tech incubator run by Toronto Metropolitan University (Ryerson University) and an award-winning and prestigious incubator from the World University Incubator. It is located in downtown Toronto and occupies a room once used by Google Canada's headquarters.

Established in September 2010, it was initially only available to those affiliated with Ryerson State University (the predecessor of the Metropolitan University of Toronto), but was opened to the general public around 2013, and as of 2022, about 10% of its students were from the university.

The DMZ reports directly to the president and operates with a high degree of autonomy. The university funds the DMZ's operations, but it sometimes applies for and receives funds from the Canadian government jointly with other organisations.

To move to a DMZ, a company must (1) already have a product to sell, (2) have a proven sales record, and (3) have at least one full-time employee. Tenant screening was performed based on presentation. The screening process was rigorous with an acceptance rate of 4%. The screening process focuses on the founding team, market, product/service compatibility, market size, and other factors. The monthly rent is 400 Canadian dollars and the tenancy period ranges from four months to one year.

The DMZ also offers Bootcamp (a 16-week program for pre-incubators) and Basecamp (an 8-week summer school for students) and requires an optional 2.5% equity stake for Bootcamp participants. Basecamp created over 100 startups.

The number of companies occupying the DMZ decreased considerably due to the coronavirus disease 2019 (COVID-19) pandemic, but as of September 2022, there were 85 companies in the DMZ. In terms of sectors, (1) AI accounted for 50%, (2) augmented reality (VA), and (3) blockchain. Biotech startups have recently moved.

The DMZ also sought a base outside Toronto, and expanded to New York City (Financial District) in 2017. In Japan, Sagamihara and Toronto (former Scarborough: friendship city agreement) were connected through a JETRO project, and Landing Pad TOKYO (LPT) was launched in April 2020 with the Japan Industrial Promotion Association (hereinafter 'JIPA') as the recipient. LPT is an 'accelerator' with the mission of promoting innovation among small- and medium-sized companies in Japan, mainly in the manufacturing industry, through seminars/workshops held virtually three times a week, discussion meetings, business matching such as Mini Collision, collaboration and personnel exchange with universities and technical colleges, and the Japanese version of 'Basecamp' and 'Launchpad TOKYO. Basecamp' and 'LaunchPad'.

② University of Toronto and 12 accelerators

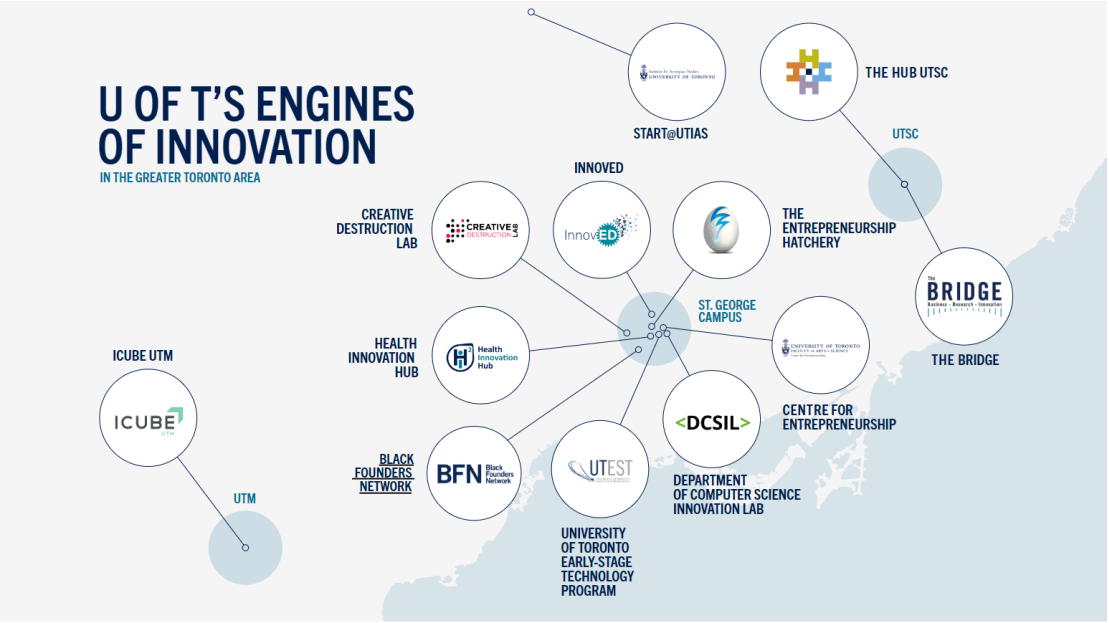
The University of Toronto is dedicated to entrepreneurship. The University of Toronto offers 300 ship-related courses. It also has 12 accelerator programmes spread across three campuses, some of which have unique practical results (Table 1, Figure 23).

Table 1 Accelerator Programs at the University of Toronto

St. George Campus (main campus)
Ontario Institute for Studies in Education (InnovED)
Creative Destruction Lab (CDL)
Health Innovation Hub
Black Founders Network
University of Toronto Early-Stage Technology Program (UTEST)
Department of Computer Science Innovation Lab (DCSIL)
Center for Entrepreneurship
The Entrepreneurship Hatchery
UTSC (Scarborough Campus)
THE HUB UTSC
THE BRIDGE
UTM (Mississauga Campus)
ICUBE UTM
In Institute for Aerospace Studies
START@UTIAS

Source: https://entrepreneurs.utoronto.ca/for-entrepreneurs/u-of-t-accelerators/

Figure 23 Location of incubators and accelerators at the University of Toronto



Source: https://entrepreneurs.utoronto.ca/for-entrepreneurs/u-of-t-accelerators/

・The U of T Entrepreneurship: ONRamp

ONRamp provides an entrepreneurial community with a collaborative or co-working space for University of Toronto students. ONRamp at the University of Toronto connects innovative students, startups, and accelerators within the University of Toronto. The University of Toronto has as many as 12 accelerators and incubators on three campuses and serves as a coordinator for several startup support organisations on campus.

・The Creative Destruction Lab (CDL)

CDLwas founded in 2012 by Professor Ajay Agrawal of the Rotman School of Business at the University of Toronto. The purpose was to support technology-oriented startups, especially those founded by young researchers without business experience. At the time, Professor Agrawal and his colleagues were concerned about the brain drain from Canada to the U.S., which was the driving force behind the establishment of the CDL.

Professor Agrawal came up with the idea of a program that would bring the US VCs he knew to Toronto and match Canadian startups with Silicon Valley VCs. Around the same time, Professor Hinton and his colleagues were fortunate that their research attracted attention, and VC participation from California was realised.

The program took place over two days every eight weeks and lasted for nine months. Startups make

presentations, are advised by investors and entrepreneurs on their presentations, and set goals for the next eight weeks. After this, the startups gave another presentation, and investors and technology entrepreneurs voted to eliminate one or two startups from each round. Startup pitches and Q&A sessions occur in the middle of the circular rows of seats, with startups in the inner rows, VCs in the second row, and companies in the third row. This is a long time for startups.

Canadian VCs, who initially showed no interest in Canadian start-ups, began to realise the potential of CDL activities and gradually began participating in the programme. Currently, there are 20 startups with 30–40 supporters in Japan and abroad.

CDL supports technology startups that have been primarily in the seed stage, focusing on AI, quantum computing, cleantech, and healthtech since 2015, but later expanded the field and broadened it to include supply chain, retail and distribution services, and climate.

The CDL structure now extends beyond the University of Toronto and Canada to the rest of the world, with 12 chapters worldwide, each focusing on an area of technical strength (e.g. CDL-Toronto focuses on AI and Quantum Machine Learning). (e.g. CDL-Toronto provides specialised support for AI and the Quantum Machine Learning streams).

The number of startups participating in the CDL increased each year, from 25 in 2015 to 50 in 2016 and 75 in 2017.

The CDL is also active in investment and has invested in 745 companies to date. Most of these investments are pre-seeds, seeds, or other small investments. However, the CDL does not invest in capital gains but in growth, and the majority of its investments do not involve the receipt of equity.

Atomwise and Deep Genomics are two companies that have grown with CDL's support. Atomwise was founded in 2012 by Abraham Heifets, a graduate of the University of Toronto, and uses AI for drug discovery. In the early stages of its founding, the company went around to VCs in Toronto in an attempt to obtain investment but kept getting turned down because they did not understand what was new. Under such circumstances, the company received an 'investment without receiving equity' from CDL in October 2012. Additionally, NEXT Canada invested in pre-seeding, and we received a grant from the Grand Challenge Canada. Furthermore, Silicon Valley Angel and Y Combinators began to show interest, and when the company began to receive investment from California VC Draper Fisher Jurvetson and others in 2015, it moved to California to be closer to its investors.

In contrast, Deep Genomics Inc. still operates in Toronto, Canada. The company combines deep learning and molecular biology. Founder and University of Toronto professor Brendan Frey, a protégé of Professor Hinton's, says he stays in Toronto because 'there are good people here and it's not too hot'.

