Addressing Income Inequality caused by Tech Disruption

Louis Obukohwo

Catalyst Fellow • Institute For Community Prosperity • Mount Royal University • lobuk496@mtroyal.ca

Methodology

Secondary Research:
My research is based on information collected through secondary research. I collected qualitative and quantitative data from academic journals, government websites, online articles, and books. I also utilized the Mount Royal University's library to gain access to relevant scholarly research articles. Practicing deep listening helps me effectively connect different interrelated concepts surrounding disruption caused by technology.

Analysis:
I analyzed conceptual nodes of my system through the use of diagrammatic models such as Systems Mapping, Concept Mapping and simple mental mapping to assist in elaborately exploring the connections between various concepts connected to my research. I also analysed my systematic problem by applying deep listening during community-related conversations to help connect different interrelated concepts surrounding disruption caused by technology.

Recommendation

Calgary can embrace technological disruption by encouraging digital collaboration and innovations through initiatives such as coworking space developments, accelerators and incubators developments, innovational government programs, government funding for technology startups, venture capital and angel investment acquirements, and crowdfunding initiatives (Startup, 2020)

Support Recognition

Community Partners - Calgary Economic Development
Hubba Khatoon
Jason Ribeiro
Court Ellingson

Faculty Mentor - Mount Royal University
Catherine Pearl

Fellowship Coordinators - Institute For Community Prosperity
Barb Davies
James Stauch

ADDRESSING INCOME INEQUALITY CAUSED BY TECH DISRUPTION

Catalyst Journey by Louis Obukohwo

HOW IS TECH AFFECTING INCOME INEQUALITY

Up to 800 million jobs could be replaced by automation in the next decade (Vincent, 2017). These job losses are a short-term effect of tech disruption. (Deto, 2017).

SMART CITIES

There is hope. Many mid-sized OECD cities likes Calgary are becoming Smart Cities to help attract and retain tech talent while creating jobs by fostering tech companies & tech-related initiatives (Rojas, 2018).

CO-WORKING & ECOSYSTEMS

Cities like Calgary are developing vibrant ecosystems comprised of co-working spaces, incubators, accelerators and venture funding to help support innovative ideas and startups (Startup, 2019). Cities like Calgary are looking to globally collaborate for more access to innovation (Gouvernement, n.d.).

INNOVATIVE-RESILIENT PEOPLE

Innovative ideas and initiatives from governments, academic institutions, and entrepreneurs can help build the changes that will help bridge income inequality and create more economic stability (Innovating Canada, 2020).

"SMARTS, FUNDING, AND INNOVATION"
BY LOUIS OBUKOHWO

References

Bristol City Council. (2019). Connecting bristol. Retrieved from https://www.connectingbristol.org/wp-content/uploads/2019/09/Connecting_Bristol_300819_WEB.pdf

Deto, R. (2017). Is pittsburgh's economy growing for everyone? Retrieved from https://www.pghcitypaper.com/Blogh/archives/2017/05/11/is-pittsburghs-economy-growing-for-everyone

Gouvernement. (n.d.). La french tech. Retrieved from https://www.gouvernement.fr/en/la-french-tech

Innovating Canada. (2020). Calgary: canada's most adventurous tech city. Retrieved from https://www.innovatingcanada.ca/business-and-economy/calgary-canadas-most-adventurous-tech-city/

Rojas, A. (2018). How to land a tech job in berlin. Retrieved from https://medium.com/ironhack/how-to-land-a-tech- job-in-berlin-bb391a96a2c0

Startup Commons. (2020). What is startup ecosystem. Retrieved from https://www.startupcommons.org/what-is-startup-ecosystem.html

Startup Calgary. (2019). Calgary's coworking spaces, incubators and accelerators. Retrieved from https://www.startupcalgary.ca/startup-calgary-resources/2017/12/11/calgarys-coworking-spaces-incubators-and-accelerators

Louis Obukohwo

Creative Work for Catalyst Fellowship

The Journey

I started this fellowship journey trying to wrap my head around income inequality. I decided to make some contemporary paintings around the things I saw on my walks home from MRU. All these paintings are inspired from events that took place in Lower Mount Royal (Calgary, Alberta) in between October, 2019 to April 2020.

The Collection

'Dumpster in alley way'
Acrylic on canvas

This was the first painting I made in Fall 2019. I noticed that many lower class people would dig through the dumpsters in the alleyways behind my apartment for their daily treasures. 'These are the antiheroes of a classist and capitalist modern world', I thought to myself.
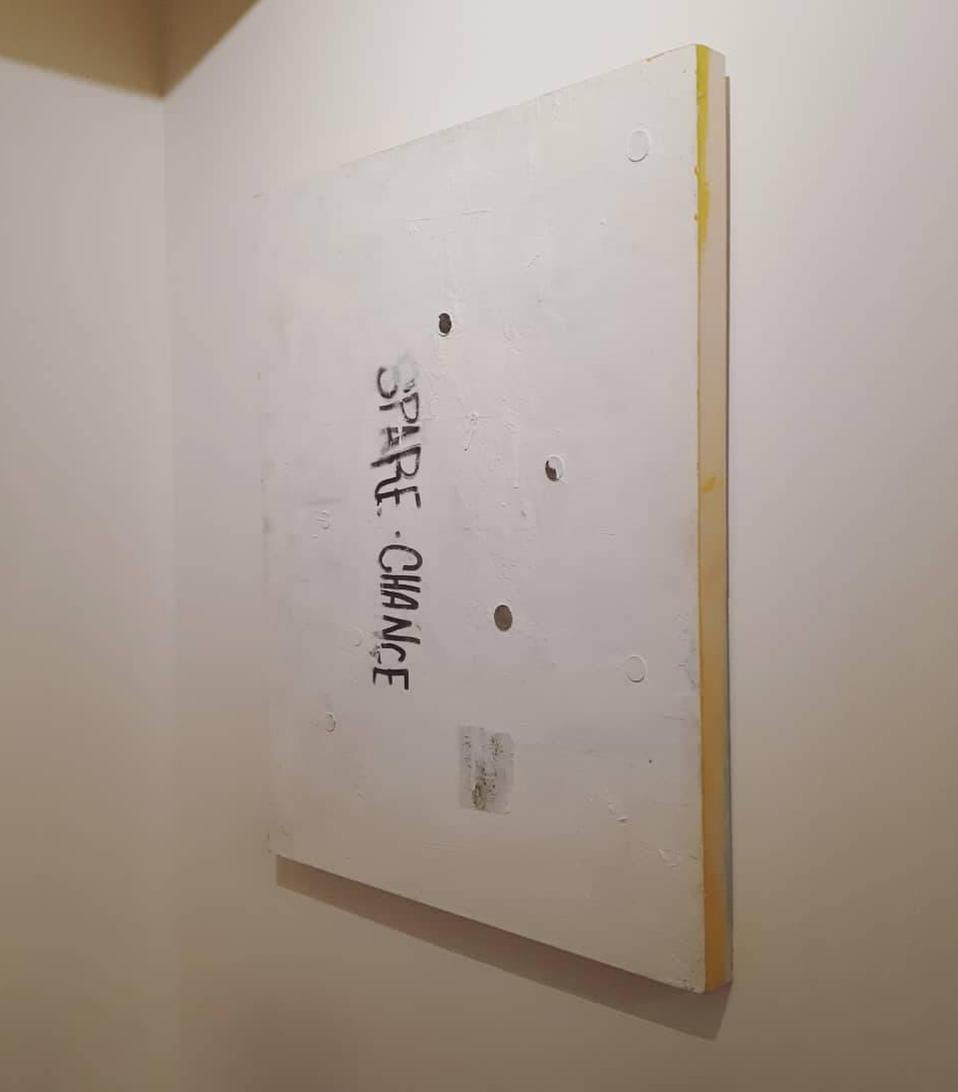
'Looking through dumpster in alleyway'

Acrylic on framed panel

'Big dumpsters behind 140 10 ave sw'
Acrylic on wood panel

Spare Change, Spare Chance

'Spare Change'
Acrylic & Mixed Media on Wooden Canvas

I found this wooden canvas covered in snow behind a dumpster in an alleyway with inscriptions stating 'Homeless & Hungry Pls Spare Change'. I then took it home where I put all my spare change and other spare items onto the canvas and painted onto it. This piece struggles with how spare change could ever make a true difference for someone facing the systematic problem we know as poverty. I started to understand that income inequality was not poverty.

'Footy Steve At Ship & Anchor'

Pubs and cocktail bars are bohemic places to connect with people about my research. Eventually I started doing work on understanding technological disruption. I was also realizing that older people might be losing connection with technology and this could narrow the scope of people that could fill in tech skill gaps in high tech jobs. Footy Steve worked at the zoo and he told he how the animals are kept in controlled environments that operate automatically with the help of technology. He's also an avid soccer match observer.

Fin.

Addressing Income Inequality caused by Tech Disruption

Catalyst Fellowship
Louis Obukohwo

Introduction

Calgary is going through a period of intense disruptions (Stephenson, 2020). Fluctuating market shifts, a declining oil/gas industry and the COVID-19 pandemic are but a few of the disruptions conspiring to bring considerable socio-economic adversity to Calgary (Stephenson, 2020). This paper explores the disruptive 'technological wave' and whether it is encouraging a growing level of income inequality.

How might we address income inequality caused by technological disruption in Calgary?
Research suggests that about 400 to 800 million occupations will be replaced by automation in the next 10 years (Vincent, 2017). Companies in Calgary's traditional industries (like oil and gas) are investing heavily into technology because they believe that Calgary's technology industry can be a more reliable industry when compared to traditional industries (Bell, 2020). Research suggests that disruptive technology can propagate income inequality and cause many workers to redefine their career paths or retrain for 'in-demand' jobs (Vincent, 2017).

Innovative ideas and entrepreneurial adaptability can help trigger the initiatives we need to properly utilize technological advancements to aid or bridge income inequality in Calgary (Innovating Canada, 2020).

Background

I initially signed up to be a member of the Trico Studio in 2018 because of Safehouse Society for Innovation and Creativity, a non-profit I'm involved with.

