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ALUMNI INSIGHTS
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Table of Contents

Editor's Letter

Here at Waterloo Business Review we have a three-fold mission: to engage, educate, and empower undergraduates to pursue their greatest potential. Through our online publication, we hope to provide content that will equip students with the business acumen to help them build their knowledge to thrive in a transforming professional environment.

We ensure that every single article that we share with you will provide thoughts on leadership and offer you valuable perspectives that you can apply to your everyday life.

Andrew Dai
Editor-in-Chief

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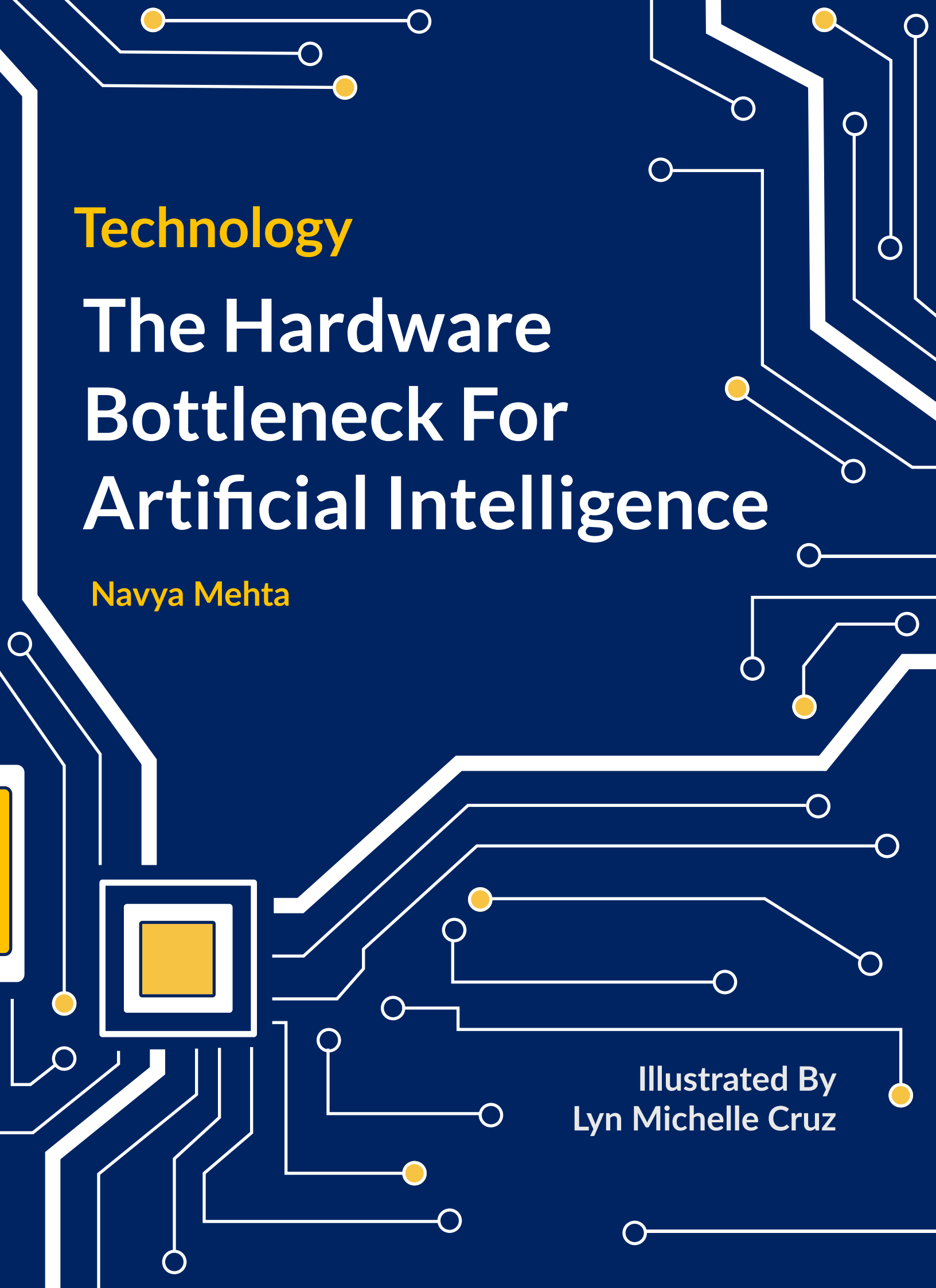
Technology

The Hardware Bottleneck For Artificial Intelligence

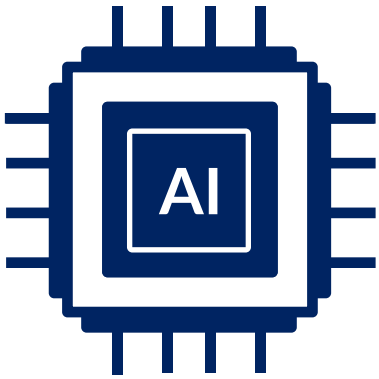
Navya Mehta



Illustrated By
Lyn Michelle Cruz

Research in AI has yielded models with complexities of increasing orders of magnitude to solve the world's pressing machine learning problems. The current state-of-the-art ranges from Facebook's M2M-100 model that translates over 100 languages to Google's BERT embeddings and more. However, this also leads to the demand for increased processing power for the algorithms to learn a larger number of variables, requiring better hardware infrastructure. With the demise of Moore's Law constraining speed-gains from the number of transistors on circuitry, to what extent does the future of AI research have a fundamental hardware bottleneck? We explore emerging trends that may dominate mainstream research by consequence: the intersection with quantum computing to gain new hardware capabilities and design hybrid quantum-based models, or even tinyML to miniaturize existing models for compatibility on low-power embedded systems.

AI's history can be traced to Pitts and McCulloch's work on simple artificial neurons performing logic functions that culminated in Minsky's basic neural net machine, SNARC, in 1951. In the aftermath of the Dartmouth Conference of 1956, more complex architectures were designed, including STUDENT and ELIZA which used large "semantic nets" to converse in English to Gerald Tesauro's TD-Gammon which leveraged temporal difference learning to analyze gaming environments. The complexity stems from the transition in the "layers" used in creating such models, from simpler single-input neural networks (Ivakhnenko and Lapa, 1967) to convolutions to process images for computer vision (Fukushima, 1980) and recurrent memory for sequenced data (Rumelhart, 1986). The depth and combinations of such features in a single network have significantly increased model training time to learn a vast magnitude of hidden variables.



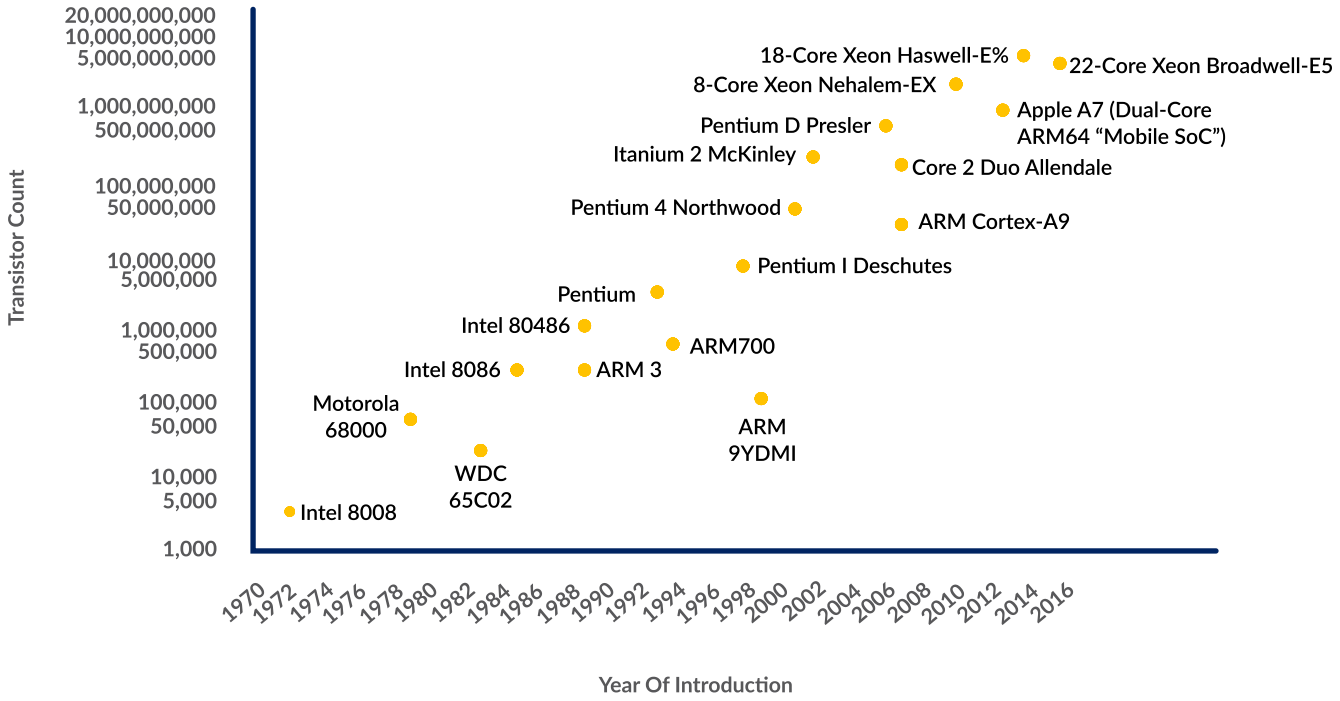
The above advancements in the size, complexities, and hyperparameters for deep neural networks have significantly outpaced research in semiconductor technology that is core to any hardware system, noted in studies by the University of Notre Dame. The growth of the internet