・The University of Toronto Early-Stage Technology (UTEST)

UTEST is a research and development-based accelerator for new companies operating in

partnership with the Toronto Innovation Acceleration Partners (TIAP) and the University of Toronto Fund. UTEST provides intensive entrepreneurial education, advisory support, financial assistance, and incubator facilities.

③ MaRS Discovery District

MaRS is a non-profit corporation established in Toronto, Ontario, Canada in 2000. Its goal was to commercialise publicly funded medical research and other technologies with the support of the private sector and to serve as a link between entrepreneurs and companies, researchers, investors, human resources, and capitalists.

The MaRS concept was proposed in 2000 by Dr John Evans, former president of the University of Toronto. The original idea began with discussions on how to use the corner of the Toronto General Hospital. Initially, selling it to a condominium developer was suggested, but Dr Evans and MaRS, a civic group, suggested that it should be used as a place for cross-disciplinary collaboration and innovation and decided to use it as a facility for the commercialisation of academic results.

The MaRS District was initiated in 2003 with private funding, and occupancy began in 2005. At the community's insistence, it was to be developed and expanded by Alexandria Real Estate in California, but the collapse of Lehman Brothers forced a temporary halt. However, development was restarted in 2011 and completed in 2016 with the assistance of the Ontario government.

Currently, MaRS focuses on growth industries as tenants, starting with healthcare (healthtech) and expanding to financial (fintech), cleantech, and enterprise (AI). An area of 1.5 million square foot facility is home to major technology companies such as Facebook, Paypal, and AirbnB, as well as VCs, accelerators, and hundreds of startups. VCs in the MaRS will commit $2.4 billion in funding in 2020, resulting in $1.5 billion in revenue and 23,000 jobs.

④ Vector Institute

The Vector Institute is a state-of-the-art AI research facility dedicated to applied research in deep and machine learning, established through a collaboration between the government, private industry, and several Ontario universities, including the University of Toronto. The Vector Institute also provides a forum for researchers in the AI to meet with companies and VCs.

The Vector Institute is housed at MaRS Discovery District and has more than 400 researchers and 800 students with expertise in machine learning, deep learning, and AI projects in collaboration with companies. The institute also provides start-up support to researchers who want to commercialise their research results and offers mentoring services.

More than 30 private companies, including the Canadian federal and Ontario provincial governments, Accenture, Google, Uber Technology, and Shopify contributed $135 million to the Vector Institute's work.

⑤ NEXT Canada (NEXT 36, NEXT AI, NEXT Founder)

Founded in 2010, NEXT Canada is a nonprofit organisation that fosters excellence in building world-class companies and promoting the commercialisation of technology. At the time of its founding, the brain drain to the U.S. was a serious problem for Canada. Business leaders and university faculty members, experiencing a sense of crisis, began a program to identify outstanding human resources and nurture their entrepreneurial spirit to create human resources in Canada.

NEXT Canada is a nonprofit organisation funded by donations, corporations, and the government, with support from for-profit and nonprofit organisations, including RBC, Scotiabank, the Weston Family Foundation, EY, Scale AI, Hatch, BDC, Magna, Osler, Hoskin, and Harcourt, and Air Canada. The company also attracts talented future Canadian students from across the country, provides them with entrepreneurial education, and supports the startups they create once they have started their own businesses.

NEXT Canada also acts as an investor by investing in newly established pre-seed and seed-stage companies. However, NEXT Canada does not expect capital gains. Therefore, when another company acquires a portfolio, it sells shares without claiming voting rights.

To date, NEXT Canada has offered pioneering entrepreneurship development programmes. The scope of services has gradually expanded to include ‘NEXT36’, which brings together 36 promising young people from across Canada each year and trains their talents and entrepreneurial spirit; ‘NEXT AI’, which specializes in developing human resources in the field of AI; and ‘NEXT Founder’, which focuses on entrepreneurs.

NEXT Canada now has more than 1,000 graduates who have been involved in founding more than 500 startups, creating 4,000 jobs, and raising $2 billion in funding (NEXT Canada's website, https://www.nextcanada.com/).

⑥ Mitacs

Mitacs is a non-governmental organisation that works with 65 Canadian universities and more than 6,000 companies to organise 5,000 industry-academia collaborations annually across Canada. Mitacs works to create a seedbed for innovation by identifying and supporting young researchers at an early stage, both domestically and internationally, and involving them in joint industry-academia research. The organisation is funded by the federal government, 10 state governments, and more than 60 universities and has an annual budget of more than 9 billion yen. The NPO has an annual budget of more than JPY 9 billion per year.

3.3 EE in Waterloo

(1) Historical Characteristics

The region is approximately 100 km southwest of Toronto and is home to 360,000 people in the Waterloo (113,500 people)=Kitchener Region (242,400 people).

Waterloo was founded as an agricultural community by German immigrants. The town has long had a strong tradition of cooperative work among residents, and the culture of cooperation among residents, such as building barns together, is taken for granted.

Major employers in the Waterloo Region include the University of Waterloo and RIM (in present day Blackberry), Christie Digital Systems, Descartes, D2L, OpenText Corporation, Teledyne DALSA, and Sandvine.

RIM, which was founded in 1984 by Mike Lazaridis, a University of Waterloo graduate, and Douglas Fregin, a graduate from another university, and became a major regional player with an IPO in 1998.However, in 2008, the collapse of Lehman Brothers and the advent of smartphones placed RIM in a difficult situation, leaving only 2,200 workers in the Waterloo Region. At that time, some of those laid off went on to start their own businesses or joined startups that had already been established (Speigel, 20218).

T here are many start-ups by graduates of the University of Waterloo, which has a unique program called the Co-op Program and a generous community structure to support them (Howitt, 2019, Spigel & Vinodrai, 2021).

In 2020, Waterloo, despite its small size, ranked fifth in Startup Genome's annual ‘Global Innovation Ecosystem Ranking’, and was further noted as ‘the region with the highest entrepreneurial density’ after Silicon Valley.

(2) Social and physical characteristics

Notable start-up support organisations in Waterloo include (1) Velocity, an incubation affiliated with the University of Waterloo; (2) The Accelerator Centre, a collaboration between industry, academia, and government; and (3) Communitech, founded by the private sector, Catalyst 137, which was established by the private sector.

① University of Waterloo

The University of Waterloo, founded in 1957 during the Cold War, is Canada’s largest science and engineering university. Originally, it was an associate faculty of Waterloo College. Currently, there are 41,000 undergraduate and graduate students. The University of Waterloo is well known in the fields of mathematics, engineering, and computers, and its computer science is ranked first in Canada and 25th in the world. It has reigned as the most innovative university in Canada for 28 years and has been called the ‘MIT’ of Canada.

The University of Waterloo is famous for its Co-op Program. This program is a combination of

university and internship, in which undergraduates repeat internship (four months), university (eight months), and four months (internship) cycles to graduate in five years. With not only academic knowledge, but also rich experience as working professionals, University of Waterloo students have earned a reputation for ‘making $9 for every $1 invested,"invested’, and have a much higher employment rate and salary than graduates from other parts of Canada.

The uniqueness of the University of Waterloo can also be observed in its intellectual property policy, which was designed to support venture start-ups. The policy is clear: ‘Intellectual property belongs to the inventor without any system whereby the university pays for and supports individual researchers to obtain patents, and only recoups any income later’.

Additionally, many graduates from the University of Waterloo have started successful businesses. It is estimated that 18% of the founders of Canadian tech start-ups are graduates of the University of Waterloo. The most famous example is RIM (Blackberry), founded by Mike Lazaridis, a University of Waterloo graduate. After his success, he donated the company to the University of Waterloo, and his initiative led to the establishment of the university's new research centre for quantum computing and nanotechnology.

② Velocity

The Velocity is an incubation facility affiliated with the University of Waterloo. Established in 2008 to support early-stage entrepreneurs looking to scale, Velocity houses 40–60 early stage companies. Velocity also teaches aspiring and established entrepreneurs how to design a business and early-stage entrepreneurs how to scale up. It also has an investment function and invests in 261 companies, 18 of which have successful exit strategies.

③ The Accelerator Centre (AC)

It is Canada's most highly regarded nonprofit accelerator and was founded in May 2006 on the campus of the University of Waterloo. Originally established by the University of Waterloo, federal and provincial governments, the community, and the city, it now works in partnership with universities located in Waterloo (Wilfrid Laurier University, Conestoga College, and the University of Guelph) and economic organisations. AC is now working with universities in Waterloo (Wilfrid Laurier University, Conestoga College, and the University of Guelph) and economic organisations. In particular, partnerships with universities have been a great strength of the AC.

The support is targeted at hardware, IT, and software startups. It provides office space, mentoring services, and investment and has been rated as the world’s fifth-largest private accelerator since 2017. It promotes the development and commercialisation of technology-oriented start-ups. In addition to its accelerator program, it has an investment function that invests $21.6 million; it has invested in 113 companies, resulting in 7 successful exit strategies.

AC plays a central role in Waterloo ecosystems. It provided 20,000 hours of mentoring services, created 5,000 jobs, and generated USD 5 billion.