The Trico Studio is a space to network with other non-profits and changemakers who are really trying to make a difference through intellectual ideas, collaboration and action. It's the place to be. I met Barb Davies at the Trico Studio and she told me about the Institute For Community Prosperity and the Catalyst Fellowship. As a catalyst fellow, I was partnered up with Calgary Economic Development (CED) and Catherine Pearl, my faculty mentor. CED is interested in how to mitigate income inequality caused by technological disruption and I feel very excited to help CED make a real difference by working on this particular systemic problem.

This research illuminates how technological disruption contributes to income inequality in Calgary. It elaborates on the Gini Coefficient and Palma ratio which are used to measure income inequality. It benchmarks against similar economies, exploring what other cities are doing to embrace the technological wave. This research also defines what mid-sized economies are and explains why they are significant to the benchmarking process. It also considers how bridging the lack of high-tech talent in Calgary's growing technology industry can be significant to mitigating income inequality through opportunities created by technological innovations.

Research Methods

My research is based on information collected through secondary research. I collected qualitative and quantitative data from academic journals, government websites, online articles, and books. I used the Mount Royal University's library to gain access to relevant scholarly research articles. Practicing deep listening helps me effectively connect interrelated concepts surrounding disruption caused by technology. Constant engagement in personal conversations with various Calgarians about my research helped better connect with this research and its possibilities. I would have liked to engage more with the Calgary community through a community event, but the Covid-19 pandemic enforced physical distancing.

This report uses diagrammatic models such as systems Mapping, concept Mapping and simple mental mapping to assist in exploring the connections between various concepts and my research.

How can we measure income inequality?

Gini Coefficient:
This is a global method of quantifying inequality. It is usually a number in between 0 and 1, where 0 represents a situation whereby everyone has equal wealth and 1 represents one person accumulating all the wealth. This measurement method seems very reactive, and the changes at the extreme ends are usually not reflected clearly (BBC, 2015).

Palma Ratio:
The Palma Ratio is used as a proxy for income inequality (BBC, 2015). It has been used by advanced economies to determine income inequality (BBC, 2015). It is useful for analyzing the top 0.10 of wealthy people and the bottom 0.40 of people living in impoverishment (BBC, 2015).

What is income inequality?

Income inequality is the great dissimilitude of wealth distribution between dissimilar sections of a given population (Kopp, 2019). It is the unequal distribution of income among a section of the population when compared to another section of the population (Kopp, 2019). These sections are determined by population demographics and factors including gender, profession, background (Kopp, 2019). Major cities in Canada are currently challenged with experiencing significant income inequality when compared to income inequality in more rural towns (Abedi, 2017). Income inequality is a systematic problem that is detrimental to Calgary's financial stability (D'Orazio, 2019). Research suggests that income inequality is a significant problem because it can propagate higher credit demands, higher unemployment, economic volatility, and financial fragility (D'Orazio, 2019).

Income inequality arises from various factors, including the following:

- **Policy:** Public policy or policies of financial institutions affect economic agents through taxation and redistribution of income and financial borrowing or loaning activities. Loosened credit policies can encourage income inequality due to debt-related behaviours in poorer households whereby the poor become poorer due to debt acquisition. At the same time, lower access to credit can lead to lower market shares and unemployment. Policy has the power to either propagate or mitigate income inequality (D'Orazio, 2019).

- **Market Power:** Market power promotes income inequality (Ennis et al., 2017). The rich own shares and gain returns on their investments in corporations; these corporations can increase their prices (which only the wealthy can afford); the poor get poorer by purchasing these highly priced commodities and the rich continue to profit from market power and relatively high prices in this way (Ennis et al., 2017). Market power can lead to the increase of wealth among wealthy people while reducing the wealth of poorer sections of the population (Ennis et al., 2017).

- **Technological Disruption:** is when an alteration of work tasks occurs due to the growth of technological advancements (Gibson, 2018). More will be explained about how this factor contributes to income inequality in the following section.

Technological Disruption

Technological disruption occurs when technological innovation alters the way certain tasks are executed (Smith, 2019). Unlike various other factors that propagate income inequality, technological disruption progresses exponentially (Gibson, 2018). Research suggests that our modern society may not be ready for the changes that are going to occur due to exponential technological advancements (Gibson, 2018).

How is Technological Disruption contributing to Income Inequality in Calgary?
Middle class jobs in Calgary that require repetitive tasks are at risk of automation (Stauch & Turner, 2020). Income inequality is expanding because middle class jobs like trucking, cashiers, telemarketing and certain labour-intensive jobs are being replaced by technological innovations (Stauch & Turner, 2020). Technological disruption causes labour displacements which can increase inequality because of super intelligent computers being able to do various complex tasks (Gibson, 2018).

Technological advancements can affect jobs in the tech industry as demonstrated in Fig. 1C (refer to appendix) (Metta et al., 2018). On one hand, disruption caused by technology can lead to the loss of support jobs that involve moderate to low level skills (Metta et al., 2018). On the other hand, technological advancements can create opportunities for high level professions such as software engineering, IT and data management (Metta et al., 2018); technological innovations can also use gamification and simple interfaces to help middle class workers effectively work with technology in various jobs (Metta et al., 2018). Information and Communication Technology comprises a majority (about 61%) of the technology industry in Canada (Statista, 2018). ICT makes up about 4.5% of Canada's GDP (Canada, 2019). Technology provides useful tools to help answer complex problems in everyday life (Metta et al., 2018). Middle class jobs in Calgary that are usually social in nature are less likely to be disrupted by technological advancements, but even such jobs may use technological advancements to better aid their work tasks (Metta et al., 2018).

The urgency about technological disruption is that it can lead to the loss of many middle class and low-skilled jobs, thereby propagating income inequality (Stauch & Turner, 2020). Research suggests that Calgary's industries need to properly utilize and embrace technology to help prevent economic adversities such as increased income inequality (Chin et al., 2018).

Calgary's unique relationship with Technological Disruption and Income Inequality?

Historically, Calgary has experienced a thriving oil and gas industry (Doherty, 2019). This industry has faced significant decline and disruption in recent years (Subramaniam, 2019). Around 2014, a major economic downturn was triggered by a fluctuation of global oil and gas prices (Doherty, 2019). Canada has lost about 50,000 oil-related jobs in the last few years (Subramaniam, 2019). About 40,000 middle class jobs in oil and gas such as fracturing and drilling have been lost due to the recession (Doherty, 2019). Thousands of middle class jobs in construction and manufacturing have also been adversely affected by the recession (Doherty, 2019). This downturn was made worse in early 2020 by a Saudi-Russian induced supply glut coupled with collapsing global demand due to the COVID 19 pandemic (Seskus, 2020). My systems map (Fig. 1C in appendix) shows how the decline of traditional industries relates to the availability of jobs to Calgarians. Calgary's dependence on the oil and gas industry could be contributing to the income inequality it is experiencing (Subramaniam, 2019).

Research suggests that Calgary's formerly booming oil economy in Calgary encouraged residents to study oil-related academic programs in the past (Fletcher, 2019). This might explain why there is currently a shortage of tech-related talent in Calgary (Fletcher, 2019). Calgary's specific problem is that its growing technology sector finds it difficult to fill technology-related job positions because of a significant lack of tech-related talent in Calgary (Castillo, 2019). Older professionals have also grown out of touch with technology, and this further encourages income inequality due to traditional industries becoming technologically intensive (Cowen, 2014). However, Calgary's thriving technology industry can be the silver lining that bridges a significant amount of income inequality (Fletcher, 2019). Research suggests that diversifying Calgary's economy by investing in technology and technological innovation can help bridge income inequality by providing more tech-related jobs for Calgary residents (Nati, 2019). For example, investments in interfaces that are easier for middle to low skilled workers to use can innovatively help to bridge Calgary's income inequality in the years to come (Cowen, 2014).

Fig. 1A

| Rise in Tech-related employment demand in YYC | — | Opportunity to bridge income disparity in Calgary's Employment Pool | — | Decline in demand for oil and gas employment |

Fig. 1A is a mind map that represents the idea of possible innovational opportunities to bridge displaced professions (especially from traditional industries like oil and gas) with tech-related industries. Fig. 1B (refer to appendix) provides an example of what a timeline could look like for bridging income disparity through tech-related investments and initiatives.

As demonstrated in Fig.1C (refer to appendix), Calgary is already taking some measures to adapt to the 'tech wave' by utilizing its strong ecosystem of about thirty coworking spaces, accelerators and incubators (Startup, 2019). Accelerators like the Trade Accelerator Program and The Accelerators work to help innovative startups and ideas to prosper (Calgary, 2020). Calgary is also taking initiatives to redirect professionals from traditional industries (like oil and gas) into tech-related jobs that are currently in demand, thereby aiding to bridge income inequality (Stephenson, 2019). CED and the Informations and Communications Technology Council (ICTC) recently developed an easy-to-use web program that helps unemployed professionals find their way back into jobs that can utilize their transferable skills in Calgary (Calgary, 2019). Initiatives like Civic Tech YYC, a meetup of community members interested in using technology to better the community, create inclusive spaces where people can foster innovative ideas for communal well-being (Civic Tech, 2020).

Benchmarking

The benchmarking process compares similar cities to Calgary by looking at mid-sized urban cities in economically advanced countries that are a part of the Organisation for Economic Co-operation and Development (OECD). The hope of the benchmarking is to expound innovative ideas that other similar cities are practicing in their conquest to mitigate income inequality caused by technological disruption. The idea is to effectively triangulate cities, like Calgary, with similar advanced economies. Advanced economies are more likely to be exposed to new technological advancements (Gibson, 2018). Advanced economies are also more likely to tackle new economic issues caused by technological advancements (Gibson, 2018). The selection of these cities is also based on key indicators such as economy, quality of life, a presence of higher learning institutions and household usage of computers or gadgets with internet access (refer to Fig. 2B in the appendix).