has made unparalleled amounts of unstructured data available to train such models, which further complicates these woes. As Shi (2019) illustrates, hardware platforms currently used like graphics processing units lack the computational bandwidth and memory energy-efficiency to continuously scale AI development in the future. Notable examples of increasing hardware requirements include DeepMind's AlphaGo Zero, the world's premier reinforcement-learning agent at the board-game Go which was trained on 4.9 million games against itself, requiring over 64 GPUs and 19 CPU servers, as compared to the chess model Fritz-3 in 1995 that ran on merely 2 CPUs. Alternatively, consider OpenAI's GPT-3, a 175 billion-parameter language model trained on over 410 billion word tokens, requiring theoretically 355 years to train on a single GPU. The size of state-of-the-art ML models grows exponentially each year, from GPT-2's 10 billion tokens in 2018 to GPT-3's 410 billion in 2020. On the other hand, GPU advancements are linear with NVIDIA's flagship GPU increasing memory size from 32 to 40GB over two years. Thus, a hardware constraint exists, which can not only impair future ML research but also immensely increase model training time, and is attributed to the degradation of Moore's Law.

Moore's Law, central to semiconductor design, claims that the number of transistors in a circuit, used as a proxy for hardware speed, would double every two years as seen in a historic trend from 1970 (Figure 1). While initial innovations by Bell Labs and Toshiba shrunk the size oftransistors by seven orders of magnitude in under five decades, fundamental limits have neared - the current 10 nanometer transistor size often means that the channel on silicon chips isn't always stable for current, causing electrical leakage. Thus, it is much harder to shrink transistors anymore as leakage threatens the chip integrity, limiting its carrying voltage and consequently processing power.

The constraint is further manifested in Dennard scaling- as transistors shrink, their power density remains constant which keeps the chip's power requirement in proportion with area and creates a barrier on speed. Hence, we are likely not going to witness the rampant innovation in transistor density seen since the 1970s, meaning that current hardware is unlikely to keep pace with requirements for AI research. This is particularly relevant since the availability of a mechanism to sustain future research is necessary to avoid an 'AI winter' which could otherwise stagnate advancements in the field. Thus, newer

Historic Trends In The Semiconductor Industry - Moore's Law (Roser, 2019)



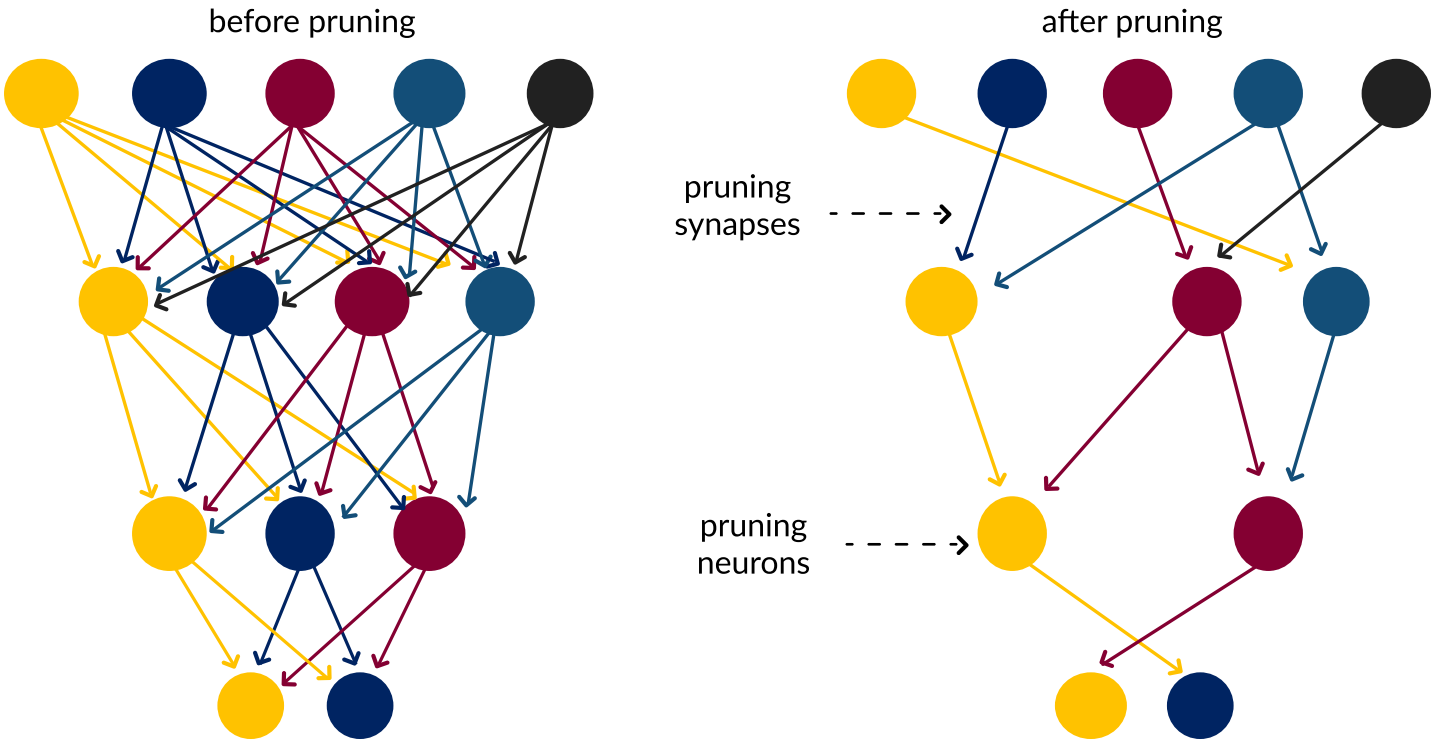
paradigms must be imagined. They are likely to concentrate on creating more powerful hardware with quantum computing or also designing a novel set of algorithms with lower hardware requisiteswith tinyML. Addressing the former, since the crucible of classical hardware lies in encoding information in binary as strings of 1s and 0s, can we rethink computing without this constraint? he human brain does not visualize decision-making as binary, but rather with uncertainty. Can we develop architectures that can similarly integrate this probabilistic measure in information processing, effectively birthing a newer generation of hardware? Instead of bits requiring transistors to be either on (1) or off (0), can they represent a probability distribution? This elemental question fast-tracked the Noisy Intermediate-Scale Quantum (NISQ) era where computing leverages superposition (the ability for objects to exist in multiple energy states simultaneously) and entanglement (an object's state instantly referencing another even over large distances to create dependencies). Such quantum phenomena use 'qubits' which can exist in superpositions with varied probabilities. Hence, particles can vary their probabilities over the course of quantum processes whilst interacting with distant particles in perfect unison by entanglement, seemingly

facilitating instant information processing. Such speed gains are evidenced by Google's quantum supremacy breakthrough, where their 54-bit Sycamore quantum chip performed a numeric computation task in under 200 seconds to beat a traditional computer's 10,000-year estimated run-time.

So, how do such hardware advances benefit artificial intelligence? Firstly, it would address the hardware bottleneck by drastically reducing training and inference times required to run neural networks in fields across computer vision, natural language processing and more. This facilitates novel research in the development of complex and resource-efficient models that scale effectively to large datasets. Hybrid "quantum-classical" models, popularized by Beer et al. (2020), offer such advantages seamlessly through Tensorflow Quantum (a novel open-source development framework). Secondly, it spearheads research into optimization problems whose sheer number of possibilities currently prevent empirical testing: what is the best order to assemble a Boeing airplane, consisting of millions of parts, to minimize cost and time? What is the best scheduling algorithm for traffic signals in urban neighbourhoods to reduce car wait times?