④ Communitech

Communitech was founded in 1997, when it began as an informal gathering of 12 CEOs, called the Atlas Group. They occasionally meet for the exchange of ideas and networks. The group included OpenText Executive, Tom Jenkins, and RIM (Blackberry) CEO, Jim Balsillie. During this gathering, the participants discussed technologies that increased their sense of belonging to the high-tech community. Communitech is now Canada's leading centre for entrepreneurship and innovation.

Today, Communitech provides seamless support to technology-oriented startups ranging from business startups to scale-up stages. An area of 80,000 square meters of facilities was managed to form an innovation community of more than 1,600 companies, including those in the surrounding area. It hosts seminars, peer-to-peer sessions (P2P), networking events, and conferences where senior entrepreneurs can share their experiences and receive support. It also has an 'innovation lab' for start-ups to collaborate with large companies for innovation. The open-door policy is characterised by a free atmosphere in which entrepreneurs and investors can come and go as they please.

Communitech currently has 1,200 members. The economic impact of the client companies is estimated at $170 billion.

⑤Catalyst 137.

Originally, in 2015, in a warehouse for a tire factory, local manufacturing company owners consulted and bought the warehouse and converted it into a manufacturing incubator, aiming to support IoT companies looking to expand globally. The year 2018 saw the installation of a cafeteria and restaurant. Currently, in addition to startups and scale-ups, the R&D departments of large companies, such as TOYOTA NNOVATION and ADVANCED TECHNOLOGY, are housed in Catalist137, making it a place for them to collaborate.

4. Comparative study of AI startups in Hongo and WT

4.1. Meaning of comparing Hongo and WT

This chapter compares AI startups in the WT region and Hongo, Tokyo.

The primary goal of this study was to pursue an ideal AI ecosystem in Hongo, Tokyo.There are several reasons for using the WT ecosystem as a reference point.

There are similarities between the two regions. First, the University of Toronto, the University of Waterloo, and the University of Tokyo are located in the region, and these universities are leaders in AI research. Second, the University of Toronto is home to top researchers in AI, including Professor Jeffrey Hinton, from whom many researchers and start-ups have emerged. On the other hand, Hongo is home to Professor Yutaka Matsuo, a leader in AI research in Japan, and many startups have been born in Matsuo's laboratory and are concentrated in the Hongo area. Third, downtown Toronto and Hongo are similar in size and space.

Although there are significant differences in the degree of racial diversity, internationality, and the number and growth stage of AI startups, relativising the current picture using the WT as a reference point may be useful in considering the direction of Hongo's future growth.

4.2. Research methods

A survey of AI startups in the Hongo and Tokyo areas, and the WT was conducted using the following methodology:

(1) Survey of Hongo, Tokyo

- Survey period February – October 2019
- Survey Subjects and Methods
  Web searches **216 firms**, **54** structured face-to-face interviews (in the AI industry only).
- Results （publication）
  - Toru Yoshioka (Kobayashi), Hiroki Maruyama, Yuri Hirai, Toshiya Watanabe, '"Hongo Valley": Why was "Hongo Valley" born? Reasons for the concentration of university-launched ventures' (2020). *Hitotsubashi Business Review*, Spring, pp. 46-60

(2) WT survey

- Phase I: 2 September to 9 October 2022; Phase II: 2 November to 30, 2022.
- Survey Subjects and Methods
  Site visit interviews,

Web search **320 companies**, online survey (Google Form) **48** respondents

Several points should be noted regarding the results of this comparative survey. The first is the difference in survey timing. The Hongo survey was conducted from February to October 2019, before the spread of the COVID-19 infection. The WT survey was conducted from September to November 2022, when the H1N1 coronavirus outbreak began to subside. Differences in the timing of the surveys are likely to have affected the results. In particular, it should be noted that the Hongo ecosystem has changed from the time of the survey to today. The second is the difference in survey methodology. The Hongo survey was a structured face-to-face interview, whereas the WT survey was an online questionnaire. The difference in survey methods may have affected the content of the responses. Finally, some options in the questions were not the same. The choices changed depending on the time of the survey and the context of the surveyed population. As much as possible, comparisons were made to the extent that they could be deemed comparable. These findings should be interpreted with this in mind.

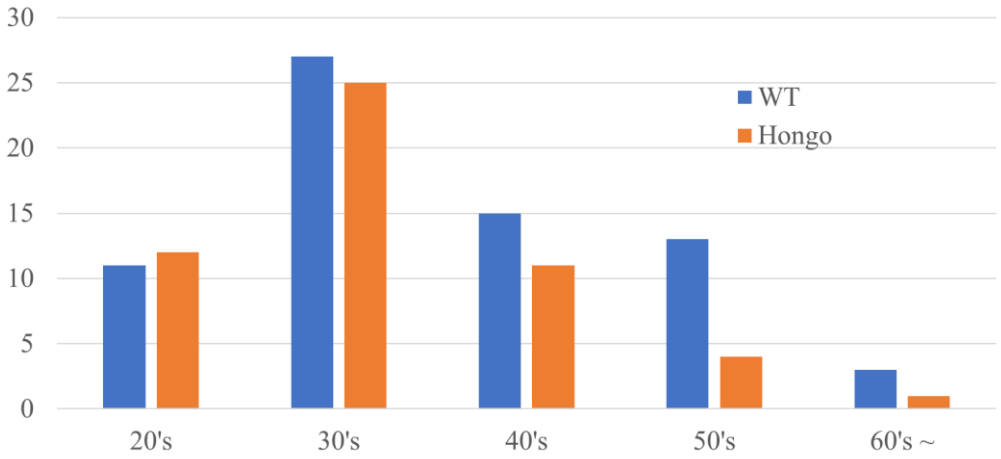
4.3. Aggregate results

(1) Facts about the founder

①Age of founder

Let us now examine the founders' ages. In both regions, most founders were in their early 30s. However, WT had more founders in their 40s and 50s than Hongo (Figure 24).

Figure 24 Age of founders



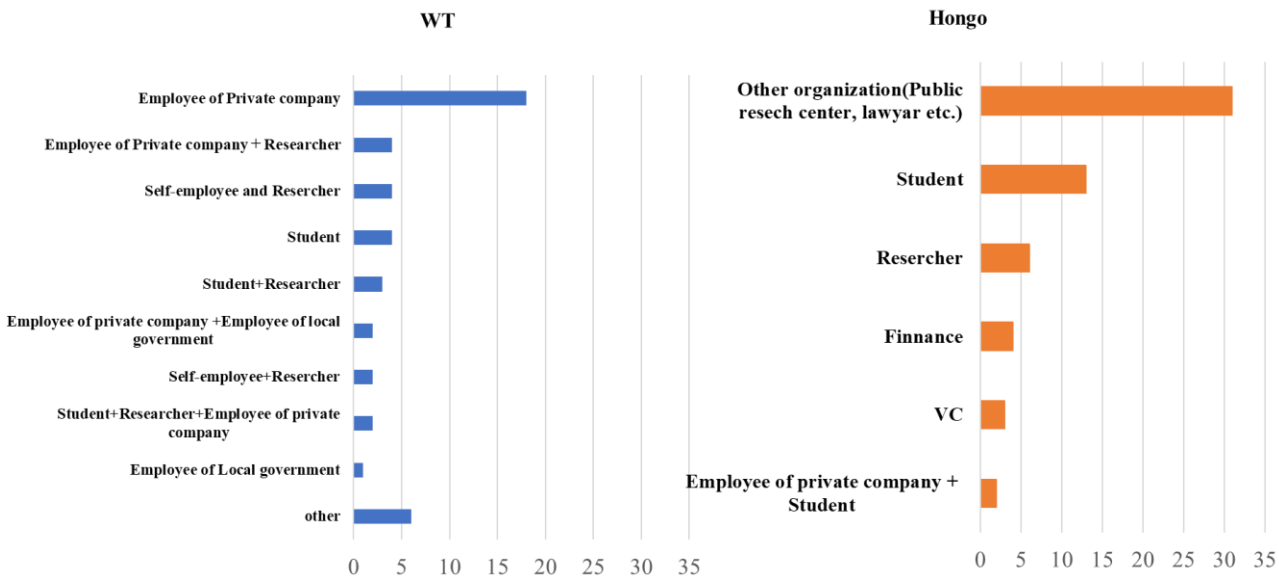
②Founder's previous jobs

While it is common for many founders to work in the private sector when asked about their previous

jobs, WT.

Many of the respondents in Hongo indicated multiple previous jobs, especially those with multi-line careers, such as working in the private sector while being a student and researcher or being self-employed. In Hongo, on the other hand, respondents had single-line careers with no multiple jobs at any point in time (Figure 25).