City	Population Is Mid-sized	Home to Universities/ Colleges/ Higher Learning Institutions	Traditional Industries*	Economy	Quality of Life	Household Internet Use
Bristol	463,400 (Bristol, 2020)	Yes (Randstad, 2019)	Yes (Ramsey, 2003)	Advanced (OECD, 2020)	High (McKeever, 2019)	High - 91% (Bristol, 2016)
Calgary	1,635,000 (Calgary, 2020)	Yes (Kaufmann, 2020)	Yes (Fletcher, 2019)	Advanced (OECD, 2020)	High (Mercer, 2020)	High - 89% (Statistics, 2018)
Denver	727,211 (United, 2020)	Yes (Accredited, 2019)	Yes (Maclean, 2016)	Advanced (OECD, 2020)	High (Weber, 2018)	High - 83.7% (United, 2020)
Aberdeen	227,560 (Scottish, 2018)	Yes (University, n.d.)	Yes (Roach, 2019)	Advanced (OECD, 2020)	High (Mercer, 2020)	High - 84% (Aberdeen, 2018)
Pittsburgh	301,038 (DATA USA, n.d.)	Yes (Katz & Nowak, 2018)	Yes (PHMC, 2015)	Advanced (OECD, 2020)	High (Mercer, 2020)	High - 79% (United, 2020)

*Traditional Industries include Oil/Energy, Manufacturing, Railways or Agriculture

Why OECD?

The OECD is a well-established organization of advanced countries that progressively tackles economic issues (OECD, 2020). Canada is a proud member of the OECD (OECD, 2020). The OECD's decades of experience as an organization makes them capable of addressing modern disruptive issues (OECD, 2020). The OECD's Gini Coefficient average is estimated to be 0.32 (Federal Ministry, 2019). Research suggests that about 59% of jobs in OECD countries can potentially be replaced by technology in the next few years (Chin et al., 2018). Research suggests that cities in OECD countries, like Calgary, will be one of the first cities to experience income inequality caused by technological disruption; this explains the sense of urgency that can be seen in observing what innovations similar cities are initiating to mitigate the adverse economic effects of technological disruption (Gibson, 2018).

Benchmarked Cities

Bristol, United Kingdom (UK):
The UK has experienced significant income inequality with almost half of its wealth captured by 10 percent of the upper class (Partington, 2018). Brexit led to a depreciation of the pound and eventually caused inflation in the UK (Partington, 2018). About 7 billion pounds was invested into UK startups in 2018 (Williams, 2019). In 2019, over 10 billion pounds was invested into tech startups (Bradshaw, 2020). The UK is embracing the tech wave by becoming a hotspot for tech investments (Wright & Armas, 2019). The UK has the leading Fintech ecosystem in the world with many of its financial organizations utilizing cloud computing (Wright & Armas, 2019).

Bristol is a mid-sized city in the UK with a population of 463,400 (Bristol, 2020). Bristol is becoming a tech hub with about 35,000 tech-related jobs, over 200 tech startups and an average salary or wage of about $80,000CAN (Randstad, 2019). Bristol is home to two universities (Randstad, 2019). The University of Bristol has one of the top computer science communities in the UK, and this has become a great resource for talent to the tech companies operating in Bristol (Randstad, 2019). Bristol is also home to The Bristol Robotics Laboratory (which is one of the top robotics research institutions in the UK) (Randstad, 2019).

Bristol's government initiatives such as the One City program are pushing for community challenges that help bolster innovations to help tackle problems such as income inequality and air pollution (Bristol, 2019). The One City program hopes to spark innovation by utilizing open source data to facilitate tech-related challenges such as hacking and software programming competitions (Bristol, 2019).

Bristol is pushing for a full-fibre initiative in an attempt to connect rural parts of the city with urban parts of the city to help with inclusive progression in its tech industry (Bristol, 2019). The One City program also hopes to create forums to help foster digital education and innovation in Bristol's community (Bristol, 2019).

Bristol's 'Digital Inspector' project helps use technology to emboss safety on the roads through the analysis of live footage from police vehicles driving around Bristol during their regular activities (Bristol, 2019). This project hopes to help with cost-effective road maintenance while simultaneously helping reduce traffic (thereby aiding to alleviate poor air conditions) (Bristol, 2019). Bristol's government launched Bristol Is Open (BIO), a collaboration with the University of Bristol that helps test softwares and programs before they get released to the masses (Bristol, 2019).

Bristol is also applying innovative funding through 'initial coin offerings' which is a way of generating funds with the help of crypto-currency investments (Bristol, 2019).

Pittsburgh, US:
Several decades ago, Pittsburgh was experiencing the loss of around 100,000 steel-related jobs and lack of work was at its highest point (Katz & Nowak, 2018). It experienced a significant drop in population due to a lack of jobs after the steel and manufacturing industries experienced significant technological disruptions (Katz & Nowak, 2018). Like Calgary, Pittsburgh has also been adversely affected by fluctuating prices in the global oil and gas sectors (Deto, 2017). Pittsburgh eventually rose from the ashes when Carnegie Mellon University started developing robotics with support from Bechtel Group to help with dangerous tasks at Three Mile Island nuclear power plant (Katz & Nowak, 2018). Eventually the National Robotic Engineering Center (NREC) was formed in the Carnegie Mellon Robotics Institute to help catalyze robotic innovations (Katz & Nowak, 2018). Pittsburgh embraced the tech wave by encouraging tech funding, systems thinking and entrepreneurial initiatives (Katz & Nowak, 2018). Pittsburgh is making long-term investments in technology to help create jobs through digital innovation and effective systems thinking (Katz & Nowak, 2018). Pittsburgh went from rusting in its steel manufacturing days to become an exemplary hotspot of technology in the US (Katz & Nowak, 2018). It is now home to big tech companies like Google, Uber and Ford that could hire residents and create jobs (Katz & Nowak, 2018). Pittsburgh aims to embrace the tech wave in a way that creates positive economic advancements (Fraser & Fraser, 2018).

Pittsburgh is now on its way to becoming a smart city, but some of the short-term costs are the loss of support jobs that don't require much skill (Deto, 2017). Pittsburgh's government perceives the loss of middle class jobs as a temporary situation as its city matures into an innovative tech hub that could offer innovative solutions to job loss in the future (Deto, 2017).

Denver, US:
Denver is a city with about 727,211 residents (United, 2020). The city is home to about 28 academic institutions including universities and colleges (Accredited, 2019). Denver's traditional industries include railway, agriculture and oil/gas (Maclean, 2016). A major downturn in Denver's oil industry around the 1970s catalyzed the Denver government to develop a strategy that helped the city rely less on the oil and gas industry (Maclean, 2016).

Denver's strategy involves the development of funds that helped diversify their economy (Maclean, 2016). The city made significant investments in aeronautics and technology to help effectively diversify the economy (Maclean, 2016). Denver also supported the creation of the Denver Tech Center which further propagated a healthy ecosystem for tech (Maclean, 2016). Eventually, large tech companies like Google started calling Denver home (Maclean, 2016). Denver now has a prosperous Technology and IT industry that helps provide some stability even when the oil and gas industry is fluctuating (Accredited, 2019).

Aberdeen, UK:
Aberdeen is an urban city with a population of about 227,560 residents (Scottish, 2018). It is home to the revered University of Aberdeen (University, n.d.). Aberdeen has also experienced the recent oil recessions that have adversely impacted Calgary's economy (Smith, 2018). Many middle class and lower class workers in Aberdeen have lost their jobs in traditional industries like oil and gas (Smith, 2018).

Aberdeen's government is working to execute their strategic plan to diversify its economy through technological advancements and entrepreneurial innovations (Smith, 2018). Aberdeen's government is utilizing the City Region Deal Investment (a 10 year agreement between Aberdeen, Scotland and the UK to help revive Aberdeen's economy) to help create investments in innovation and technology (Scottish, 2018). Research suggests that this deal could provide Aberdeen access to about $150 million for diversification initiatives such as funding for technological innovation and startups (Scottish, 2018). Aberdeen's diversification strategy involves supporting its high-tech ecosystems through funding and innovative ideas (Smith, 2018). This diversification strategy aims to inspire tech companies to provide innovative solutions that could help create jobs, improve infrastructure and support communal well-being (Smith, 2018).

So what did we learn from Benchmarking these cities:

City	Innovation/Initiative	Feasibility	Impact
Aberdeen	Aberdeen's Diversification Strategy	Calgary would need to have access to considerable funding - about $100 million from Alberta or Canada (Scottish, 2018).	New infrastructure such as Technology hubs and centers could help propagate the creation of new middle class jobs through technological innovations (Smith, 2018).
Bristol	One City Program (Bristol, 2019)	Calgary would need a fund of about $12 million to help connect the city through full-fibre connectivity (Bristol, 2020).	More access to technology and the internet could help Calgary's population get more accustomed to the use of technology, thereby bridging technological illiteracy (Bristol, 2019). Connectivity through online solutions could help connect in-demand talent to the right middle class jobs in Calgary (Bristol, 2019).
Pittsburgh	National Robotic Engineering Center (Katz & Nowak, 2018)	A respected research institute or university or the government in Calgary would need to create a centre for technological innovation; the centre should have the ability to work with global tech companies through cooperative initiatives (National, 2019).	This could create jobs for many residents in Calgary and could attract global tech companies that could collaboratively help create tech innovations to help bridge income inequality (National, 2019); such innovations could be gamification applications to help support middle class workers in Calgary (National, 2019).
Denver	Denver's diversification strategy	Calgary would need to diversify away from traditional industries like oil and gas, and focus on its technology and innovative sectors (Konecny, 2015). Such a strategy could take several years of innovation and investment (Konecny, 2015).	This could help support the prosperity of tech-related industries such as IT, Fintech, Healthcare and Software Development (Konecny, 2015).

Some Inspirational Cities

Berlin, Germany:
In recent years, cities in Germany, like Berlin, experienced a deepening of income inequality (Carter, 2019). Berlin has a Gini Coefficient index of about 2.9 (which indicates that Berlin has less income inequality than Calgary) (OECD, 2018). This rise in income inequality seems to have plateaued through a job boom that followed after 2005, as there was a rise in full-time employment in a way that helped lower and middle class workers to avoid further income inequality (Martin, Martin & Loffler, 2019). Tax rectification initiatives were also used to stifle the expansion of income inequality in Germany after 2005 (Martin, Martin & Loffler, 2019). Germany is aware that encouraging tech companies to thrive can create innovative ideas and high wage or salary jobs (Federal Ministry, 2019). Germany is also interested in ensuring healthy market competition by making sure foreign tech companies are taxed accordingly (Federal Ministry, 2019).