How can logistics like multiple dependent delivery routes be ascertained for lowest time-to-consumer?

Pruning Machine Learning Models for tinyML



Alternatively, instead of focussing on powerful hardware with quantum enhancements to "break" any existing any existing bottleneck, researchers expect AI literature published in the near future to instead be guided more by the "miniaturization" of current models to run on low-memory, low-power devices - the burgeoning field of tinyML. Drawing from Pete Warden at the O'Reilly AI Conference 2019, this newer paradigm of "data-centric" computing focuses on improving energy-efficiency, privacy, storage, and latency by leveraging IoT systems and the over 250 billion microcontrollers in use. TinyML attempts to rely on a three-pronged process (pruning, quantization, and encoding) to translate larger model designs to smaller versions that microcontrollers can effectively run. Pruning, shown in Figure 2, relies on removing model layers that have low impact on output, reducing model size with minor changes in accuracy. Since microcontrollers often support lower numeric precision than traditional GPUs, quantization reduces floating-point representation sizes (number of decimal

points) while Huffman encoding compresses model weights to achieve similar results with lower storage space such that it can subsequently be loaded by ML development platforms like Tensorflow Lite. These stages often miniaturize systems by an entire order of magnitude, like Microsoft's Bonsai algorithm reduced by 1:10000 with comparable precision, allowing a novel class of algorithms to be deployed to end-points.

What use-cases does tinyML bring to the forefront? Elementally, instead of machine learning being positioned as the final stage in a data pipeline, tinyML attempts to add intelligent nodes throughout the process. his has two critical impacts on the hardware bottleneck in question. Firstly, by "miniaturizing" models, hardware requirements are lowered and the bottleneck ceases to exist, allowing novel AI applications.

Consider real-time voice recognition ('Ok Google' or 'Hey Siri') which can deplete device battery in a few hours if the phone's main CPU has to always be active to recognize commands. Thus, initial tinyML curiosity led to developing low-power hardware that can run on a single CR2032 battery for over a year while hosting those advanced voice detection algorithms. Secondly, some processes can be moved

upstream in the pipeline for processing by these smaller models, reducing the dataset and thus the compute time for more conventional large-scale models to run downstream on traditional hardware. Consider a video surveillance and security system that often has large data-sets due to high frame-rates on a 24/7 recording. Advanced microcontrollers can be added to the control flow to run basic object detection and motion analysis (only save images containing an object of interest), scene segmentation algorithms (finding patches of the recording that are relevant), or upscaling/denoising such that the traditional threat assessment model now has lesser, more relevant data to operate on.

To conclude, the potent hardware constraint facing AI research stems from the demise of Moore's Law rendering hardware advancements inadequate to match increases in model complexity and data-set sizes that are involved in building

state-of-the-art AI models. Therefore, several emerging trends aim to dominate the research ecosystem by consequence, including novel quantum hardware to scalable high-compute algorithms and tinyML to deploy “compressed” models onto embedded systems. As each narrative enhances new use-cases, the future of artificial intelligence research stands at the cusp of a novel paradigm.

Business Strategy:

Business Models That Are Out of This World

The Future of Business in Space

Katrina Hermanns

Illustrated By
Victoria Ross

A Small Step for a Man, and a Leap Forward for the Space Industry

The space industry has evolved significantly since the first space program was founded in 1957. The technology used to launch rockets has advanced from intercontinental ballistic missiles to the International Space Station (ISS), advanced satellites and reusable rockets. Although the technological advancement that has occurred over time is impressive, there has also been a remarkable fundamental shift in the entities who are launching rockets, their philosophies, and their visions.

The original space programs were born out of World War II when Nazi Germany created the first long-range missile, and the Soviet Union and the United States formed their own missile programs in response. By 2018 a total of 72 governmental space agencies were actively researching and developing space technology, and 14 of them have the ability to independently launch rockets. The vision of these agencies was no longer to demonstrate their nation's technological prowess, but rather to contribute to the international effort to explore what exists beyond the earth's atmosphere. In recent years a more fundamental shift has taken place in the

space industry as the era of “New Space” has emerged. New Space can be defined as a cultural and philosophical shift toward greater privatization of space exploration businesses and activities. It is based on 3 concepts: lower prices, shorter development, and increasingly flexible methodologies. The New Space age has a fast paced, agile approach to technological development and has adopted some of its philosophies and methodologies from ideas that were born in Silicon Valley.

This cultural and philosophical shift was not a natural evolution initiated by governmental space agencies. Rather, it was brought on by private companies entering the market. Companies like SpaceX and Blue Origin had the capital resources to challenge the efforts of government space agencies and sparked a wave of new innovation within the industry. Following the lead of SpaceX and Blue Origin, many other private companies have entered the space industry, promising to deliver higher value results for a lower cost. These companies, regardless of size, typically focus on any one aspect of the space industry which could include direct exploration and colonization efforts, development of technology to decrease cost and increase the efficiency of space travel, or delivering services such as telecommunications and data collection.

Although the recent rapid innovation within the space industry is encouraging, the private companies operating in the space industry face a critical challenge. Unlike government agencies, they do not have access to low stakes, exploration-based funding - instead, they have investors to answer to and are expected to one day turn a profit. This raises the question of where private space companies should focus their time and efforts in order to build a profitable and sustainable business, while still satisfying the goal of commercializing space travel and colonization.

Transistor Count

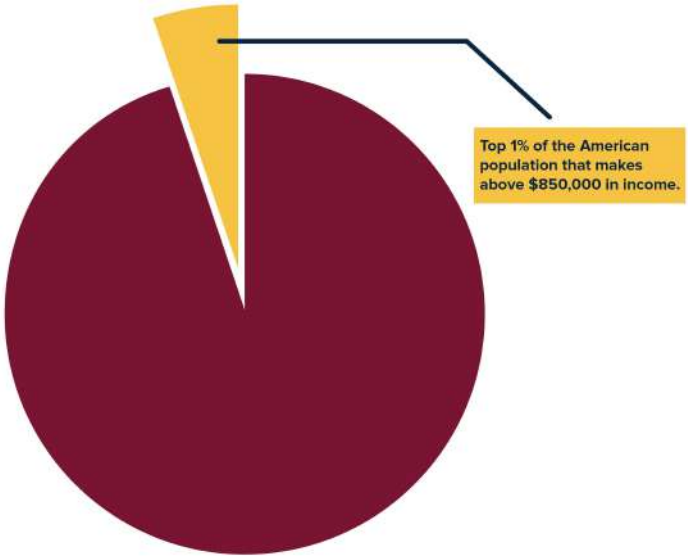
	Resources	Reimbursable Value	Annual ISS Resources
Available Immediately	Trash Disposal (Passive Cargo)	$3000 per kg	175 kg
	Conditioned Cargo (Round Trip)	$13,500 per kg	N/A
	Powered Cargo (Round Trip)	$18,000 per kg	N/A
	ISS Expedition Crew Member Time	$17,500 per hr	90 hrs
Available for Private Astronaut Missions	Regenerative Life Support and Toilet	$11,250 per crew per day	Available as needed
	Crew Supplies (Food, air, crew provisions, supplies, medical kit, exercise equipment, etc.)	$22,500 per crew per day	Available as needed
	Stowage	$105 per CTBE per day	Available as needed
	Power	$42 per kWh	Available as needed

Affordability of a Space Vacation

In June of 2019, NASA released a price list of what it would cost to vacation on the ISS. Although the prices shocked civilians who dream of one day visiting outer space, it also surprised many of the participants in the New Space age. Governmental space agencies have traditionally held the stance that space travel should be reserved for exploration and research purposes only, which directly opposes Space-X's and Blue Origin's mission to commercialize and colonize space travel. By releasing a price list, NASA indicated to the world that they have shifted their stance and are opening their hospitality to the general public. However, the opposition of governmental space agencies is not the only obstacle that civilian's face when trying to vacation in outer space. Space travel is expensive, and all of the costs fall on the customer who wants to visit space. NASA has said that it would cost $35,000 a night to stay on the ISS, but that is only after paying $50 million for the flight there (Elburn, 2019). Virgin Galactic projects that it will take more than 700 paying customers on their suborbital space flights (which reach an altitude of at least 80 km) in 2021, with a single ticket currently costing $250,000 (Davenport, 2019). However, Virgin Galactic has also said that this price is likely to rise.

"The high overhead costs of space travel not only shrinks the total addressable market to include a fraction of the 1%, but also forces companies in the space industry to keep their margins low until their costs can be decreased."