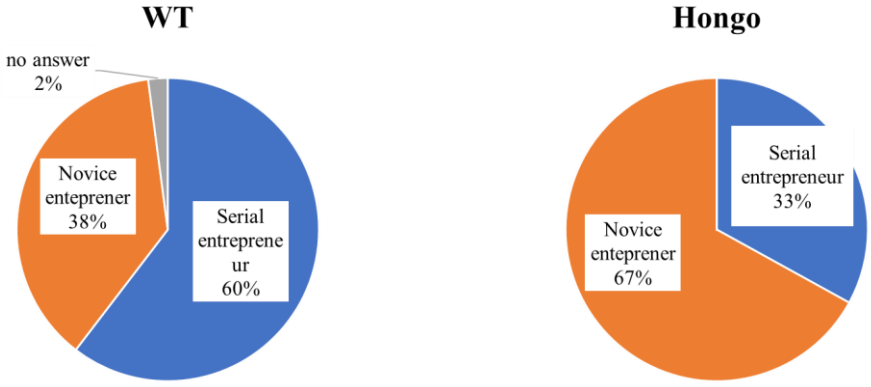
Figure 25 Founder's previous jobs



③Founder's Experience in starting businesses

Regarding whether the founders had experience in entrepreneurship, 60% of the founders in WT had entrepreneurial experience, while only 30% of the founders in Hongo had entrepreneurial experience. WT had a higher percentage of serial entrepreneurs (Figure 26).

Figure 26 Founder's experience in starting businesses

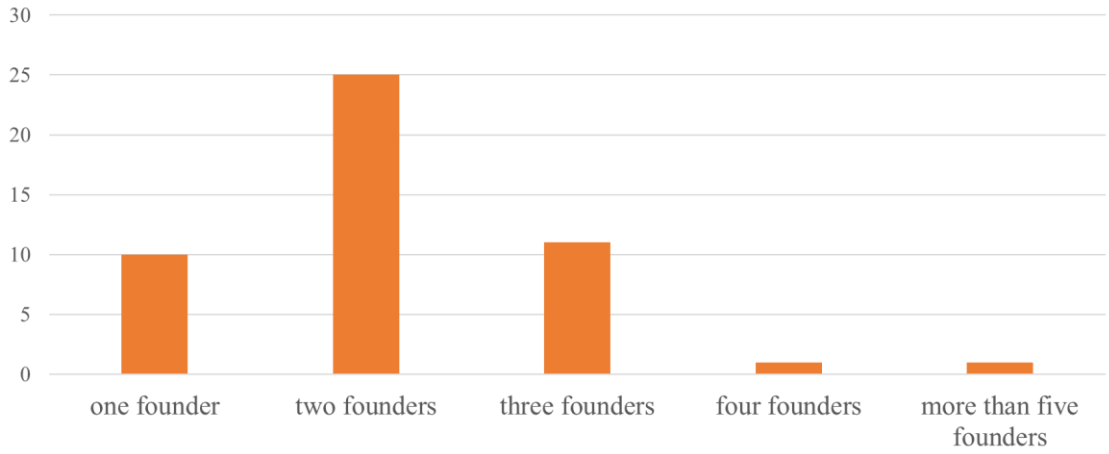


④About the Entrepreneurial Team (WT only)

・Entrepreneurial Members

Let us look at the entrepreneurial team (this item represents data only for the WT). First, in terms of the number of entrepreneurial team members, the largest number of startups started with two members, followed by three and one (Figure 27).

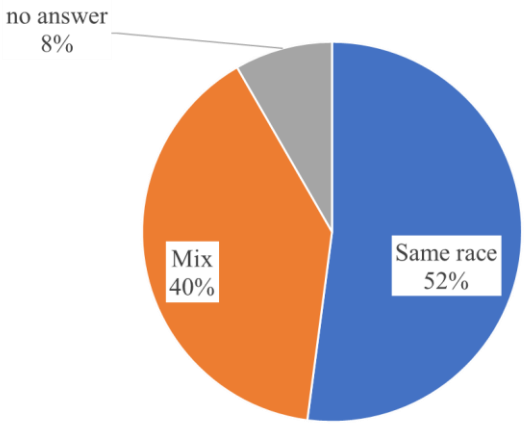
Figure 27 Number of founding members at startup



・Racial Composition

Regarding the combination of multiple entrepreneurial ventures, we first examined the racial composition. We see that 40% of the co-founded firms were founded in partnership with someone of a different race (Figure 28), which may reflect the fact that WT is a highly diverse society with a large percentage of immigrants. On the other hand, more than half of the firms in the pre-seed stage were founded with a mix of people, but the percentage of firms of the same race increased as the stage increased.

Figure 28 Racial composition of entrepreneurial members (WT)



・**Education of the founder and the team**

Forty per cent of the founders had a doctorate and 23% had a master's degree. Half of the founders have a master's degree or higher (Figure 29). This is likely due to the specialised nature of AI.

Looking at the combination of educational backgrounds within the founding teams, only 6% of the firms had PhD holders, indicating that they were often combined with other degrees (Figure 30). Doctor degrees are in science and technology, while the others are in business (MBA), arts, and other liberal arts fields.

Figure 29 Educational background of founders

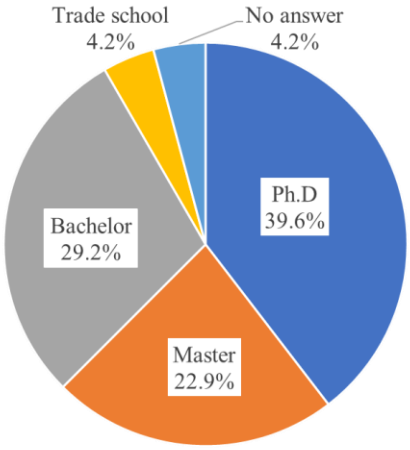
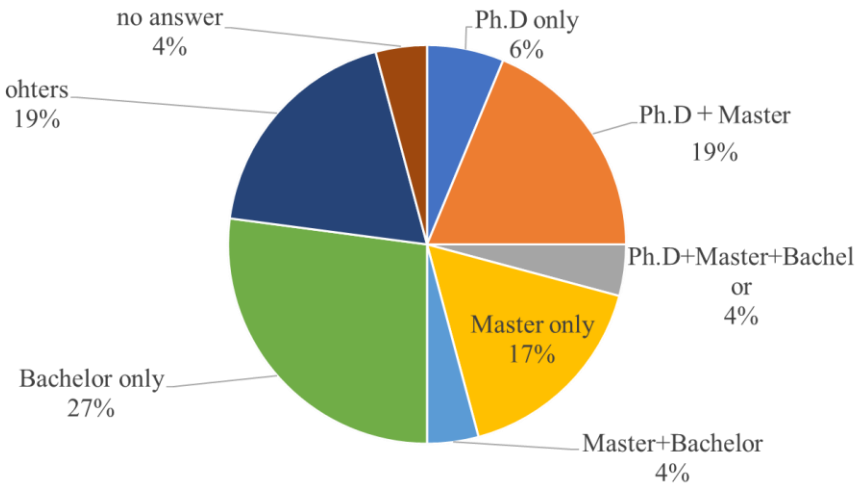


Figure 30 Combination of founders' educational backgrounds



(2) Place of establishment

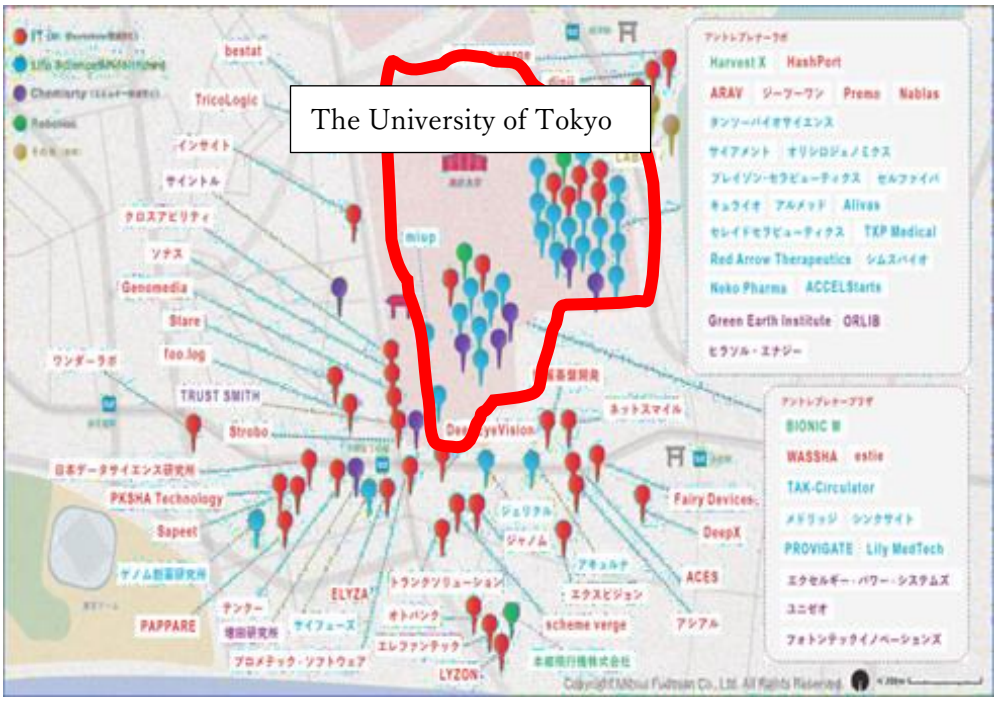
In terms of startup locations, Toronto's startups are clustered in the city centre and not on university campuses. The locations were also mixed regardless of the stage (Figure 31). In the Hongo area, many

startups are located at the University of Tokyo campus, and some are located near the University of Tokyo (Figure 32).