Berlin is known to be a new hotspot for technology (Rojas, 2018). A majority of digital startups in Germany operate in Berlin (Rojas, 2018). Berlin is also one of the leading destinations for foreign tech workers and startups (Rojas, 2018). Berlin is host to the Digital Innovation Summit which is a yearly summit that started just over a decade ago (DIS, 2020). DIS invites global digital innovators to connect and educate at the seminar (DIS, 2020). Berlin's efforts to become a space where tech startups can thrive is estimated to produce around 100,000 jobs in 2020 (Rojas, 2018).

Berlin is home to Rocket Internet which is one of the most influential companies when it comes to investing in entrepreneurial tech ideas and startups (Rocket Internet, 2018). Rocket Internet is known for catalyzing a lot of the tech scene in Berlin and is responsible for investing in companies like home24, Hello Fresh and Zalando (Rojas, 2018).

Berlin is home to notable community hubs that act as catalysts for innovation and networking (Rojas, 2018). Such community hubs include Wework and Factory Berlin (Rojas, 2018). These community hubs and coworking environments help bolster technological cooperation and innovation in Berlin (Wework, 2020). Factory Berlin has thousands of members that work out of its spaces; its competitive advantage is that its founder Udo Schloemer is knowledgeable about tech as well as real estate and this allowed him to source suitable spaces for tech coworking spaces (Factory Berlin, n.d.). Berlin's efforts for technological innovation gave birth to the famous 'Soundcloud' which is a music streaming platform used globally today (Rojas, 2018).

Global tech companies are recognizing Berlin as a hub for tech talent (Earley, 2019). Berlin's efforts to build a bubbling ecosystem is finally paying off with companies like Revolut (a UK Fintech company) creating many jobs for Berlin's residents (Earley, 2019).

Research suggests that tech companies in Berlin are slowly progressing when it comes to how much innovation they are providing to the public (Naude & Nagler, 2017). Since Berlin hopes to become a smart city, government initiatives and venture capital funds have been focused more on highly skilled tech talent, and this could be affecting job opportunities for middle class workers that are not highly skilled (Naude & Nagler, 2017). Research suggests that government initiatives that provide securities such as Universal Basic Income will be helpful to mitigate income inequality (Naude & Nagler, 2017). Research also suggests that government initiatives that enrich poorer residents quicker than wealthy residents could help bridge income inequality (Naude & Nagler, 2017).

Paris, France:
Cities in France, like Paris, are experiencing a decrease in the number of middle class workers due to the automation of work activities (Normand, 2019). Paris is facing a threatening growth in income inequality (Hasselt, 2019). The city of Paris is embracing the tech wave by becoming a tech superpower (Trajkovska, 2019). Paris' Gini Coefficient index is about 0.29 which means that Paris is experiencing relatively less income inequality (OECD, 2018). There has been a recent rise in funding for small tech companies (Trajkovska, 2019). Paris has encouraged the use of start-up hubs to help catalyze tech innovation and progression in the city (Trajkovska, 2019). Some notable start-up hubs in Paris are Numa, Deskopolitan, Station F(the largest European incubator campus based in Paris), and Kwerk (Trajkovska, 2019). Some of these start-up hubs offer conducive services and spaces for small tech businesses (Trajkovska, 2019). These start-up hubs have become generators of innovative tech ideas while providing vibrant spaces for different minds to network and exchange ideas (Trajkovska, 2019). Paris is using technology in innovative ways to help tackle climate change(TT:Clear, 2017). Paris also plays host to forums such at the Disruption Forum to help catalyze the exchange of information on how to address technological disruption (Grynkiewicz, 2019).

The start-up companies working in these start-up hubs try to use technology to make various services more accessible for people (Trajkovska, 2019). Some of the top venture fund companies are Bright eyes, Partech, Cap Horn Investment and orange digital venture (Trajkovska, 2019). There seems to be a pattern whereby entrepreneurs are creating venture companies or start-ups to help support innovative tech ideas and start-ups (Trajkovska, 2019). Entrepreneurs and angel investors like Jean-David Blanc and Xavier Niel (main angel investor for Station F) are known for backing start-ups through venture capital management and funding (Trajkovska, 2019).

France is also taking initiatives to attract global talent to work in its booming technology industry in order to satisfy growing

tech positions (Evans, 2018). France's government initiated a 'Tech Visa' that allowed for tech-related talent to easily gain access to booming ecosystems in Paris (Nawrat, 2019).

A tax of 3% on money made by large tech companies was recently suspended because US companies felt that the tax was weighing-down large companies such as Google and Facebook (Amaro, 2020). The French government is currently looking to help facilitate an international tax framework for giant tech companies operating in OECD cities (Amaro, 2020).

La French Tech is a relatively new government initiative that awards certifications to ecosystems in cities that prove to be tech centres (Gouvernement, n.d.). Cities would usually send an application to the La French Tech and get examined before a certification is awarded (Gouvernement, n.d.). This initiative focuses on encouraging what startups are working on in a way that accelerates progress through the help of venture funding, incubators and professional mentorship (Gouvernement, n.d.). This government initiative also offers opportunities with the help of the French 'Tech Visa', that help international ecosystems collaborate with french ecosystems in cities like Paris (Gouvernement, n.d.).

Observations & Implications

Technology has disrupted many jobs in Calgary, but Calgary has also been recently hit by a recession that has also caused the loss of thousands of middle class jobs that require repetitive tasks and medium to low level skills (Doherty, 2019). Mid-sized OECD economies (including Calgary) are embracing the tech wave to generate technological innovations that can benefit economic progression and enrich everyday life (Fraser & Fraser, 2018). Technological innovations can help create simpler interfaces and procedures to help support middle class Calgarian jobs instead of replacing these jobs (Metta et al., 2018).

Cities, like Calgary, are adapting to technological disruption by becoming smart cities in order to facilitate innovation that attracts both technological talent and jobs from tech-related companies/organizations (Bristol, 2019).

Conclusion

Like Calgary, other advanced economies are embracing the tech wave by catalyzing technological innovations through digital ecosystems as demonstrated in Fig. 1C (Startup, 2020). Calgary can embrace technological disruption by encouraging digital collaboration and innovations through initiatives such as coworking space developments, accelerators and incubators developments, innovational government programs, government funding for technology startups, venture capital and angel investment acquisitions, and crowdfunding initiatives (Startup, 2020).

Calgary can learn from Berlin by engaging in initiatives that help attract and retain global tech companies to help create jobs for Calgary's residents while attracting global tech talent (Rojas, 2018). Calgary can learn from Bristol and look into raising innovative funding through the use of crypto-currency investments (Bristol, 2019). Government initiatives that provide middle and low class professionals with security or welfare such as the Universal Basic Income initiative could help mitigate income inequality in Calgary (Naude & Nagler, 2017). Implementing innovative initiatives (such as simpler interfaces or access to online training) can increase labor productivity in tech-related industries to help medium and low skilled workers get job opportunities to help mitigate income inequality (Naude & Nagler, 2017).

My research shows me that this 'smart city race' is global, and many cities like Calgary are trying to transform into smart cities the way caterpillars transform into butterflies (Gibson, 2018). They probably realize that technology is gaining global exponential momentum and that the only way to progress in the future is to flow with the momentum (Gibson, 2018). Cities like Calgary are figuring it out, and these cities are trying to facilitate different ways of globally collaborating on innovative ideas that could help mitigate income inequality (Gouvernement, n.d.).

Covid-19's Impact on Technological Advancements In Calgary's Ecosystem

The dreadful Covid-19 crisis is causing a significant amount of global economic adversity (Beech, 2020). Research suggests that venture funding for digital startups might decrease by about 25% as a result of the Covid-19 crisis (Morelix, 2020). Research suggests that up to $28 billion could leave global tech ecosystems if half of global venture capital deals diminish (Morelix, 2020).