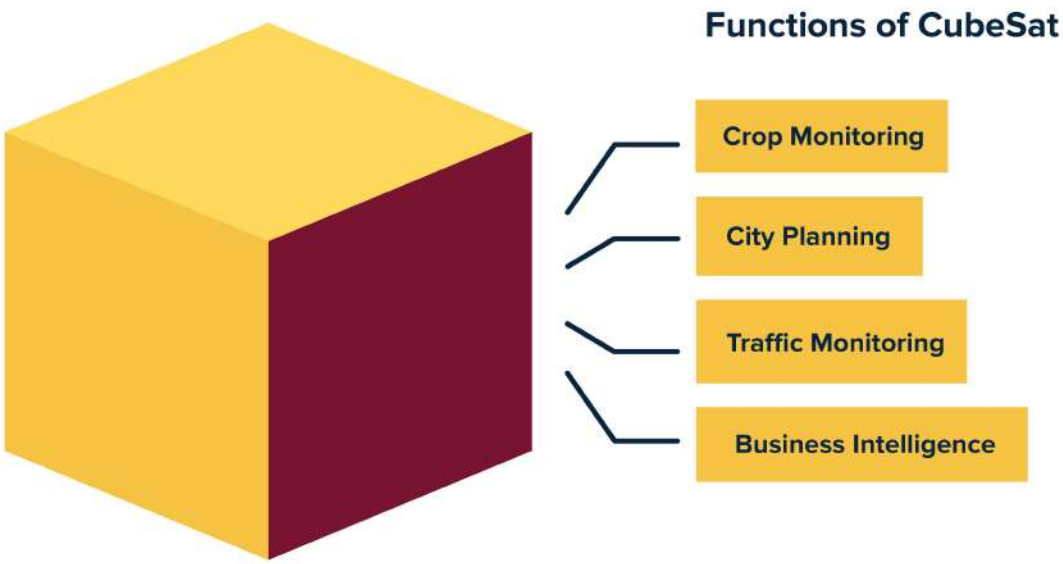
The prices listed by NASA and Virgin Galactic make it clear that commercialized space travel is not going to be accessible to everyone. By estimating a discretionary income allocation of 20%, only people who earn above $850,000 would have the means to purchase Virgin Galactic's tickets for a short flight outside of the atmosphere. According to income statistics provided by the Wall Street Journal, only 1% of the American population can afford these tickets. This raises the question of how lucrative and successful the business model will be, since the product is only accessible to a small portion of the overall population. Although there are many products and services that are priced outside of the general population's budget, such as exotic cars, the companies that produce these products have carefully priced them such that they have significant profit margins, which average about 40% of the sales price (Im, 2018). In the case of space travel, making 40% on a flight to the ISS which costs NASA $50 million would cost the consumer $70 million. The high overhead costs of space travel not only shrinks the total addressable market to include a fraction of the 1%, but also forces companies in the space industry to keep their margins low until their costs can be decreased.



In comparison to the commercialized travel sector, services provided by the space industry have quicker and potentially larger profit potential. These services include data collection and telecommunications operations such as satellite tv, internet and phone services. CubeSats, which are small satellites that operate in low orbit are used to collect or relay information down to earth. The cost of designing and manufacturing a CubeSat has declined 60%-80% since their invention in 1999,

and the cost to launch them has also decreased by 30% (Wharton, 2019). Additionally, the audience that has a need for, and can afford the services provided by a CubeSat is much broader. Farmers use satellite images to plan and monitor their crops, and commercial retailers like Walmart can also use imagery to gain insight into their own foot traffic, and the foot traffic of their competitors. Our daily processes on earth are increasingly driven by data, and space has the opportunity to provide us with more of it at a lower cost. One of the crop monitoring solutions currently available to farmers is IOT devices which are placed in soil and can cost hundreds of dollars per acre. For example, the leading American IOT brand is Phytech, and their solution costs $500 per acre. However, Farmers also have the option to pay approximately $1.62 per acre of land to monitor their crops via satellite, and studies have shown that satellite monitoring services decrease water and energy consumption by 10%, which has an equivalent economic benefit of $25.14 - $62.85 per acre, per year (Vuolo et al., 2015). When comparing the economics of the two solutions, the future of satellite monitoring looks the most promising.

When comparing the potential market of commercialized space travel and space-based services, it becomes clear that space-based services have the potential to address a larger market, provide economic benefits to other industries, and have larger profit margins by utilizing cheaper



technologies and mass production. Although commercialized space travel has an adventurous appeal, space-based services can act as the bread and butter for companies participating in the New Space age, and allow them to fund further research, exploration and commercial space travel.

"...space-based services have the potential to address a larger market, provide economic benefits to other industries, and have larger profit margins by utilizing cheaper technologies and mass production."

Applying Space Technology in Other Industries

Companies that focus on the commercialization of space travel also face financial challenges that are caused by the limited size of their total addressable market, and extended time to market. As previously discussed, the total addressable market for commercialized space travel is small, and when this challenge is paired with an extended time to market it becomes extremely difficult for companies to become profitable in an amount of time that investors would deem to be viable. The development of commercialized space travel involves an expensive research and development phase, as well as extensive testing, both of which create a long and costly time to market, and a period where companies incur significant losses. For example, Virgin Galactic reported a net loss of $63 million in the second quarter of 2020, and a net loss of $60 million in the first quarter of 2020 (Virgin Galactic, 2020). These losses are a result of the development and testing of their suborbital flight program, as they are currently in the testing and refinement phase.

Compared to business models that focus on commercializing activities in space, service based business models sit in a unique position where their direct total addressable market is much larger. They also have the ability to be more agile with their technology and apply it in other industries, which in turn increases their potential to generate revenue and creates a shorter time horizon to profitability as a result. NASA was able to demonstrate this approach with the development of cameras used on CubeSats. Eric Fossum, a NASA scientist, carried out extensive research to minimize the size of cameras. As a result, he developed CMOS active pixel sensors which have revolutionized the digital

imaging industry. The pixel sensors have been used in various smartphone cameras, as well as the GoPro camera brand. Developing this technology not only helped to advance the camera technology used for satellite imaging, but also created an alternative revenue stream through licensing and commercial development of the camera technology. NASA was able to licence this technology long before its CubeSats were deployed, and thus were able to generate revenue before their core product was launched. Other examples of technology that was developed for outer space, but also generated revenue from other applications include LADARVision 4000 used in LASIK eye surgery, and microalgae nutritional supplements which are used in products made by Minute Maid, Horizon Organic, Kellogg and Yoplait (Space Foundation, 2020).

Ultimately the ability to apply technology in multiple sectors allows companies who focus on space-based services to build working capital at a faster rate and diversify their sources of income. This creates room to pivot, research and explore their niche in the space industry at a slower pace, as they are not completely relying on their singular product to drive them towards profitability. Although companies who are focused on the commercialization of space travel participate in research and development in order to decrease their operational costs, increase efficiency and improve safety, their progress has not been as widely applicable compared to service-based research. In each of the last 5 years, over 75% of the inductees to the Space Technology Hall of Fame have been the product of a service-based development, or advancement in the health of professional astronauts (Space Foundation, 2020).

The Need for an Ecosystem Approach

Companies that focus on the commercialization of space travel face the challenges of high costs, extended time to market, and limited ability to generate revenue through alternative technological applications. These characteristics limit their ability to capture outside funding, and decrease their probability of success. However, when taking a step back and viewing the space industry as a whole, the answer to these challenges appears to exist within the industry already. Service-based business models are able to achieve the low time to market, and early revenue streams that companies focused on the commercialization of space travel are looking for. In this situation, the application

of an ecosystem approach could create mutual benefits for both service-based and commercialization focused businesses, and allow the future of commercialized travel to look more promising.

"...applying an ecosystem perspective would mean identifying ways in which the service-based businesses and commercialization focused businesses could interact, and finding ways to generate value from those interactions."

An ecosystem perspective is defined as extending the traditional view of an industry and aligning parts of the industry that may interact in order for value to materialize. A common example of an ecosystem approach is the Ferrari brand. Although they produce a luxury vehicle, they have also recognized that their brand has a following of passionate fans. They were able to align the Ferrari brand and the Ferrari Formula One team with their fan's passion to produce a line of merchandise which produces an additional $2.5 billion in sales each year. Their merchandise revenue actually exceeds the revenue produced by selling vehicles (Robertson, 2020). In the space industry, applying an ecosystem perspective would mean identifying ways in which the service-based businesses and commercialization focused businesses could interact, and finding ways to generate value from those interactions. Although technology plays an important role in the space industry, it is not the only way these two business models can interact - the generation and flow of information and cash are also possible interactions. By using an ecosystem approach to couple the service-based and commercialization business models under one roof, companies who are participating in the New Space age and currently focusing solely on commercialization would be able to balance their time to market and generate multiple revenue streams, which in turn creates a quicker path to profitability. The company would be able to generate early revenues through the services they provide and alternative applications, which could then be used to fund the development of commercialized space travel. The technology developed for the service sector of the business may also be applicable to the commercialized travel sector, which allows the company to generate additional revenue from a single technology.