The University of Tokyo has an incubation facility, the ‘Entrepreneur Plaza’, on the Hongo Campus in 2007, with 30 private rooms of approximately 58m². Only ‘corporations in which directors, faculty members, staff, or students of the University of Tokyo (Todai) are involved’ are eligible to move into this plaza. The period of use is ‘either one, two, or three years, taking into consideration the business situation and the purpose of use of the facility’, with no exceptions, and cannot be used for a total of 10 years or more.

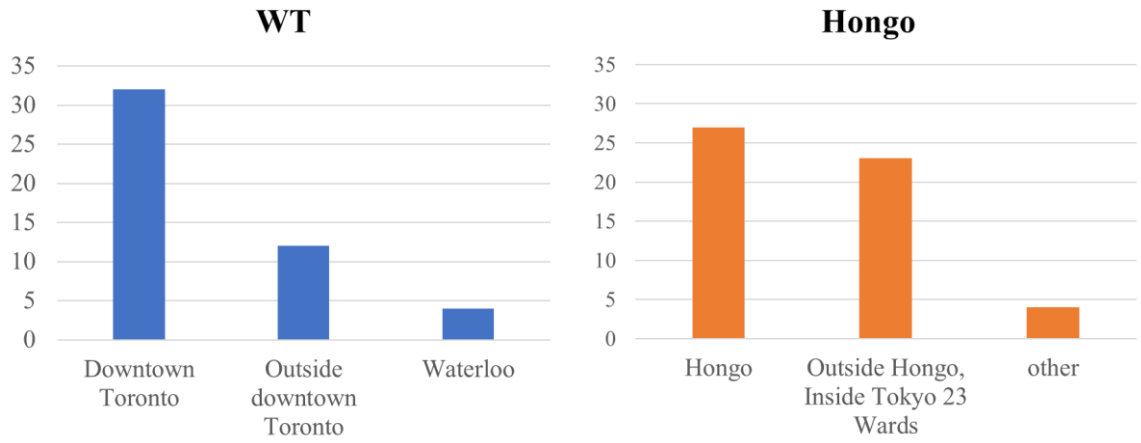
Figure 31 Startup locations around the University of Toronto

Figure 32 Startup locations in Hongo



Looking at startup locations, Toronto is concentrated in the city centre. Hongo, on the other hand, has the largest number of start-ups, but many are in the 23 wards outside Hongo (Figure 33).

Figure 33 Areas of establishment



A comparison of the incubator tenants is presented. Overall, the WT has a diverse range of incubators, with companies occupying them. Many of the respondents in the Hongo survey had experience at University of Tokyo-related incubators (Entrepreneur Plaza), with 34 of the 54 firms having moved in (Table 2). On the other hand, entrepreneurs in Hongo said that once they leave Entrepreneur Plaza, there are few other incubation facilities in the Hongo area, and entrepreneurs who

have left the incubation centre have no choice but to leave Hongo to operate in other parts of Tokyo.

However, the situation is gradually changing: in 2018, a Softbank-funded AI-focused incubation facility called 'KERNEL HONGO' was established in Hongo, and in 2021, the president of the University of Tokyo announced 'Hongo Intelligence Hill (tentative name)', which will create a cluster of startups and investors in the Hongo area (Nikkei, 1 October 2021). he momentum to 'change Hongo' is gradually growing.

Table 2 Number of companies using incubator

WT

Name of incubator	Number of the companies in the incubator
DMZ	5
MaRS discover district	2
Next36	1
Centre for Peace Advancement	1
Velocity	1
The Accelerator Centre in Waterloo	1
total	11

Hongo

Type of incubator	Number of the companies in the incubator (past number)
Incubation affiliated with Tokyo University	14(20)
Incubation not affiliated with Tokyo University	9(4)
total	23(24)

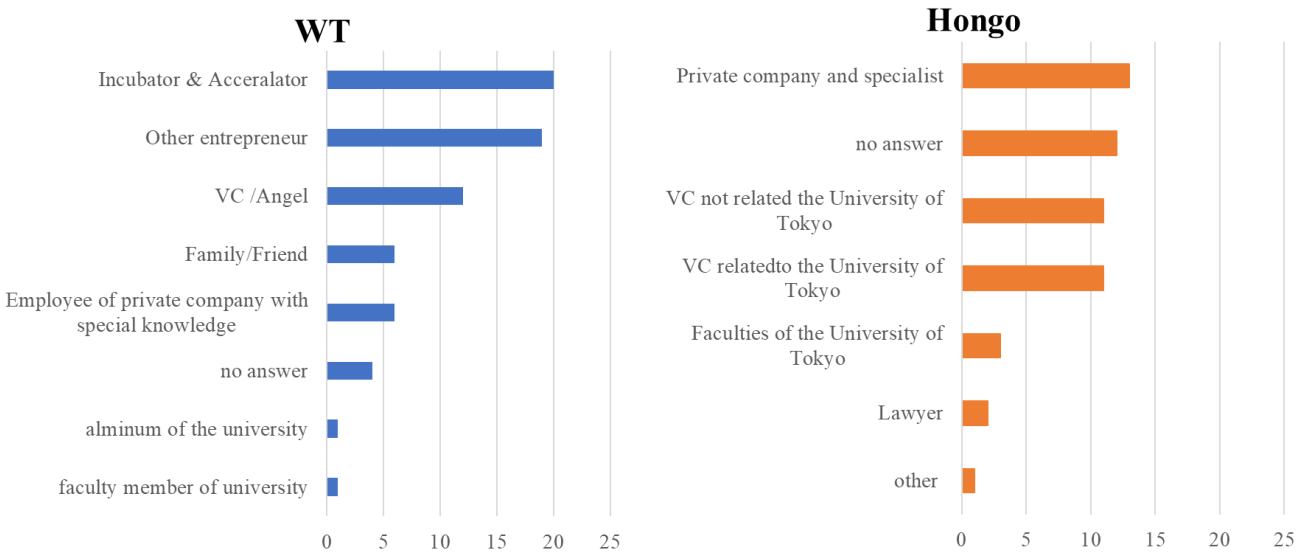
(3) By type of consultation by founders, and with whom they consulted

Entrepreneurs are solitary, and the extent to which they can consult with peers and senior entrepreneurs is an important factor in their choice of place of operation. In the survey, entrepreneurs in each region were asked about what and with whom they consulted. As mentioned above, this is not a completely accurate comparison, as there are differences in the options in both the WT and Hongo surveys; however, we will attempt to compare them as accurately as possible. Incidentally, no response to the question 'Please name a consultant' (i.e. no consultant was listed as an option or in the 'other' category) was considered to mean that there was no one to consult.

①Consultant about management

Regarding management, it is clear that in WT, there are consultants, such as incubators, accelerators, and other entrepreneurs. On the other hand, in Hongo, private companies/professionals were the most common, followed by non-response (Figure 34).

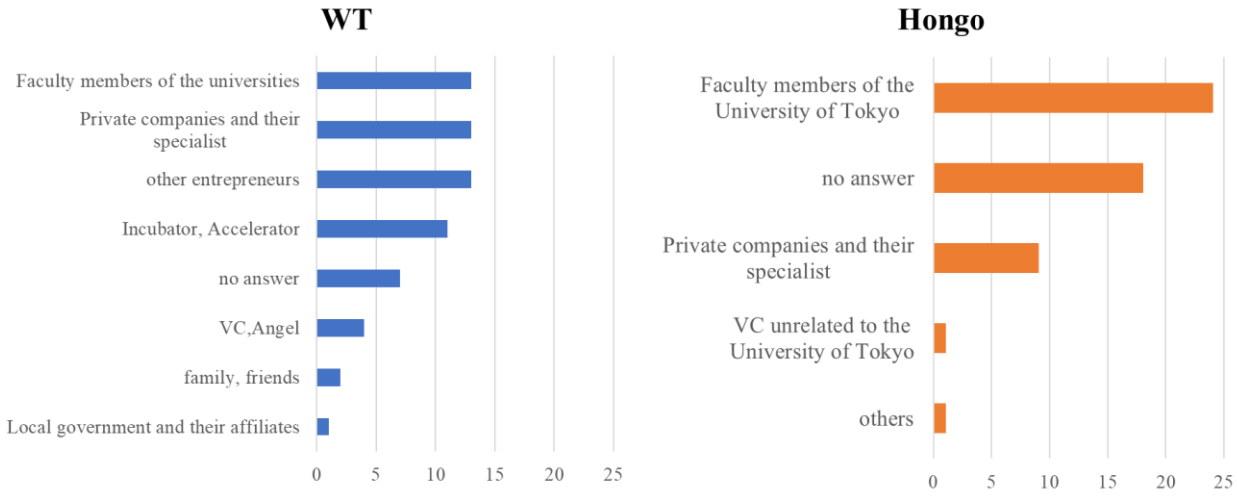
Figure 34 Consultations about management (number of cases, multiple responses allowed)



②Consultant about technology

University faculty were members most frequently consulted for technology in both regions. Consultations with private companies were common in both regions. However, Hongo had the second highest number of ‘no response’, followed by ‘university faculty member’, and the small number of ‘other entreprenuers’ responses, suggesting that there are no other places to consult other than university faculty. WT shows that other entrepreneurs and incubators/accelerators are also consulted on technology (Figure 35).