There are some windows of hope in these trying times (Beech, 2020). The Covid-19 crisis is currently catalyzing technological innovations to help fight the virus (Beech, 2020). 3D printing companies are creating door openers and protective gear that can help protect people from spreading the virus (Beech, 2019). Strong support from the government and entrepreneurial organizations could help promote progressive tech advancements in Calgary (Morelix, 2020). Initiatives such as government funding and venture capital funding for startups could create jobs in Calgary to help offset the economic adversities caused by Covid-19 (Morelix, 2020). Research suggests that some tech companies are even benefiting from opportunities linked to digital solutions that help people work remotely (Stephenson, 2020). Some governments are also taking initiatives to pay worker wages to help keep key corporate businesses operational (Morelix, 2020). Alberta's government is already taking initiatives to rejuvenate the tech ecosystem in Calgary through an upcoming diversification initiative (Stephenson, 2020). Supporting the funding of startups through the help of efficient budgets could help catalyze technological advancements that could help Calgary's economy thrive in the future (Morelix, 2020).
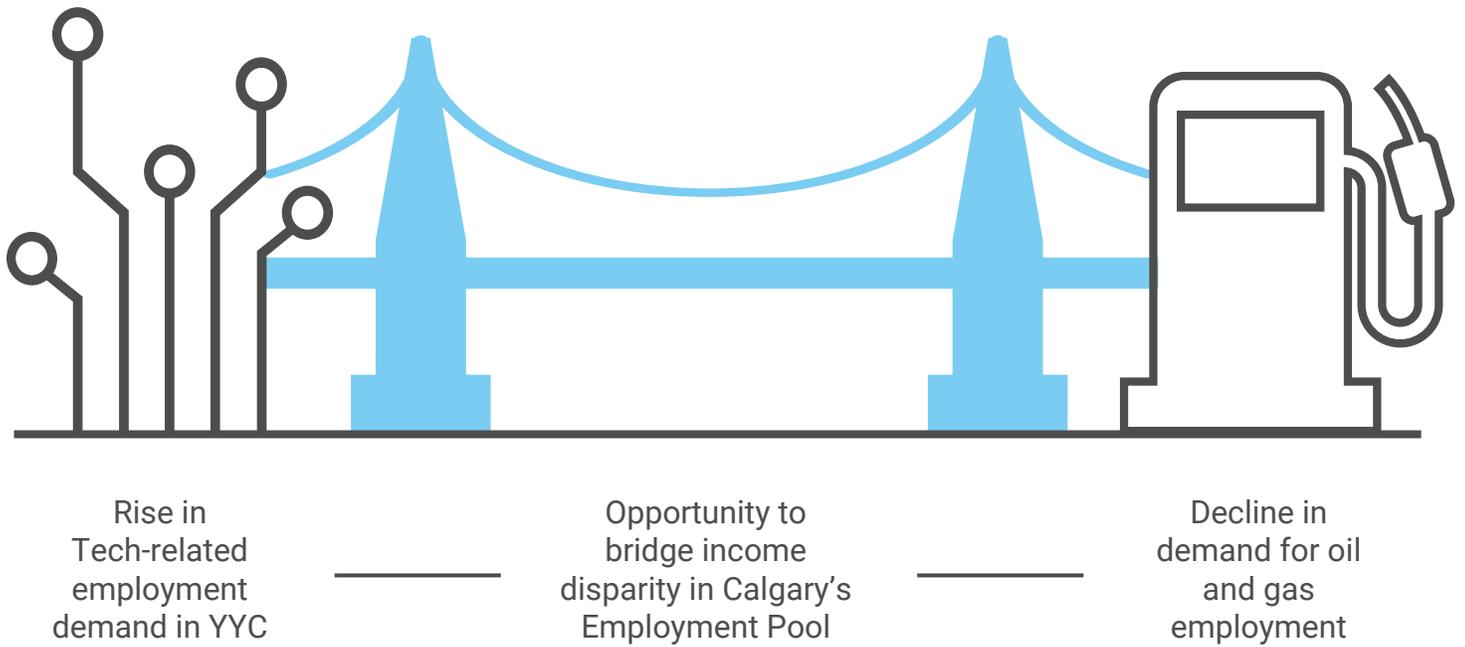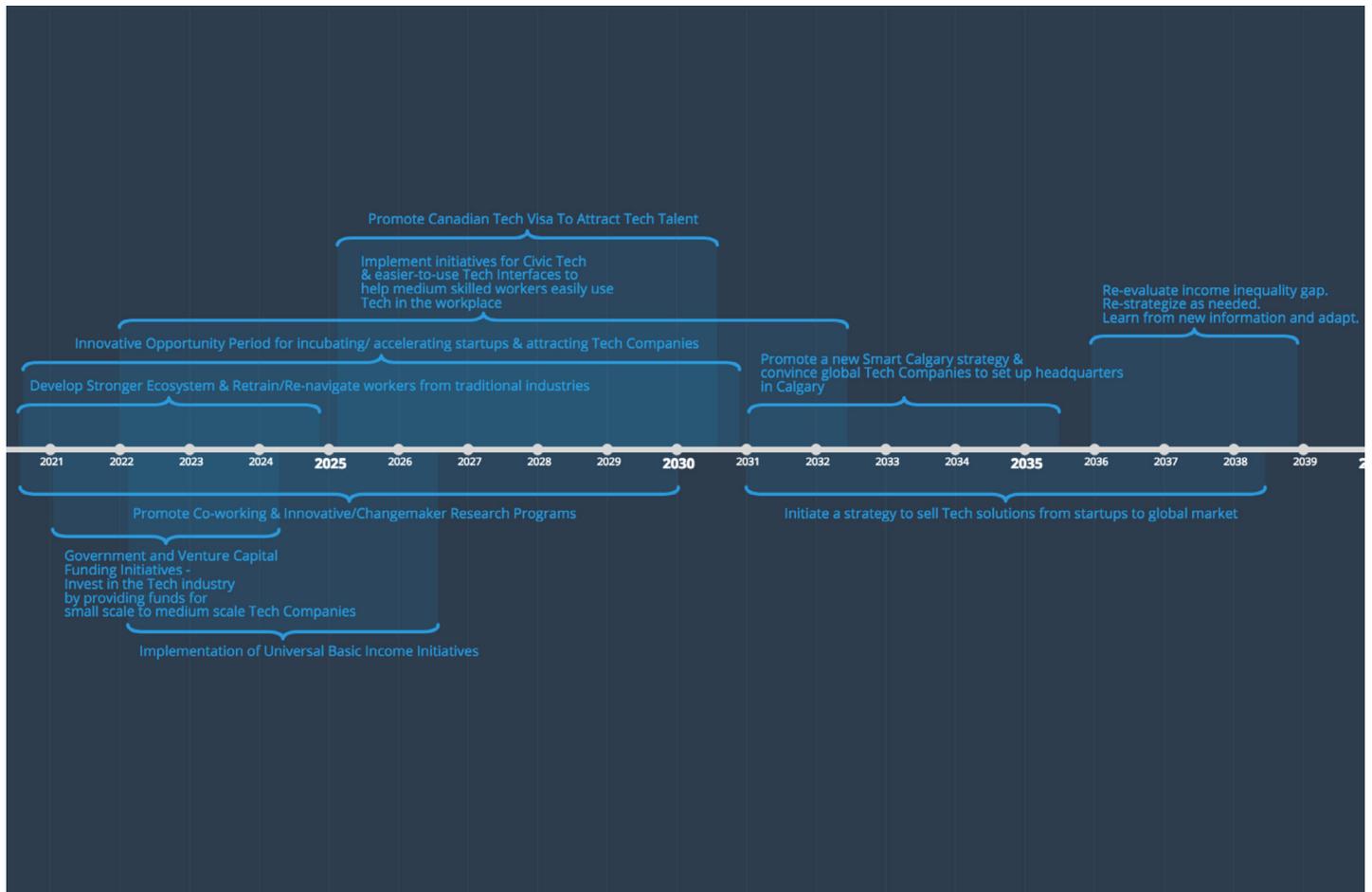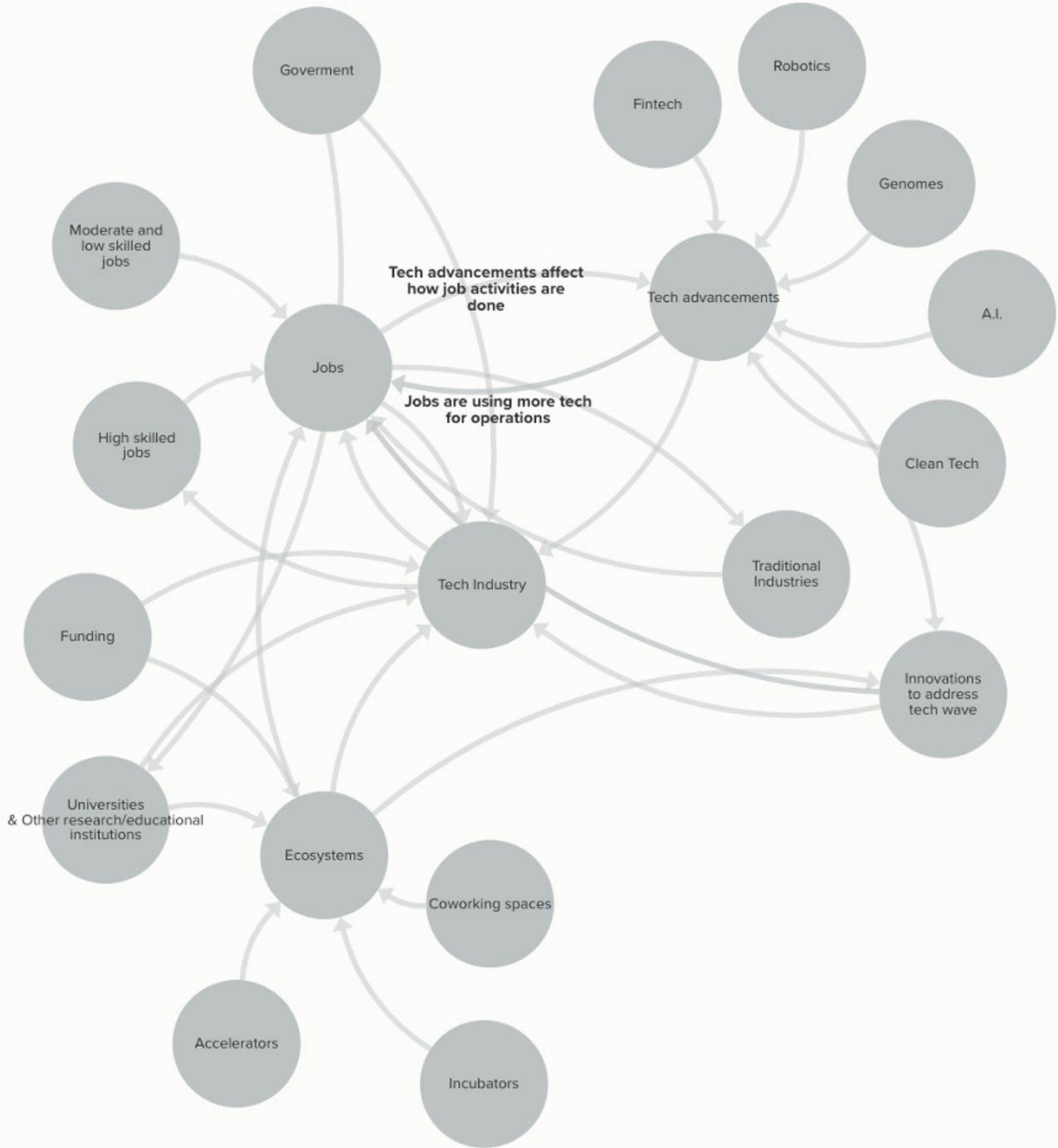
Appendix

Fig. 1A

| Rise in Tech-related employment demand in YYC | — | Opportunity to bridge income disparity in Calgary's Employment Pool | — | Decline in demand for oil and gas employment |

Fig. 1B

Promote Canadian Tech Visa To Attract Tech Talent

Implement initiatives for Civic Tech & easier-to-use Tech Interfaces to help medium skilled workers easily use Tech in the workplace

Re-evaluate income inequality gap. Re-strategize as needed. Learn from new information and adapt.