The ecosystem perspective recommends creating vertical silos within a development effort in order to better identify and organize technological advancements. The

silos help to identify commonalities between different sectors of a business - in the case of space, this would be across services, commercialization and alternative applications. This would allow for investors, managers and employees to directly see where technology advancements exist across the combined business and identify other industries where the technology can be applied more easily. An example of a vertical silo is fuel development. Spacecraft to launch satellites and transport humans need large amounts of fuel, and New Space companies could partner with other companies in the energy sector to focus on developing renewable and alternative fuels. The fuel technology developed in this silo would not only benefit the space industry, but also the energy industry.

If companies were to adopt an ecosystem perspective and subsequently change their business model to include sectors focused on services and commercialized travel, they could also create the opportunity for a new source of funding. NASA and other government space agencies are still playing a critical role in scientific advancement and research in outer space. However, they do not have the operational agility that private space companies like SpaceX do. In order to decrease their costs and keep up with the industry's rapid evolution, NASA has contracted private companies to provide them with technology and services. A recent example of this is NASA's contract with SpaceX to launch a satellite which will make the first-ever global survey of Earth's surface water (Heiney, 2020). This contract provides SpaceX with additional revenue to fund their eventual goal of colonizing Mars. However, including both service and commercialization sectors within their business model would allow government agencies the opportunity to not only fund them through the procurement of their rockets, but through satellites, data and other services too.

	Business Sector		
3D Printing Company	Filament Selection	Sales & Distribution	Engine Parts (i.e. Filters, seals etc.)
Space Company	Materials Engineering	Supply Chain Management	Propulsion
Energy Company	Oil & Gas drilling machinery	Distribution	Renewable Fuel

The Future of Business in Space

The New Space age encompasses new technology, philosophies and actors in the market as it is driven by a fundamental shift towards privatization. However, private companies do not have the exploration-driven funding that government space agencies do, and need to find a balance between innovation, and generating profits and long term sustainability. Building a private space company where the model solely focuses on commercializing space travel faces the challenges of a limited total addressable market, and a long and costly time to market.

In comparison to a $250,000 per space flight ticket, the service-based sector appears to be more grounded and realizable in the near future. The service-based sector is able to overcome the challenges faced by the commerilized travel sector as its services appeal to a wide array of other industries, some of which include agriculture and telecommunications. Space-based services also have a quicker time to market, as they not only bypass the extensive safety testing that the commercialized travel sector must perform, but they are able to generate alternative revenue streams by extrapolating and licencing technology to other industries.

“The service based industry is able to address a large market and provide revenue stream early on, while commercialized travel appears to be a big-ticket item of the future.”

Comparing the commercialization and service based space sectors side by side leads to the realization that they complement one another. The service based industry is able to address a large market and provide revenue stream early on, while commercialized travel appears to be a big-ticket item of the future. By combining these two sectors within their business model, companies participating in the New Space age can generate the revenue required immediately to build and grow their business using services, and look to establish themselves as a long term competitor by developing commercialization technology and strategies. Using an ecosystem approach to do this will allow space companies to silo their overlapping efforts in services and commercialization. Siloing will allow them to better understand where they can generate value now, and where value may emerge in the future.An additional consideration for companies participating

in the New Space age is the potential that lies on collaborating with government space agencies. The complementary resources and knowledge will serve long-term benefits for the business in addition to helping private companies to strengthen their position among intense competition. NASA and SpaceX is a great example that sets a precedent in the merging of the public and private sector.

The space industry has evolved significantly since the first ballistic missiles in WWII, and will continue to move forward at a rapid pace. Private companies in the New Space age will need to decide where to focus their efforts in order to generate the revenue they need to survive, while also advancing space technology. Applying an ecosystem perspective to merge the service and commercialization sectors into one model will offer businesses the cash flow they require both now and in the long term, help them to contribute to the advancement of technology through innovation within the space industry and through cross-industry extrapolation. An ecosystem perspective would allow them to establish themselves as a long term competitor who provides services to those who need them on earth, and those who wish to travel beyond the atmosphere.

Business Strategy:

Has the Gig Economy Stopped Calling?

Joyce Ren

Illustrated By
Lynn Zhu

The history of the gig economy can be traced all the way back to 1915 when jazz musicians used the term "gig", referring to their performances. Since then, a lot of gig work has been mainly related to music and the performing arts. Fast-forward to 1995, data showed that 10% of all Americans were engaged in alternative employment; whether as temporary, contractors, or on-call workers. In our modern society, the development of apps has been a key catalyst in the immense growth of the gig economy in recent years, and the continued digitization and technological advancement will continue to accelerate the supply and demand for freelance and contingent workers.

So, what exactly is the gig economy? The gig economy is made up of workers who work short-term contracts or freelance work, which also includes self-employed workers, instead of the traditional full-time job.

A large portion of the gig economy are freelancers, who by definition are individuals that work for themselves, rather than a specific organization. Although they can take contract work from different companies, they are ultimately self-employed. Popular freelance jobs include advertising, IT consulting, transcription, and design & illustration.

The current gig economy is largely composed of millennials who want to pursue non-traditional careers with increased flexibility. However, will the gig economy continue to grow? EY, a multinational professional services firm, suggests "more than one-third of the US working population is officially part of the gig economy and it is estimated that figure will grow to more than a half in the next five years".

Beneficial for both employees and employers

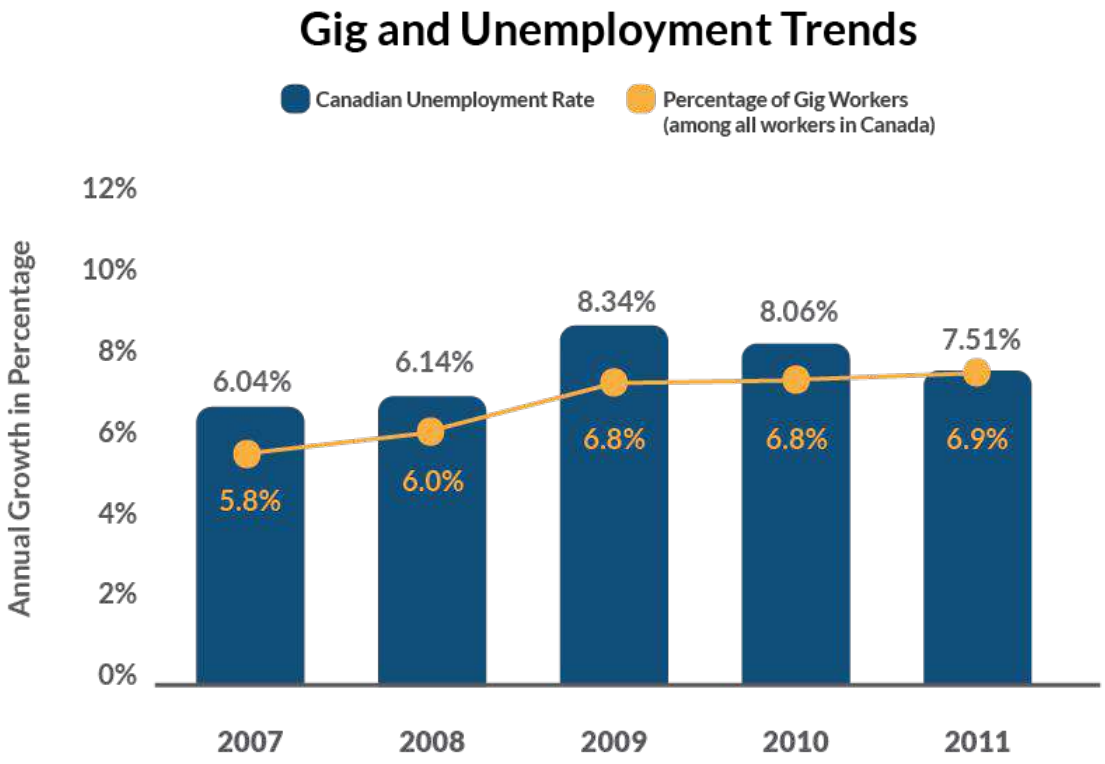
From an employee's point of view, jobs in the gig economy offer greater satisfaction largely due to the degree of autonomy that "gig jobs" offer. A report by McKinsey Institute stated that "Those who do independent work by choice (free agents and casual earners) report greater satisfaction with their work lives than those

who do it out of necessity". This statement applies to people from different countries, people of all income brackets, and education level. Free agents, meaning workers who do not have commitments restricting their actions, have a higher level of satisfaction than those holding traditional jobs involuntarily, "indicating that many people value the non-monetary aspects of working on their own terms." Statistics on the satisfaction of gig economy workers in the U.S in 2018 suggest 37% are very satisfied while 43% are somewhat satisfied, a fact which is likely largely attributable to their independence.