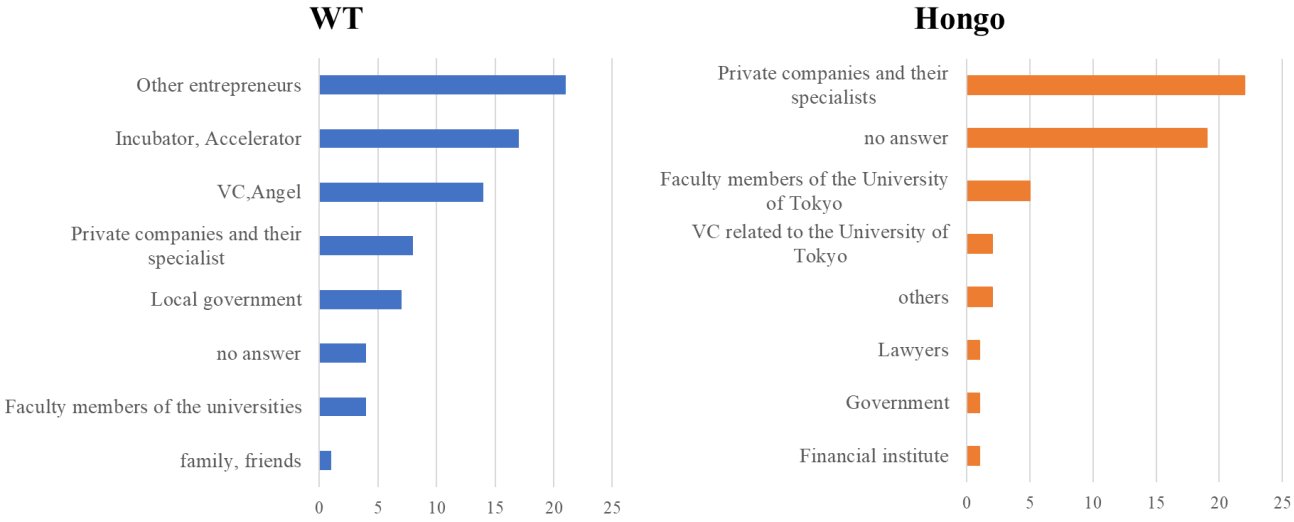
Figure 35 Sources of consultation about technology (number of cases, multiple responses allowed)



③Consultant about market

For consultation about the market, start-ups in WT consulted with other entrepreneurs, incubators/accelerators, and VC/angels, etc., were mentioned as consultants.However, in Hongo, private companies/professionals were the most frequent consultants, followed by 'no response' (Figure 36). The fact that incubators/accelerators and VCs/angels can also respond to such points in the WT is a major difference, although it may be that consultation on the market tends to be limited to specialists because of the commercialisation of the specialised field of AI.

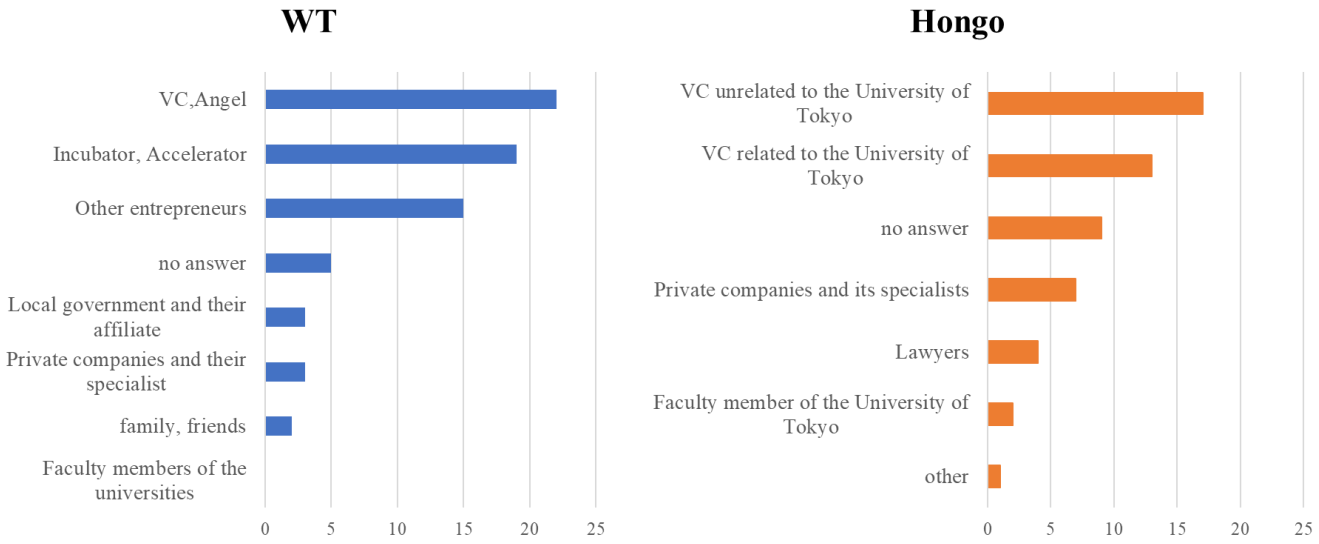
Figure 36 Where to consult about market (number of cases, multiple responses allowed)



④Consultant about fundraising

In the WT, incubators/accelerators are second only to VCs/angels, which may reflect the fact that even incubators/accelerators have their own investment or referral functions for investment. As for Hongo, 'no response' came next to VC, suggesting that the sources of consultation regarding financing are also limited (Figure 37).

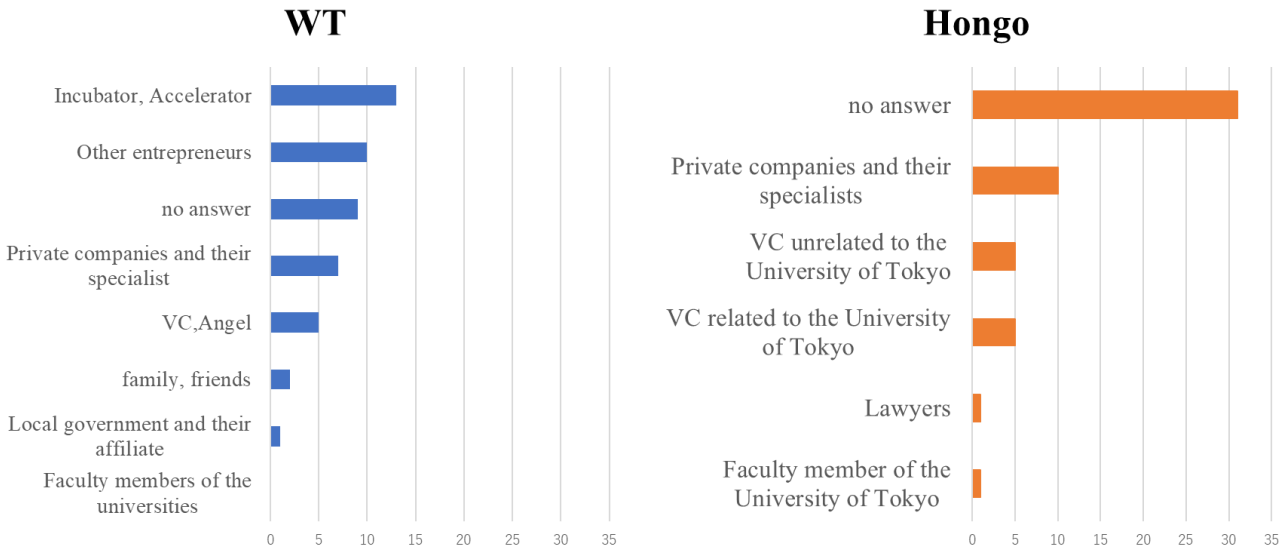
Figure 37 Sources of advice on financing (number of cases, multiple responses allowed)



⑤Consultant about human resources

In terms of human resources, WT consulted incubators/accelerators and other entrepreneurs most frequently. On the other hand, Hongo has the highest number of 'no response', indicating that there is no place to consult (Figure 38). For this reason, it is difficult to discern whether startups in Hongo do not need to consult about human resources or if they need help, there is no one to consult. If they have problems, they rely on private or VC firms.