Innovative Opportunity Period for incubating/ accelerating startups & attracting Tech Companies

Develop Stronger Ecosystem & Retrain/Re-navigate workers from traditional industries

Promote a new Smart Calgary strategy & convince global Tech Companies to set up headquarters in Calgary

2021 2022 2023 2024 **2025** 2026 2027 2028 2029 **2030** 2031 2032 2033 2034 **2035** 2036 2037 2038 2039

Promote Co-working & Innovative/Changemaker Research Programs

Initiate a strategy to sell Tech solutions from startups to global market

Government and Venture Capital Funding Initiatives - Invest in the Tech industry by providing funds for small scale to medium scale Tech Companies

Implementation of Universal Basic Income Initiatives

Fig. 1C

Goverment

Moderate and
low skilled
jobs

Fintech

Robotics

Genomes

**Tech advancements affect
how job activities are
done**

Tech advancements

A.I.

Jobs

**Jobs are using more tech
for operations**

High skilled
jobs

Clean Tech

Funding

Tech Industry

Traditional
Industries

Innovations
to address
tech wave

Universities
& Other research/educational
institutions

Ecosystems

Coworking spaces

Accelerators

Incubators

Fig. 2: Cities

City	Country	Population	Gini Coefficient	Palma Ratio	Median Income USD	Initiatives & Innovations
Calgary	Canada	1,635,000 (Calgary, 2020)	0.32 (World, 2020)	1.1 (OECD, 2018)	$72,299 (Alberta, 2017)	The Opportunity Calgary Investment Fund in 2018 (Galang, 2018). The fund is coordinated by CED (Galang, 2018). $100 million has been invested to help businesses in Calgary that work with technology (Galang, 2018). OCIF has funded businesses like Lighthouse Labs and Hatch-YYC(Calgary, 2020).
Aberdeen	UK	227,560 (Scottish, 2018)	0.36 (OECD, 2018)	1.5 (OECD, 2018)	$35,008 (Aberdeen, 2018)	Aberdeen's Diversification Strategy (Smith, 2018)
Denver	US	727,211 (United, 2020)	0.46 (Data, 2018)	1.8 (OECD, 2018)	$63, 793 (United, 2020)	Denver also supported the creation of the Denver Tech Center which further propagated a healthy ecosystem for tech (Maclean, 2016).
Paris	France	2,140,526 (Statista, 2019)	0.29 (OECD, 2018)	1.1 (OECD, 2018)	$31, 112 (World, 2020)	Venture capital investments from government initiatives and other private entities (Dillet, 2019).Top VC investors are Brighteyes Ventures, CapHorn Invest, Partech and Orange digital ventures (Trajkovska, 2019).
Berlin	Germany	3,562,038 (World, 2019)	0.29 (OECD, 2018)	1.1 (OECD, 2018)	$33,333 (World, 2020)	Investments into startup tech companies from companies like Rocket Internet (Rojas, 2018).
Bristol	UK	463,400 (Bristol, 2020)	0.36 (OECD, 2018)	1.5 (OECD, 2018)	$66,829 (Point2, 2020)	Venture Capitals from US and Asia helped invest over 3 billion pounds into the UK's tech sector (Browne, 2019). The capability and innovation fund is a fund that accelerates Fintech ideas in the UK (Wright & Armas, 2019).
Pittsburgh	US	301,038 (DATA USA, n.d.)	0.469 (DATA USA, n.d.)	1.8 (OECD, 2018)	$47,417 (DATA USA, n.d.)	Westinghouse Electric Company invested $3 million into Carnegie Mellon's Robotic Institute (Katz & Nowak, 2018). Nasa invested into the National Robotic Engineering Center towards the late 1990s (Katz & Nowak, 2018). Innovation Works has been known to invest $72 million into hundreds of startups in Pittsburgh (Katz & Nowak, 2018).

Fig. 2B: City Metrics For Benchmarked Cities

City	Population Is Mid-sized	Home to Universities/ Colleges/ Higher Learning Institutions	Traditional Industries*	Economy	Quality of Life	Household Internet Use
Bristol	463,400 (Bristol, 2020)	Yes (Randstad, 2019)	Yes (Ramsey, 2003)	Advanced (OECD, 2020)	High (McKeever, 2019)	High - 91% (Bristol, 2016)
Calgary	1,635,000 (Calgary, 2020)	Yes (Kaufmann, 2020)	Yes (Fletcher, 2019)	Advanced (OECD, 2020)	High (Mercer, 2020)	High - 89% (Statistics, 2018)
Denver	727,211 (United, 2020)	Yes (Accredited, 2019)	Yes (Maclean, 2016)	Advanced (OECD, 2020)	High (Weber, 2018)	High - 83.7% (United, 2020)
Aberdeen	227,560 (Scottish, 2018)	Yes (University, n.d.)	Yes (Roach, 2019)	Advanced (OECD, 2020)	High (Mercer, 2020)	High - 84% (Aberdeen, 2018)
Pittsburgh	301,038 (DATA USA, n.d.)	Yes (Katz & Nowak, 2018)	Yes (PHMC, 2015)	Advanced (OECD, 2020)	High (Mercer, 2020)	High - 79% (United, 2020)

*Traditional Industries include Oil/Energy, Manufacturing, Railways or Agriculture

References

42. (2020). Born to code? Retrieved from https://www.42.fr/

100 Resilient Cities. (2020). Paris resilience story. Retrieved from https://100resilientcities.org/cities/paris/

100 Resilient Cities. (2020). Bristol. Retrieved from http://www.100resilientcities.org/strategies/bristol/#/-_/

Abedi, M. (2017). Rise of income inequality in Canada 'almost exclusive' to major cities: study. Retrieved from https://globalnews.ca/news/3599083/income-inequality-canada-cities/

Aberdeen City. (2018). Population needs assessment. Community Planning Aberdeen. Retrieved from https://communityplanningaberdeen.org.uk/wp-content/uploads/2018/11/PNA-DRAFT-for-SCC-V1-Appendix-1-1.pdf

Aberdeen City Council. (2018). Aberdeen key facts. Retrieved from https://www.aberdeencity.gov.uk/sites/default/files/2018-10/Aberdeen%20Key%20Facts.pdf

Accredited. (2019). Colleges in denver. Retrieved from https://www.accreditedschoolsonline.org/colorado/denver-co/

Alberta Government. (2017). Calgary- median family income. Retrieved from https://regionaldashboard.alberta.ca/region/calgary/median-family-income/#/?from=2013&to=2017

Amaro, S. (2020). French finance minister says the battle over digital tax is not yet over. CNBC. Retrieved from https://www.cnbc.com/2020/01/22/davos-2020-france-and-us-have-some-work-still-to-do-on-digital-tax.html

BBC. (2019). What is the g7 and what does it do? Retrieved from https://www.bbc.com/news/world-49434667

BBC. (2015). Who, what, why: what is the gini coefficient? Retrieved from https://www.bbc.com/news/blogs-magazine-monitor-31847943

Beech, P. (2020). These new gadgets were designed to fight covid-19. Retrieved from https://www.weforum.org/agenda/2020/04/coronavirus-covid19-pandemic-gadgets-innovation-technology/

Bell, D. (2020). Will tech be alberta's next big thing? Industry and schools are a hard yes. CBC. Retrieved from https://www.cbc.ca/news/canada/calgary/tech-for-tomororw-next-big-thing-1.5470790

Bhardwa, S. (2017). Why i love studying in berlin. Retrieved from https://www.timeshighereducation.com/student/blogs/why-i-love-studying-berlin

Bradshaw, T. (2020). UK-based startups enjoy 10 bn funding bonanza. Retrieved from https://www.ft.com/content/7a3739e0-36f3-11ea-a6d3-9a26f8c3cba4

Brighteye Ventures. (2019). Investing in companies that help people learn and grow. Retrieved from https://www.brighteyevc.com/

Bristol City Council. (2020). The population of bristol. Retrieved from https://www.bristol.gov.uk/statistics-census-information/the-population-of-bristol

Bristol City Council. (2019). Connecting bristol. Retrieved from https://www.connectingbristol.org/wp-content/uploads/2019/09/Connecting_Bristol_300819_WEB.pdf

Bristol Is Open. (2016). Bristol is the most digitally literate core city in the uk. Retrieved from https://www.bristolisopen.com/bristol-is-the-most-digitally-literate-core-city-in-the-uk/

Bristol One City. (2020). 2019 - a snapshot. Bristol One City Plan 2020. Retrieved from https://www.bristolonecity.com/wp-content/uploads/2020/01/One-City-Plan_2020.pdf

Britannica. (2020). Transportation. Retrieved from https://www.britannica.com/place/Berlin/History

Britannica. (2020). Aberdeen. Retrieved from https://www.britannica.com/topic/rock-Scotland-1980s-overview-708529

Browne, R. (2019). Amazon and softbank help uk tech startups score record foreign investment. Retrieved from https://www.cnbc.com/2019/08/20/uk-tech-startups-see-record-foreign-funding-thanks-to-amazon-softbank.html

Canada. (2019). Canadian sector profile 2018. Retrieved from https://www.ic.gc.ca/eic/site/ict-tic.nsf/eng/h_it07229.html

Calgary Economic Development. (n.d.). Calgary in the new economy. Retrieved from https://calgaryeconomicdevelopment.com/assets/Calgary-in-the-New-Economy/Calgary-in-the-New-Economy-Final.pdf

Calgary Economic Development . (2020). Demographics. Retrieved from https://calgaryeconomicdevelopment.com/research-and-reports/demographics-lp/population/

Calgary Economic Development. (2020). Opportunity calgary investment fund. Retrieved from https://calgaryeconomicdevelopment.com/about-us/initiatives/opportunity-calgary-investment-fund

Calgary Economic Development. (2020). Trade accelerator programs. Retrieved from https://calgaryeconomicdevelopment.com/ready-to-export/trade-accelerator-program/trade-accelerator-program

Calgary Economic Development. (2019). Do your skills match those for in-demand occupations? Retrieved from https://www.calgaryupskill.ca/