Another benefit is the flexibility that the gig economy offers. As individuals reach different stages of life, they often change their interests. The same can be applied to jobs: 80% of respondents to EY's survey listed increased flexibility to other commitments as a key benefit. Being flexible also meant that the gig worker can work anytime, anywhere. A research survey conducted by McKinsey found that "78% of gig workers say they're happier than those working traditional jobs, while 68% say they're healthier". The satisfaction that the workers felt appears to contribute to the gig economy's growing popularity. In addition, people are switching between job roles more frequently, as they recognize they may no longer need to stay in one position for a prolonged period of time. Furthermore, employers also do not have to commit high costs to retain gig employees. According to PayScale's 2020 Compensation Best Practices Report, 82% of companies gave increases to base pay in 2019—but two-thirds of those companies gave raises of 3% or less. Being flexible then allows employees to switch between jobs more easily and makes the employment process less costly for employers.

Some sectors suffered severely from the pandemic, with its flexible nature, the gig economy thrived as a result

Some sectors suffered severely from the pandemic, which has further contributed to the growth of the gig economy. The North American economy saw a similar phenomenon in response to the 2008 financial crisis, largely due to increasing levels of unemployment. In the U.S, approximately 9 million workers lost their jobs with the unemployment rate peaking in 2009, at 10%. During the crisis, unemployment led to more individuals beginning freelance work and taking on contractual positions to provide and earn income. According to Forbes, "The term 'gig



economy' was popularized around the height of the 2008-2009 financial crisis, since then the task-based labor has evolved and has become a significant factor in the overall economy". An article further stated that the ideal market condition for the growth of the gig economy is one where business and labor market conditions remain weak, with low business confidence and investment, interest rates near zero, negligible wages growth, and widespread under-employment". Similar to the 2008 financial crisis, the pandemic has left many unemployed, with others forced to make changes to their existing roles into freelance roles. Data showed that the percentage of gig workers increased from 6.0% in 2008 to 6.8% in 2009 as some of those who lost their wage employment during the recession were "pushed" into self-employment. COVID-19 had a similar negative economic impact, affecting both employees and employers. In the U.S, tens of millions of people have filed for unemployment insurance since the beginning of the outbreak, and benefits are being claimed at four times the rate. The pandemic has resulted in unemployment for many and these jobless workers have taken to offer services on a more flexible or part-time basis. The growing demand for verticals such as food delivery and transportation has led to greater momentum for the gig economy. There has been a rise in wages for some gig workers such as warehouse laborers, moving van

drivers, packers, and loaders. Reports say that wages in the gig economy have increased from $17/hr before the pandemic to $22/hr. From the business side, employers have become more receptive to gig workers due to their cost-effectiveness, reductions in operational costs, and ability to scale up operations.

But, what happens after the pandemic passes? Will this surge in the gig economy last? According to Upwork, a platform that connects freelancers to jobs, the “pandemic might usher in a new era of gig work”. Instead of phasing out with the pandemic, the gig economy may become an interim economy where employers need skilled workers but do not have the resources to bring them back full-time, turning white-collar workers to the gig economy. From an employee’s perspective, existing employees have an incentive to stay in the gig economy well after the pandemic because employers might offer better working conditions and benefits. Potential gig workers will also be attracted to participate for this reason. Partially due to the intense competition, companies will likely need to “step up and guarantee their workers safer conditions and likely better benefits'' if they want to continue operations and recover quickly once the pandemic is over. To do so, they will need to find ways to attract gig workers. In fact, in the state of California, situations are already improving for the local gig workers. Proposition 22 was a recent ballot measure that stated that app-based drivers should not be considered employees but instead are considered independent contractors. In other words, companies such as Uber and Lyft would not need to provide drivers the benefits an employee would otherwise receive. Prop 22 was the result of AB5, a California Assembly Bill which required companies who hired independent contractors to reclassify them as employees. Companies such as Uber and Lyft protested the law vehemently, “arguing it would eliminate driver flexibility, while also increasing consumer prices and wait times”. In response, companies proposed Prop 22, providing the “drivers and other gig workers with 120 percent of the state’s minimum wage, but only for hours when they have a passenger or are en route to a pickup.” Those active hours also apply to access to health insurance: gig workers who log 15 hours of active time a week are promised a health care contribution equivalent to 50 percent of the employer-provided average under the Affordable Care Act. Although the benefits are not provided without some restrictions, it is a step of improvement for the gig workers.

Drawbacks

A potential drawback arising from the pandemic may result in a deteriorating working condition for the gig workers. The pandemic hit the economy hard, resulting in an increase in unemployment and business closures. As more companies hire gig workers, competition within the gig economy as well as between different corporations could harm the worker's commissions and earnings. "The gig economy was booming and crowded with freelancers that wanted different revenue streams before the pandemic, and now it is at risk to become overcrowded". This could mean that due to the increasing competition among gig workers, businesses may intentionally decrease the employee benefits associated with the contract. This rise in competition may continue after the pandemic ends, as "companies have started to shift from full-time job offers to multiple gigs, side jobs, and temporary employees in order to save on wages and benefits as they try to recover as well". Companies also have an incentive to do so, largely due to a decrease in consumer demand and profit.

Even without a rise in labor supply, the current working condition of the gig workers is not ideal, this is a direct result of the immaturity in the government's regulations. A common example you might have heard is how employers are exploiting their employees; this could mean very low to no income stability, benefits, health insurance, and employer pension contributions for workers. Furthermore, employers have also been laying off workers when they contracted COVID. The pandemic has increasingly hardened many employer's opinions about the employment

status of gig workers, that they are only temporary. An article by Bloomberg reported that"the industry's critics looked at the last two months and saw a stark illustration of how the gig economy offloads costs and risk. "Uber and Lyft drivers who contract the coronavirus or lose their job quickly realize what they're missing" in terms of employment benefits." said California Attorney General Xavier Becerra in a statement". The immaturity of government regulations also results in lower tax revenue for the government as employers and employees find loopholes to avoid paying taxes. This is particularly true for self-employed gig workers. To begin with, their income is difficult to track since it "lacks the web of official reporting requirements that attends employment income." If all the self-employed were to be fully audited, the CRA "calculated, up to $3 billion more in taxes would be assessed." As more people enter the gig economy, the tax gap will likely increase due to an increasing number of tax invaders or workers who are simply unaware of the proper tax procedures. How to create, implement, and enforce tax regulations to minimize the tax gap is an issue that the government has yet to solve.

Advancing technology facilitate the growth of the gig economy

In modern society, technology plays an integral role in the gig economy, from enabling new business models, to create new roles for workers. The integration of apps and business models enabled companies like Uber, Lyft, and Airbnb to create jobs. These so-called digital platform businesses primarily use on-call contingent workers who use their own tools and equipment to carry out tasks associated with the supplied service.

Key Technology-Abled Companies

For instance, to carry out its main operations, Uber introduced a rider app where customers could request a ride, notifying a nearby driver, and displaying where the driver is in relation to the customer and the estimated time of arrival. The customer can choose to enter the desired destination before or during the ride. Once the trip stops, the fare is automatically deducted from the customer's account, making the process of

calling a taxi 'smarter'. Technological change and digitization of society have also created opportunities for freelance work in the gig economy. Companies are increasingly needing individuals for responsibilities such as graphic design, social media marketing, IT work, UI/UX design, and computer programming.

Technology has also facilitated the growth of the gig economy by improving the hiring process of gig workers. It does so by expanding the networks of employees and employers through online platforms. For instance, Fiverr is a platform for freelance professionals to connect with consumers. The platform that Fiverr created is a perfect opportunity to connect sellers to buyers and creates an efficient method for the exchange of freelance services and makes it easier for individuals to find and earn income from freelance work. As the use of gig workers increases, many companies have sought ways to better integrate their workers, improve their performance management process, mitigate compliance risk, and lessen administrative burdens. New technologies now can offer HR a more standardized view of all the full-time and contingent workers on one dashboard. This can help them manage their gig workforce more strategically since they will be able to "compare labor costs, worker availability, or skill sets" to maximize their talents. For HR managers who worry about compliance-related issues, some platforms clearly separate the independent contractors and full-time employees so they can apply the appropriate measures.