Figure 38 Where to consult about human resources (number of cases, multiple responses allowed)



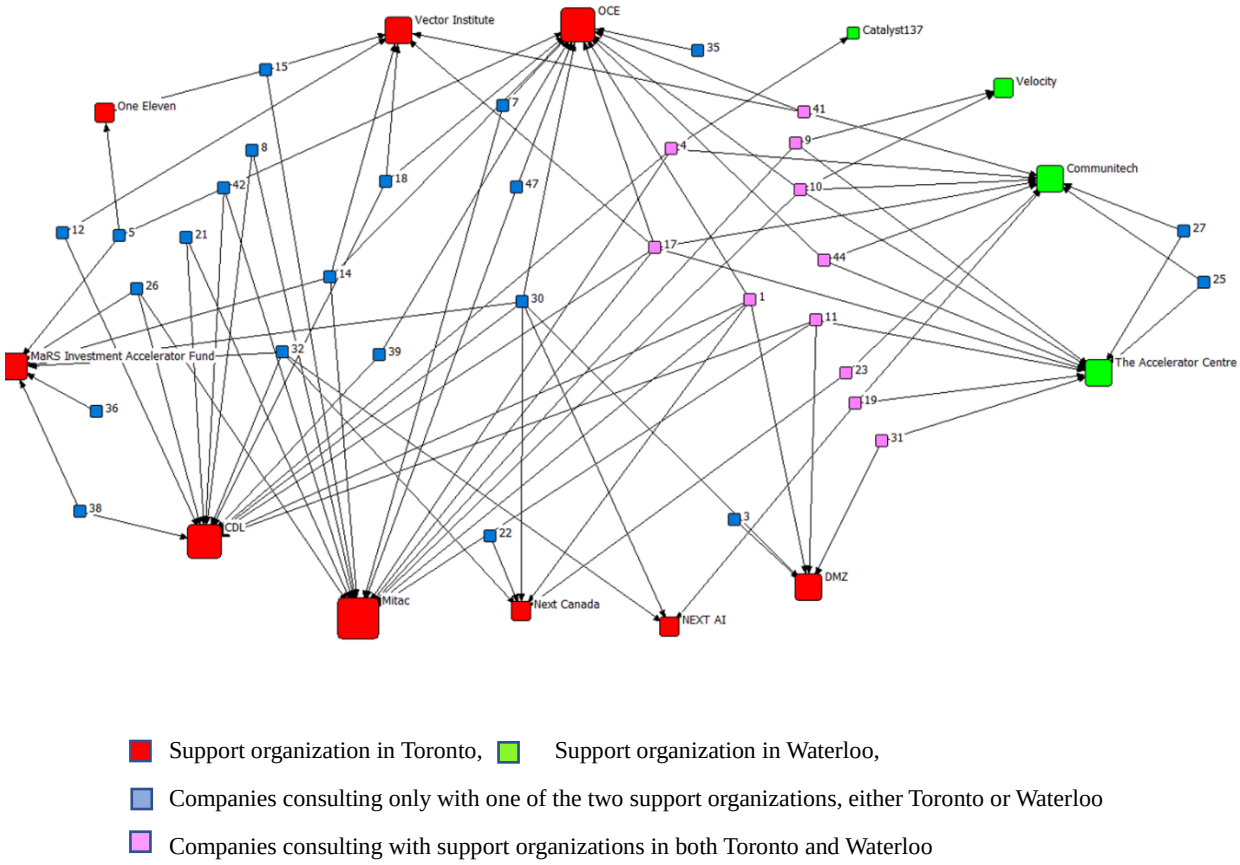
(4) Network of support organizations and supporters

To see how they work with support organisations, the founders were asked to give specific names to organisations (WT) and individuals and organisations (Hongo) with which they had consulted or used services.

In WT, the number of firms that 'did not consult anywhere' was 16 out of 48, indicating that one-third of firms did not use the service. The reasons for this are assumed to be as follows: (1) six companies are located in the suburbs of Toronto, making it difficult for them to receive various services located in downtown Toronto and (2) they did not want to answer who they consulted (non-response) (Figure 39).

However, the remaining two-thirds of the firms that had received services utilised multiple support organisation services (Figure 39, blue/pink squares). Several firms utilised support organisations located as far apart as Toronto and Waterloo (pink squares in Figure 39).

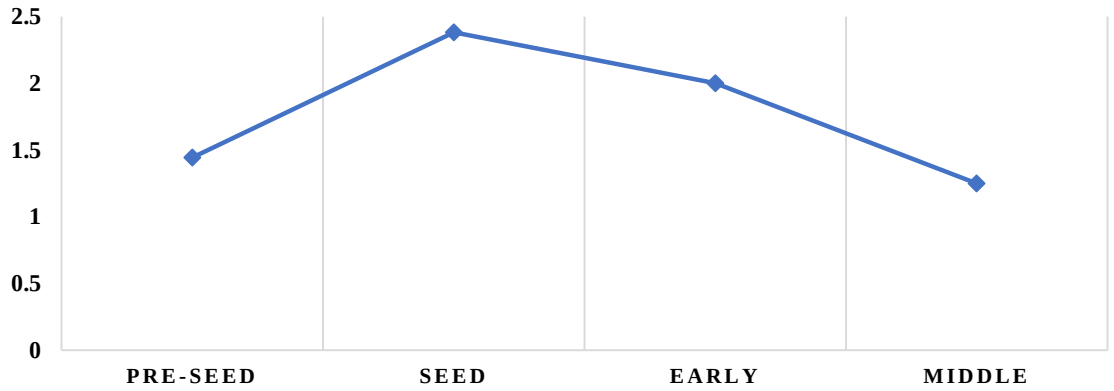
Figure 39 Consultation network in WT



Looking at the characteristics of the companies at each investment stage, the most consulted companies were in the seed stage, followed by those in the early, pre-seed, and middle stages (Figure 40). In the pre-seed stage, companies are less likely to seek advice because it is still difficult to see the

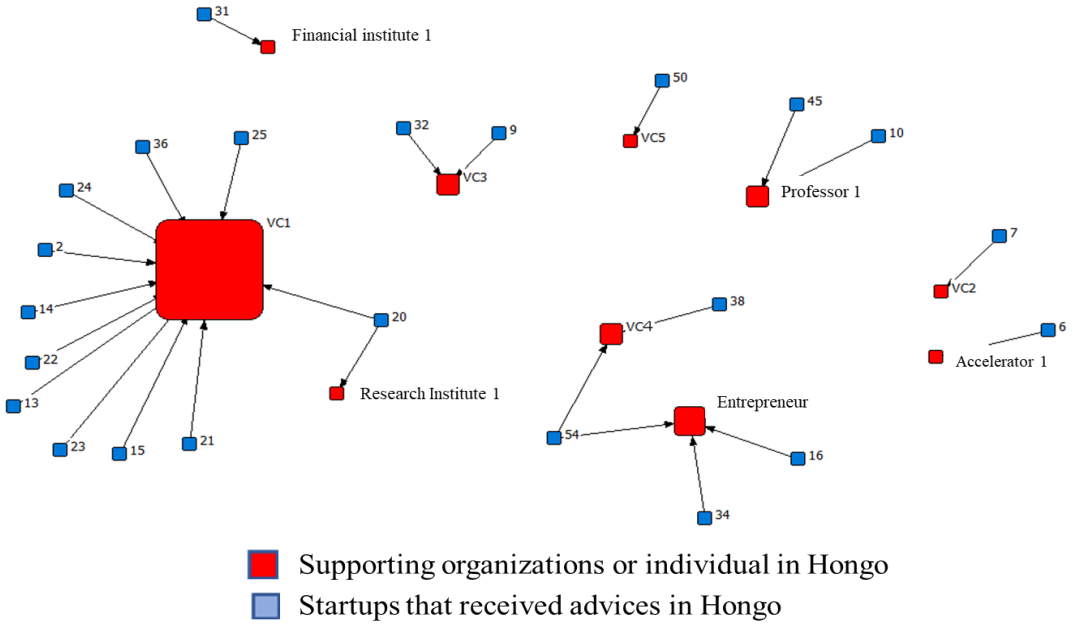
nature of their business and they are not familiar with local support organisations. In the early and middle phases, the number of consulting firms is likely to decrease as the support needed for the company's business gradually becomes narrowly focused.

Figure 40 Average number of consultations by stage (WT)



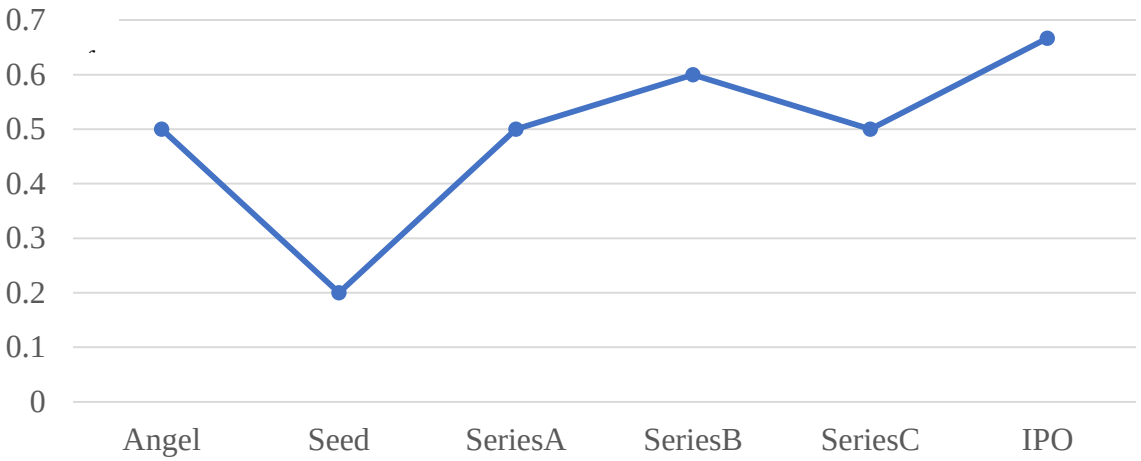
On the other hand, only one Hongo startup responded that it had ‘no consultants at all’, and almost all of them consulted someone on some topic. However, when looking at the consulting parties, there is a concentration in one organisation, but no other notable concentration (Figure 41). Additionally, many consultants were anonymous; therefore, we could not confirm any overlap in the number of consultants. However, if we ignore this and draw a network diagram, we can say that Hongo's consultation network is fragmented.