Cap Horn. (n.d.). About us. Retrieved from https://caphorn.vc/aboutus/

Carter, A. (2019). Income inequality in germany reaches record high. Retrieved from https://www.iamexpat.de/expat-info/german-expat-news/income-inequality-germany-reaches-record-high

Castillo, K., D., C. (2019). 'We are hiring big time': Calgary tech companies join forces to attract job seekers. Global News. Retrieved from https://globalnews.ca/news/6239314/calgary-technology-jobs/

Central Intelligence Agency. (2019). Internet users. Retrieved from https://www.cia.gov/library/publications/the-world-factbook/geos/fr.html#field-anchor-communications-internet-users

Cooke, P. (2019). What's the g7, what countries are members, what does the group do and how often does it meet.The Sun. Retrieved from https://www.thesun.co.uk/news/6476220/g7-countries-members-summits-held-group/

Chin, V., Malone, C., Puckett, J., & Turpitz, A. (2018). Governing in the age of disruption. Boston Consulting Group. Retrieved from https://www.bcg.com/en-ca/publications/2018/governing-age-disruption.aspx

Civic Tech YYC. (2020). About. Retrieved from https://civictechyyc.ca/about/

Context Magazine. (2020). Oil and natural gas: backbone of the alberta economy. Retrieved from https://context.capp.ca/energy-matters/2019/btn_oil-and-gas-is-backbone-of-alberta-economy

Cowen, T. (2014). How technology could help fight income inequality? Retrieved from https://www.nytimes.com/2014/12/07/upshot/how-technology-could-help-fight-income-inequality.html

Denver Business Journal. (2019). Denver bumps colorado springs. Retrieved from https://www.bizjournals.com/denver/news/2019/04/09/denver-colorado-springs-best-places-to-live-2019.html

Deto, R. (2017). Is pittsburgh's economy growing for everyone? Retrieved from https://www.pghcitypaper.com/Blogh/archives/2017/05/11/is-pittsburghs-economy-growing-for-everyone

DATA USA. (n.d.). Pittsburgh, pa. Retrieved from https://datausa.io/profile/geo/pittsburgh-pa/

DATA USA. (2018). Wage distribution. Retrieved from https://datausa.io/profile/geo/denver-co/#economy

Davidson, J. (2019). Aberdeen and edinburgh ranked among top uk cities to live and work in. Holyrood. Retrieved from https://www.holyrood.com/news/view,aberdeen-and-edinburgh-ranked-among-top-uk-cities-to-live-and-work-in_14703.htm

Denver South. (2018). Supporting the ecosystem of tech. Retrieved from https://denversouthedp.org/supporting-the-ecosystem-of-tech-3-lessons-for-denver-south-in-attracting-and-retaining-tech-companies/

Dillet, R. (2019). Macron announces £5 billion late stage investment from institutional investors.Retrieved from https://techcrunch.com/2019/09/17/macron-announces-e5-billion-late-stage-investment-pledge-from-institutional-investors/

DIS. (2020). Dis at a glance. Retrieved from https://www.innovators-summit.com/

DIS. (2020). Why berlin? Retrieved from https://www.innovators-summit.com/about/why-berlin/

DIS.(2020). Speakers in 2020. Retrieved from https://www.innovators-summit.com/speakers/speakers-2020/

Divercities. (2019). Milan. Retrieved from https://www.urbandivercities.eu/milan/

Doherty, B. (2019). Alberta's economy sees a drop in oil and gas jobs, shift toward health care and education employment. The Star. Retrieved from https://www.thestar.com/calgary/2019/06/27/albertas-economy-sees-drop-in-oil-and-gas-jobs-shift-toward-health-care-and-education-employment.html

Earley, K. (2019). Revolut announces 80 tech jobs in a new berlin hub. Retrieved from https://www.siliconrepublic.com/start-ups/revolut-tech-hub-berlin

Evans, J. (2018). Liberty, equality and technology: France is poised to become a tech power. Retrieved from https://techcrunch.com/2018/07/15/liberty-equality-technology-france-is-finally-poised-to-become-a-tech-power/

Factory Berlin. (n.d.). Learn about factory berlin. Retrieved from https://factoryberlin.com/about/

Fashion Technology Accelerator. (2020). Fashion technology ecosystem milan. Retrieved from https://www.ftaccelerator.it/blog/milan-fashion-technology-ecosystem/

Federal Ministry Of Finance. (2019). Social inequality and inclusive growth. Retrieved from https://www.bundesfinanzministerium.de/Content/EN/Standardartikel/Topics/International_affairs/Articles/2019-06-07-social-inequalitiy-and-inclusive-growth.html

Fletcher, R. (2019). 'We're hiring constantly': how the tech industry figures into calgary. CBC. Retrieved from https://www.cbc.ca/news/canada/calgary/calgary-tech-industry-blackline-novatel-jobs-workers-1.5124348

Fletcher, R. (2019). The greying of calgary: 2019 census shows the city is becoming more like winnipeg. CBC. Retrieved from https://www.cbc.ca/news/canada/calgary/calgary-2019-civic-census-results-1.5268588

Fraser, J., & Fraser, J. (2018). Work disrupted. Retrieved from https://pittsburghquarterly.com/pq-health-science/pq-technology/item/1848-work-disrupted.html

Gibson, A., J. (2018). Tip of the spear (1st ed). Jim A. Gibson.

Galang, J. (2018). Calgary launches $100 million tech investment fund. Retrieved from https://betakit.com/calgary-launches-100-million-tech-investment-fund/

Galvanize. (2020). Coworking space at galvanize campuses. Retrieved from https://www.galvanize.com/campuses

Gouvernement. (n.d.). La french tech. Retrieved from https://www.gouvernement.fr/en/la-french-tech

Grynkiewicz, T. (2019). The next Mark Zuckerberg of Fintech may be Living in France. Retrieved from https://www.netguru.com/blog/next-mark-zuckerberg-fintech-insurtech-france-get-disruption-forum-paris

Hasselt, V., D., G. (2019). Rich and poor increasingly segregated in paris region. Retrieved from https://www.france24.com/en/20190603-paris-france-rich-poor-segregate-housing-renting-gentrification-yellow-vest-money-income

Home24. (2019). Home24 - your online furniture store. Retrieved from https://www.home24.de/

Innovating Canada. (2020). Calgary: canada's most adventurous tech city. Retrieved from https://www.innovatingcanada.ca/business-and-economy/calgary-canadas-most-adventurous-tech-city/

Internet Live Stats. (2016). Germany internet users. Retrieved from https://www.internetlivestats.com/internet-users/germany/

Katz, B., & Nowak, J. (2018). How the once-struggling pittsburgh is reinventing itself as an innovation hub. Retrieved from https://nextcity.org/daily/entry/how-the-once-struggling-pittsburgh-is-reinventing-itself-as-innovation-hub

Kaufmann, B. (2020). U of c shifts to online instruction, but campus remains open. Calgary Herald. Retrieved March 2020 from https://calgaryherald.com/news/local-news/university-of-calgary-suspends-classes-due-to-covid-19-threat/

Konecny, D. (2015). The diversification of denver's economy. Colorado Real Estate Journal. http://essexfg.com/uploads/2015-07-21-crej-downtownoffice.pdf

Leaders in tech summit. (2020). Harness disruption to help drive digital transformation. Retrieved from https://tmt.knect365.com/leaders-innovation-summit/

Loizos, C. (2019). Atomico vcs say that 'everybody cares' in europe where the startup dollars Are coming from. Retrieved from https://techcrunch.com/2019/12/26/vcs-from-accel-and-softbank-talk-europes-startup-scene-what-they-expect-in-2020-and-the-future-of-softbank/

London Tech Week. (2020). Be part of the future. Retrieved from https://londontechweek.com/events

Martin, B., Martin, U., Loffler, M. (2019). Why did income inequality in Germany not increase further after 2005? German Economic Review, 20(4), 471 - 504. 10.1111/geer.12153

Maclean, R. (2016). Denver and calgary: a tale of 2 similar but very different cities. CBC. Retrieved from https://www.cbc.ca/news/canada/calgary/denver-calgary-comparison-1.3776682

McFarland, C. (2017). Mid-sized cities are the future of cities. Meeting of the minds. Retrieved March 27, 2020 from https://meetingoftheminds.org/mid-sized-cities-future-cities-three-reasons-23946

McKeever, V. (2019). Move over london- these are the best cities to live and work in. Retrieved from https://www.cnbc.com/2019/11/12/these-are-the-best-uk-cities-to-live-and-work-in.html

Mercer. (2020). Quality of living city ranking. Retrieved from https://mobilityexchange.mercer.com/Insights/quality-of-living-rankings

Metta, G., Maresca, M., Attardi, G., Benhamou, S., & Vayatus, N. (2018). The future of work. G7. Retrieved from https://www.ic.gc.ca/eic/site/133.nsf/vwapj/4_Discussion_Paper_-_The_Future_of_Work_EN.pdf/$FILE/4_Discussion_Paper_-_The_Future_of_Work_EN.pdf

Morning Future. (2019). Smart city? Milan is leading the game. Retrieved from https://www.morningfuture.com/en/article/2019/04/17/smart-city-milano-roberta-cocco/596/

Morelix, A. (2020). The impact of covid-19 on global startup ecosystems. Startup Genome. Retrieved from https://startupgenome.com/blog/impact-of-covid19-on-global-startup-ecosystems

National Robotics Engineering Center. (2019). Nsf funds research on a new genre of co-robotic games. Carnegie Mellon University. Retrieved from https://www.nrec.ri.cmu.edu/media/news-stories-pages/news-stories-2019/nsf-corobotics.html

NATI. (2019). Technology sector key to economic diversification and high-performing economy. Retrieved from https://www.nati.net/2019/04/16/technology-sector-key-to-economic-diversification-and-high-performing-economy/

Nawrat, A. (2019). Entrepreneur is a french word: investigating the french tech ecosystem. Verdict Media. Retrieved from https://www.verdict.co.uk/french-tech-ecosystem/

Naude, W. & Nagler, P. (2017). Technological innovation and inclusive growth in germany. IZA Institute of Labor Economics. Retrieved from http://ftp.iza.org/dp11194.pdf