"As the use of gig workers increases, many companies have sought ways to better integrate their workers and improve their performance management process."

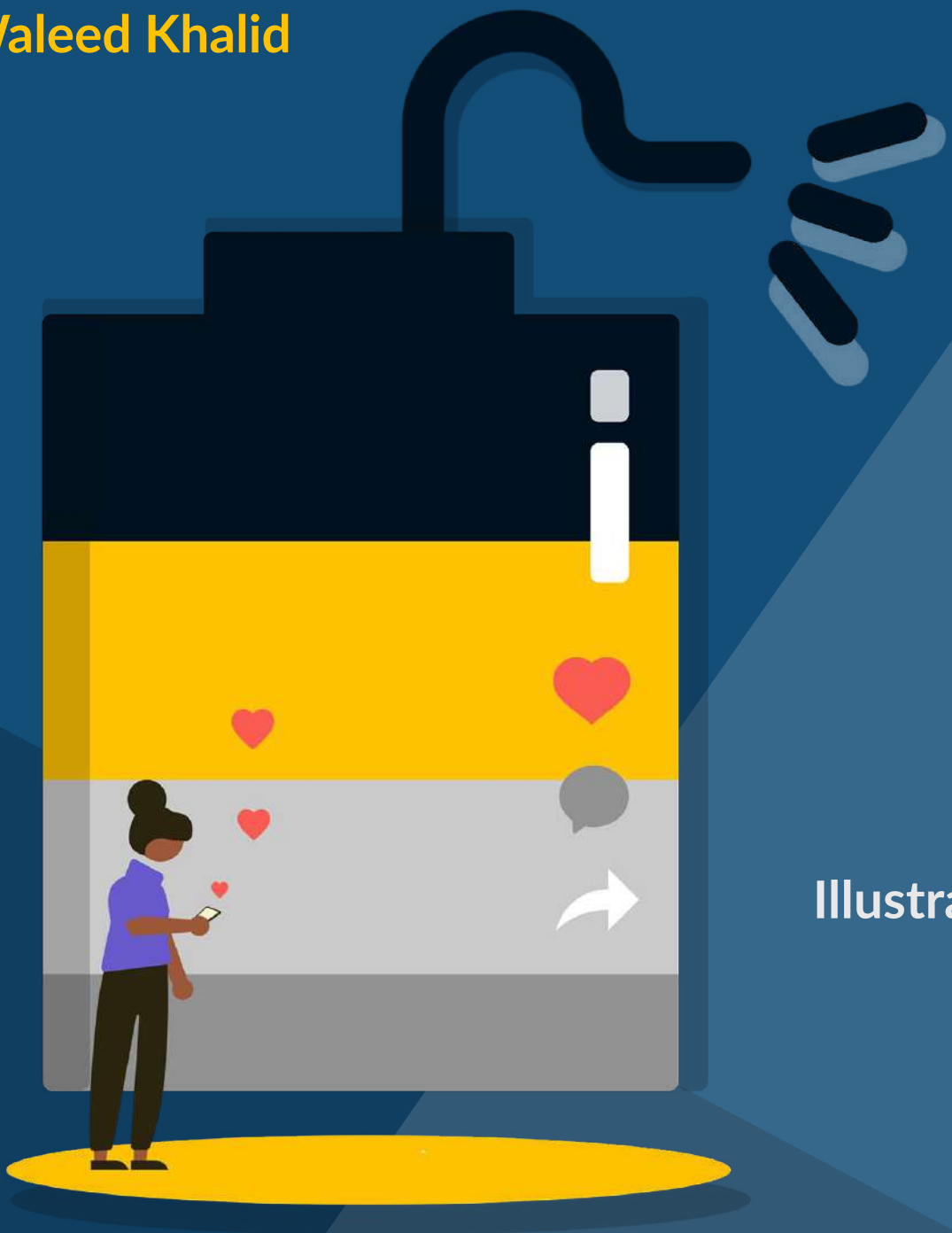
We believe that the gig economy will continue to grow because of its cost efficiency and flexibility. The current state of the economy also proves fertile for the growth of the gig economy, as well as the scalability offered by the ever-advancing technology.

However, the gig economy remains imperfect, largely due to the immaturity of government regulations and deteriorating working conditions for the gig workers. Nonetheless, the growth of the gig segment will inevitably prompt greater legislative recognition from governments, attracting more individuals to take part in the growing gig economy.

Business Strategy:

TikTok's Time Is Ticking

Waleed Khalid

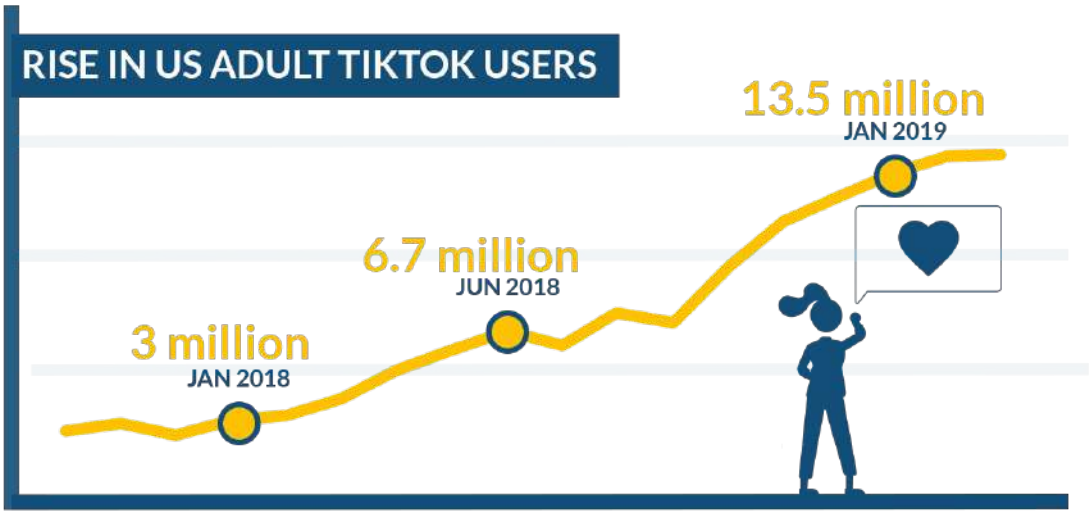


Illustrated By
Amy Li

Over the past year, TikTok has quickly become an integral part of pop-culture in many parts of the world, including the United States. The platform has provided a unique and trendy platform for comedy, activism and political satire. Recently, this growth has been challenged at the highest levels due to data concerns. Specifically, the US government has become a direct threat to the app's expansion as Washington has cited security concerns pertaining to national security. This has led to a highly speculated and forced divestiture as the US administration has outright ordered a sell-off of American operations. When considering the undertones and implications of the challenges the US division is to face, from political workings, stakeholders and drawing on similarities from the failure of Vine—TikTok's future is in question. As Tik Tok and many of its users have risen to stardom, a forced sell-off of American operations will hurt the app in the long run, leading to the failure of its American division.

As the concept grew in popularity, in 2017 the app expanded outwards and rose to top charts within key Asian markets including Thailand and Japan under the new name: TikTok. As the app saw great initial success and growth, the US saw the rise of a competing platform: Musical.ly. Later that year, Musical.ly was purchased by TikTok's parent company at a deal valued at $1 billion. By the summer of 2018, ByteDance announced the merger of apps TikTok and Musical.ly with all profiles being moved to the new and enhanced TikTok platform which would soon witness instrumental growth in global markets.

"Combining musical.ly and TikTok is a natural fit given the shared mission of both experiences — to create a community



where everyone can be a creator," Musical.ly co-founder Alex Zhu said at the time.