Figure 41 Consultation Networks in Hongo



Next, looking at the average number of clients by investment stage, the number of consultations in Hongo was generally lower than that in WT. In particular, the number of consulting firms in the seed stage was the smallest, and the number of consulting firms increased as the investment stage progressed from Series A, Series B, and Series C to IPO (Figure 42). This result contrasts with the WT, where the number of consulting parties is greater at the seed stage, whereas in Hongo, the number of consulting parties increases as more investments are made. In other words, it can be read that in Hongo, startups do not seek advice until they reach that stage and struggle on their own, and the startups that get through that stage are able to obtain a large number of consulting contacts. This could be due to a variety of reasons, such as start-ups not consulting, consultants only approaching startups that have shown success, or the two parties not being well matched.

Figure 42 Average number of consultations by stage (Hongo)



*1. angles (approximately 10 million yen) and 2. Seed (10~tens of millions of yen), 3. Series A (tens to hundreds of millions of yen); 4. Series B (several billion yen), and 5. Series C and beyond (more than several billion yen); and 6. IPO

4.4. Analysis

The results of the above two surveys revealed the following points.

- In both regions, most founders were in their 30s, but entrepreneurs in their 40s and 50s were also active in WT.
- In terms of the founder group, WT entrepreneurs were more diverse than Hongo entrepreneurs in terms of experience, education, and race.
- There are more support organisations in WT than in Hongo. Support organisations in WT are open. Some WT startups use more than one support organisation, where startup connections have also been established.

- In Hongo, there is a large number of support organisations related to the University of Tokyo in terms of incubation and entrepreneurial support. Conversely, there are few support organisations outside the University of Tokyo in Hongo.
- When it comes to consulting sites, there are more consulting sites in WT than in Hongo.
- In WT, many startups do not consult anyone, butthose that do consult are active and consult multiple persons.
- Startups in the seed stage actively utilise consultants. Additionally, several startups use support organisations in Toronto and Waterloo, despite the 100 km distance between the two cities.
- Most start-ups consulted someone in Hongo, but a significant number stated that they did not have anyone to consult (no response), depending on the theme. There were significantly more non-responders to human resource consultations. Even when there was a consulting firm, many startups answered anonymously; therefore, we could not confirm any overlap in the number of consulting firms. If there was no overlap, the entire network was considered fragmented. The number of consulting firms at the seed stage was the smallest, and the number of consulting firms increased as the stage progressed.

4.5 Considerations

The AI start-up ecosystem in the WT and both regions showed a certain degree of growth. However, compared with Hongo, the WT cluster was more mature in terms of network size and quality.

The WT is home to many support organisations, and startups looking to grow utilise several of them from the seed stage to form a network, although not all of them are in the WT. Some startups use multiple support organisations in Toronto and Waterloo. It is assumed that startups accumulate knowledge using these support organisations.

On the other hand, Hongo’s ecosystem has developed in a manner dependent on the University of Tokyo. In terms of support organisations, one organisation seemed to be the most prominent in receiving consultations from entrepreneurs, but there were no other support organisations or people that many start-ups considered a source of consultation. Overall, the consultation network appeared to be fragmented. Additionally, there are few consultation services available for startups in the seed stage. It is unclear from the data whether this is because startups cannot find a consulting firm, consulting firms are not interested in seed-stage startups, or the matching process is not going well. While there is some debate as to whether seed-stage consultations are effective, for Hongo's ecosystem to advance to the next stage, it may be necessary to have more support organisations that seed-stage startups can consult.

5. Conclusion

There is no doubt that AI will become the foundation of various industries in the future. The key to success in the AI field is the number of human resources that can be gathered. However, there are only a limited number of regions in which human resources can be gathered to form an ecosystem. Furthermore, these regions are becoming connected through people, goods, money, and information, and it is difficult to compete globally without being part of this flow. Considering this, it is no exaggeration to say that the revitalisation of AI startups in Hongo, home to the University of Tokyo, which is leading Japan's AI field, will determine the fate of Japan's AI industry and, by extension, the Japanese industry.

This paper discusses the direction Hongo should take in the future through a comparison with the WT. There are several limitations to this study, and there are still points to be explored in depth regarding the WT ecosystem, especially the role of the government and local authorities, collaboration among supporting organisations, and the funding environment, which should be further discussed. The possibility of sample bias in the questionnaire survey cannot be ruled out.

Despite these limitations, this is the first study to compare the WT and Hongo, and we believe that we have been able to offer policy suggestions. This study can provide a foundation for the next steps in Hongo.

Acknowledgements

This research was supported by Mitsui Fudosan Todai Labs, the University of Tokyo's Future Vision Research Center, the Embassy of Canada in Japan, and the Japan External Trade Organization (JETRO). We would also like to thank Mr. Satoshi Yamaguchi (President and Chief Consultant, Knowgic Technology) and Mr. Gillian Hatton (Managing Consultant and Founder, Location Strategies Limited) for their assistance with this study. founder) for their assistance. We express our gratitude for them. The authors are responsible for the content of this article.

【References】

Magazine＆Book

Chakravorti, B., A Bhalla, R. S. Chaturvedi, and C. Filipovic. (2021). 50 Global Hubs for Top AI Talent. *Harvard Business Review* Online. (21 December. 2021). https://hbr.org/2021/12/50-global-hubs-for-top-ai-talent

Howitt, C. (2019). *BlackBerry Town: How high tech success has played out for Canada's Kitchener-Waterloo*. James Lorimer & Company.

Nishihara, J. (2009). Toronto's Development into a Cosmopolitan City and Its Urban Planning. *Urban*

Geography, 4, 88-98.

Spigel, B. (2017). The relational organization of entrepreneurial ecosystems. *Entrepreneur Theory and Practice*, (1), 49-72.

Spigel, B., & Vinodrai, T. (2021). Meeting its Waterloo? Recycling in entrepreneurial ecosystems after anchor firm collapse. *Entrepreneurship & Regional Development*, *33*(7-8), 599-620.

Electronic Sources

Crunchbase.
（https://www.crunchbase.com/） Retrieved March 12, 2023

NEXT Canada
(https://www.nextcanada.com/) Retrieved December 12, 2022

Nihon Keizai Shimbun (January 16, 2023)
(https://www.nikkei.com/article/DGXZQOUC216720R21C22A2000000/) Retrieved November 7, 2022

MacroPolo
（https://macropolo.org/digital-projects/the-global-ai-talent-tracker/https://macropolo.org/digital-projects/the-global-ai-talent-tracker/international-collaboration/） Retrieved March 10, 2023

Stanford University, Human-Cantered-Artificial Intelligent (2022). Artificial Intelligence Index Report.
（https://aiindex.stanford.edu/wp-content/uploads/2022/03/2022-AI-Index-Report_Master.pdf) Retrieved January 21, 2023

Statistics Canada (2016)
（https://www.statcan.gc.ca/en/start） Retrieved March 3, 2023

Statistics Canada (2016)
(https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/index-eng.cfm) Retrieved March 3, 2023

StartusInsights, Global Startup Heatmap Artificial Intelligence
（https://www.startus-insights.com/innovators-guide/ai-trends/） Retrieved February 10, 2023

Startup Toronto
(https://startupheretoronto.com/) Retrieved February 8, 2023

Tractica (2016) .Artificial Intelligence Market Forecasts：191 Consumer, Enterprise, and Government Use Cases for Machine Learning, Deep Learning, Natural Language Processing, Computer Vision, Machine Reasoning, and Strong AI Across 27 Industry Sectors(August, 24, 2016)
（https://www.dri.co.jp/auto/report/tractica/tracaimf.html#top） Retrieved February 8, 2023

University of Toronto, Entrepreneurship

(https://entrepreneurs.utoronto.ca/for-entrepreneurs/u-of-t-accelerators/) Retrieved March 1, 2023

Waterloo EDC (https://www.waterlooedc.ca/blog/what-is-toronto-waterloo-corridor)

(https://thoughtleadership.rbc.com/ai-for-good-battling-bias-before-it-becomes-irreversible/) Retrieved November 12, 2022