Normand, G. (2019). French middle class under pressure, according to oecd. Retrieved from https://www.euractiv.com/section/middle-ground-politics/news/french-middle-class-under-pressure-according-to-oecd/

OECD. (2020). Countries. Retrieved from https://www.oecd.org/about/

OECD. (2020). Who we are. Retrieved from https://www.oecd.org/about/

OECD. (2019). Regions and cities at a glance - france. Retrieved from https://www.oecd.org/cfe/FRANCE-Regions-and-Cities-2018.pdf

OECD. (2018). Income inequality. Retrieved from https://data.oecd.org/inequality/income-inequality.htm

Partington, R. (2019). UK income inequality increasing as benefits cuts hits the poorest. Retrieved from https://www.theguardian.com/inequality/2019/feb/26/uk-income-inequality-benefits-income-ons

Partington, R. (2018). How unequal is britain and are the poor getting poorer? Retrieved from https://www.theguardian.com/inequality/2018/sep/05/qa-how-unequal-is-britain-and-are-the-poor-getting-poorer

PHMC. (2015). Railroad growth and development, 1830s - 1850s. Retrieved from http://www.phmc.state.pa.us/portal/communities/railroads/history.html

Point2 Homes. (2020). Bristol demographics. Retrieved from https://www.point2homes.com/US/Neighborhood/CT/Bristol-Demographics.html

Ramsey, K. (2003). The bristol coal industry. Retrieved from http://www.bris.ac.uk/Depts/History/bristolrecordsociety/publications/bha106.pdf

Randstad. (2019). 5 reasons why bristol is set to become europe's digital capital. Retrieved from https://www.randstad.co.uk/career-advice/work-life/tech-jobs-5-reasons-why-bristol-is-set-to-become-europes-digital-capital/

Roach, S. (2019). Aberdeen: a city gambling that oil and gas is still the future. Retrieved from https://www.desmog.co.uk/2019/02/24/aberdeen-city-gambling-oil-and-gas-still-future

Rojas, A. (2018). How to land a tech job in berlin. Retrieved from https://medium.com/ironhack/how-to-land-a-tech-job-in-berlin-bb391a96a2c0

Rocket Internet. (2018). What we do. Retrieved from https://www.rocket-internet.com/

Rocket Internet. (n.d.). Companies. Retrieved from https://www.rocket-internet.com/companies

Romoli, A. (2016). Welcome to milan: italy's biggest startup hub. Retrieved from https://magazine.startus.cc/milan-italys-biggest-startup-hub/

Sabatini, M., & Fratta, L., S. (2019). Preparing for Italy's 4.0 digital future. Retrieved from https://www2.deloitte.com/us/en/insights/focus/industry-4-0/italy-4-0-digital-future-technology.html

Scottish Government. (2018). Aberdeen city. Retrieved from https://statistics.gov.scot/atlas/resource?uri=http%3A%2F%2Fstatistics.gov.scot%2Fid%2Fstatistical-geography%2FS12000033

Scottish Government. (2018). City region deals. Retrieved from https://www.gov.scot/policies/cities-regions/city-region-deals/

Seskus, T. (2020). 'Agonizing': the prospect of a historic oil glut weighs on crude prices. Retrieved from https://www.cbc.ca/news/business/oil-prices-fall-below-thirty-1.5499208

Small, S. (2014). 10 urban agriculture projects in paris, france. Retrieved fromhttps://foodtank.com/news/2014/08/ten-urban-agriculture-projects-in-paris-france/

Smith, T. (2019). What is disruptive technology. Retrieved from https://www.investopedia.com/terms/d/disruptive-technology.asp

Smith, G. (2018). The aberdeen renaissance and how it survived being on the brink of disaster. Insider. Retrieved from https://www.insider.co.uk/special-reports/aberdeen-renaissance-how-survived-being-12883817

Startup Commons. (2020). What is startup ecosystem. Retrieved from https://www.startupcommons.org/what-is-startup-ecosystem.html

Startup Calgary. (2019). Calgary's coworking spaces, incubators and accelerators. Retrieved from https://www.startupcalgary.ca/startup-calgary-resources/2017/12/11/calgarys-coworking-spaces-incubators-and-accelerators

Statistics Canada. (2018). Information and communications technology. Retrieved from https://www150.statcan.gc.ca/n1/pub/11-402-x/2011000/chap/information/information-eng.htm

Statista. (2018). Distribution of gross domestic product (GDP) of the technology sector in Canada in 2015, by industry group. Retrieved from https://www.statista.com/statistics/733539/canada-tech-sector-gdp-distribution-by-industry/

Statista. (2019). Number of inhabitants of the city of paris. Retrieved from https://www.statista.com/statistics/542125/number-of-inhabitants-by-gender-paris-france/

Stauch, J., & Turner, A. (2020). From algorithms to altruithms: the fourth social purpose revolution. Retrieved from https://thephilanthropist.ca/2020/02/from-algorithms-to-altruithms-the-fourth-social-purpose-revolution/?utm_source=The+Philanthropist&utm_campaign=523deccab9-EMAIL_CAMPAIGN_2020_02_17_01_38&utm_medium=email&utm_term=0_5ad5e4eaea-523deccab9-23183049

Stephenson, A. (2020). Covid crisis endangers future of alberta's tech sector, advocates warn. Retrieved from https://calgaryherald.com/business/local-business/covid-crisis-endangers-future-of-albertas-tech-sector-advocates-warn/

Stephenson, A. (2019). Data is the new oil: laid-off energy workers get help retooling for tech jobs. Retrieved from https://calgaryherald.com/business/local-business/new-online-tool-aims-to-connect-laid-off-workers-with-careers-in-tech/

Subramaniam, V. (2019). Retraining oil and gas workers sounds like an easy solution but the reality is incredibly complex. Retrieved from https://business.financialpost.com/commodities/energy/retraining-oil-and-gas-workers-sounds-like-an-easy-solution-but-the-reality-is-incredibly-complex

Subramaniam, V. (2019). A tale of two alberta towns: one in the throes of a boom, the other mired in the energy downturn. Retrieved from https://business.financialpost.com/commodities/energy/a-tale-of-two-alberta-towns-one-in-the-throes-of-a-boom-the-other-mired-in-the-energy-downturn

Techstars. (2017). The digital ecosystem in milan. Retrieved from https://www.techstars.com/content/startup-weekend/digital-ecosystem-milan/

Techstars. (2017). Techstars is the worldwide website that helps entrepreneurs succeed. Retrieved from https://techstars.paris/

Toubal, F. (2016). The march of the techies: technology trade and job polarisation in france. Retrieved from https://voxeu.org/article/technology-trade-and-job-polarisation-france

Trading Economics. (2020). France - gini index. Retrieved from https://tradingeconomics.com/france/gini-index-wb-data.html

TT:Clear. (2017). Technological innovations for the paris agreement. Retrieved from https://unfccc.int/ttclear/tec/brief10.html

Trajkovska, B. (2019). Paris' startup ecosystem at a glance. Retrieved from https://www.eu-startups.com/2019/03/pariss-startup-ecosystem-at-a-glance/

Trajkovska, B. (2018). London's startup ecosystem at a glance. Retrieved from https://www.eu-startups.com/2018/11/londons-startup-ecosystem-at-a-glance/

The Accelerator. (n.d.). The accelerator. Retrieved from https://www.theaccelerator.tech/

The Collective 12|12. (2020). The collective 12|12 is a redefinition of coworking. Retrieved from http://www.thecollective1212.space/#home1

Tucker, L. (2019). Top 10 universities in paris. Retrieved from https://www.topuniversities.com/where-to-study/europe/france/paris/top-10-universities-paris

Usseglio, N., A. (2016). The north-south divide: regional economic inequality in contemporary Italy. UVM Honors College Seniors Thesis, 122, 1 - 27. https://scholarworks.uvm.edu/cgi/viewcontent.cgi?article=1137&context=hcoltheses

United States Census Bureau. (2020). Denver county, colorado. Retrieved from https://www.census.gov/quickfacts/denvercountycolorado

United States Census Bureau. (2020). Pittsburgh city, pennsylvania. Retrieved from https://www.census.gov/quickfacts/fact/table/pittsburghcitypennsylvania/PST045218

University of Aberdeen. (n.d.). Schools and institutes. Retrieved from https://www.abdn.ac.uk/about/schools-institutes/index.php

Vincent, J. (2017). Automation threatens 800 million jobs, but automation could still save us. The Verge. Retrieved from https://www.theverge.com/2017/11/30/16719092/automation-robots-jobs-global-800-million-forecast

Weber, N. (2018). Denver ranks among the top cities to live in, according to new report. The Denver Post. Retrieved from https://www.denverpost.com/2018/07/23/denver-top-city-to-live-in/

Wework. (2020). Hackescher markt - coworking space in berlin mitte. Retrieved from https://www.wework.com/buildings/neue-schonhauserstrasse-3-5--berlin

Williams, N. (2019). UK ranks third for innovation, disruption and technology. Retrieved from https://www.uktech.news/news/uk-ranks-third-for-innovation-disruption-and-technology-20190312

Wright, J., & Armas, L., E. (2019). Tech disruption in retail banking: uk banks embrace the tech race. Retrieved from https://www.spglobal.com/ratings/en/research/articles/191114-tech-disruption-in-retail-banking-u-k-banks-embrace-the-tech-race-11231579

World Population Review. (2019). OECD countries 2020. Retrieved from http://worldpopulationreview.com/countries/oecd-countries/

World Population Review. (2020). Gini coefficient by country 2020. Retrieved from http://worldpopulationreview.com/countries/gini-coefficient-by-country/

World Population Review. (2019). Berlin population 2020. Retrieved from http://worldpopulationreview.com/world-cities/berlin-population/

World Population Review. (2019). Milan population 2020. Retrieved from http://worldpopulationreview.com/world-cities/milan-population/

World Population Review. (2019). London population 2020. Retrieved from http://worldpopulationreview.com/world-cities/london-population/

World Population Review. (2020). Median income by country 2020. Retrieved from http://worldpopulationreview.com/countries/median-income-by-country/