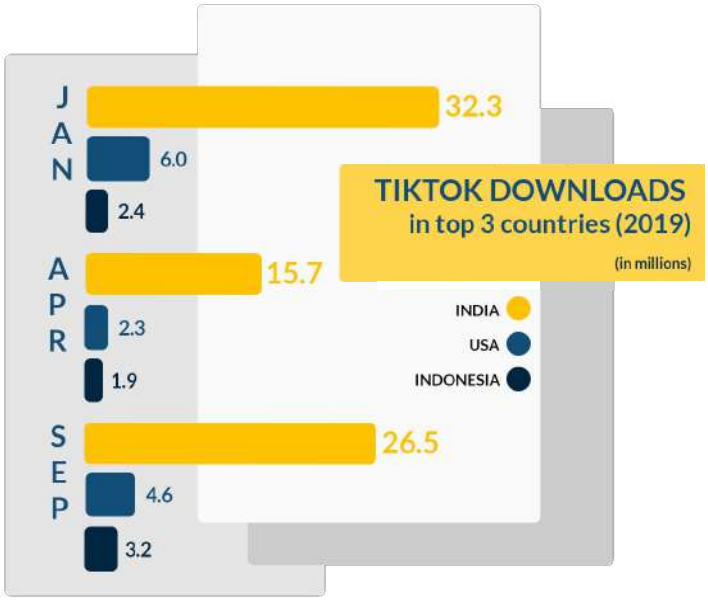
As of 2020, the app has amassed over 2 billion downloads, asserting itself and ByteDance as forces to be reckoned with. With this recent success, ByteDance has become the world's most valuable private company, receiving funding from some of the largest financial groups in the world including, Sequoia Capital, SoftBank Group, K3 Ventures and KKR. Globally, firms and investors are confident in TikTok with the heightened interest expected to further enable TikTok's growth and mission to leverage AI.

The app's unique implementation of AI has been interesting. TikTok's algorithm alone is credited with a lot of success, but trying to understand the complexities behind how TikTok is powered presents both opportunities and concerns. A user's "For You" page reflects user preferences and interests on a combination of factors ranging from user interaction with content, video information, activity and device/account settings—culminating in a new approach to content creation. The app has essentially taken factors and information to curate unique feeds for users which has in large part become why the app has grown in popularity. The way TikTok has encapsulated and used the information, however, has been under scrutiny across the world, especially in the US. In 2019, the US government launched an inquiry into ByteDance stemming from concerns of the app's usage of user data

and the potential access of the Chinese government. Specifically, 3 senators in the US led the charge for an inquiry into Bytedance by citing the app as a "potential counterintelligence we cannot ignore".

In China, the perception of US claims is seen as "bullying and extortion". ByteDance, now caught in the middle, has applied for licenses to streamline operations and tackle the challenges it faces in the US. Specifically, ByteDance in September applied for an export licence submitted to the Beijing Municipal Bureau of Commerce after China in late August updated its list of technologies that would be subject to export restrictions. For TikTok, this would be its algorithm and ultimately its operations overseas, such as the US. "Tiktok has found itself in the crosshairs of US lawmakers, who had raised national security and privacy concerns over ByteDance's ties to the Chinese government".

To further add fuel to the fire, an investigation by US officials concluded that TikTok violated the Children's Online Privacy Protection Act following several complaints with the Federal Trade Commission, resulting in a $5.7 million fine. Problems with governments don't end there. In the summer of 2020, in a highly politicized move, India banned TikTok and other Chinese apps. For TikTok, this is a sure cause for concern as the US market makes up almost 30% of the user base



During the summer, US officials reignited their concerns about the app, further suggesting a ban of the app as a way to mitigate cited concerns. President Trump explicitly expressed intent to ban the app as a way to punish China over politics. With the current US administration, the leading solution seems to be a divestiture of American operations. An executive order issued in August ordered ByteDance to sell American operations by Nov 12th, culminating in a deal with Walmart and Oracle being front runners to acquire the US operations, a deal still up in the air. This joint venture would be a combined 20% stake in a new company, TikTok Global with

80% of TikTok Global's board being American. In plans regarding post acquisitions, Oracle committed to hosting all US user data on its cloud platforms. Walmart has a vested interest because of its e-commerce presence, something TikTok has experimented with in the past year. Walmart is expected to "bring its omnichannel retail capabilities". In this bout, there is still a lot of uncertainty and looming court battles as the Chinese government is averse and simply will not agree to such a deal. Beijing is not comfortable with the forced sale and TikTok assets cannot be sold without China's approval.

Even with a sale, Walmart and Oracle would still have to abide by rules, conditions and guidelines the US administration sets out while also abiding with requirements from China and specific deal terms with Walmart and Oracle. Competing interests, requirements and politicization are inherently unprecedented and cannot support or further enable growth or even operations. One such example of competing interests is a proposed monetary reward for the US. In a political rally hosted by President Trump, the President expressed as part of the deal, the parties involved would "do me a favour" by establishing a $5 billion education fund out of this deal with the goal to teach American children "the real history of our country". With the hyper politicization alone, it's difficult to see a viable solution with current developments.

When considering the interests of Walmart and Oracle, it's hard to see how their potential control of American operations would solve anything, simply due to logistics, external factors and circumstances.

For Walmart, a stake in the TikTok app would allow the retail giant to establish a mobile marketplace driven by data and supported by stars and videos on the app promoting products.

Doug McMillan, Walmart CEO

"The acquisitions have received a lot of attention, but our plan in e-commerce is not to buy our way to success. The majority of our growth is and will be organic... So overall, we're making progress in providing the seamless shopping experience our customer's desire."

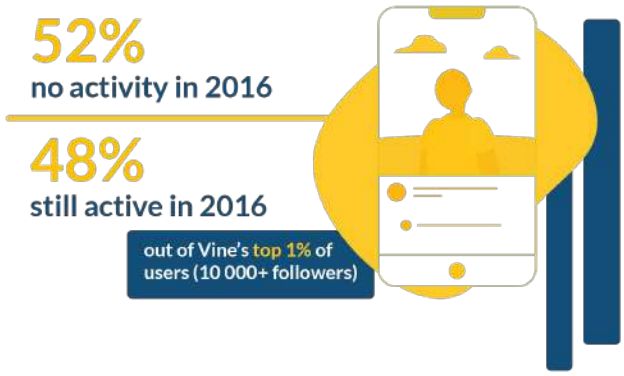
In the past few years, Walmart has been on a mission to compete with Amazon. A strategy driven by the concepts of e-commerce and digital marketplace. In 2018, Walmart paid $16 billion for a stake in an Indian online retailer, Flipkart. The company over the past few years has bought stakes and made similar acquisitions to drive their digital strategy. For Walmart, ownership of TikTok would enable the retail giant to further develop its own digital strategy and service offerings to customers. Paving a path to become the digital consumer platform it hopes to, in order to compete with Amazon. With Walmart's digital dash and TikTok's large user base in the US, data for Walmart on their consumers would prove to be invaluable as it can help gauge online habits. TikTok has been able to keep users on their app and keep them engaged. Walmart would be able to use this strength of TikTok to better understand users, converting them into lifelong shoppers. Ultimately, Walmart attributes its interest in TikTok to better-accessing consumers to enable their e-commerce and digital marketplace growth. Specifically noting the possibilities to "integrated e-commerce and advertising capabilities in other markets,", provided by the app. In Oracle's case, their reasons to pursue TikTok are more clear when it comes to business operations.

The world's second-largest software maker would benefit from data. Using TikTok's user data and social interaction would bolster Oracle's existing cloud, data and advertising businesses. The US administration expects Oracle to become TikTok's "secure cloud provider and host US user data", however, ByteDance has explicitly stated the company would not transfer its algorithm and technology to Oracle as part of the proposed deal. "The current plan does not involve the transfer of any algorithms and technologies. Oracle has the authority to check the source code of TikTok USA,"

If TikTok were to somehow divest operations, the involvement from the US government, reservations from China and conflicting business interests with a lot of uncertainty suggest troubles ahead. It simply is not plausible to foresee a future where a divestiture will allow the continued development and growth where all stakeholders and key decision-makers are pleased, which will only hurt the operations.

While TikTok has seen unprecedented growth, their ability to perform long term is in question. In fact, a very similar social media app that failed to perform long term serves as a red flag to TikTok's future.

Vine, the short-form video platform, launched in 2013 and climbed quickly to the top of the social media ladder. At it's peak, Vine had 200 million monthly users however they ceased their operations in late 2016. Similar to TikTok, Vine was new and quickly caught the attention of younger demographics through it's usage of short videos. The concept of those short videos was quickly replicated and integrated within other social media platforms. Ultimately, Vine failed as it lost market share to apps with less limitations but continued innovation and updates. As is, TikToK has many similarities to Vine, which previously failed. In order to grow and navigate its operations in the US, it's critical to draw from key issues, similarities and impediments Vine encountered. First, TikTok needs to improve its funnel. Similar to Vine and other social media apps, there is a fad phase which enables quick short-term growth. After which, innovation tapers- taking away from the user experience as new competition enters the market. TikTok has so far been able to keep users hooked by continuing to improve their algorithm and overall user experience on the app's platform. With new ownership for the American operations, Oracle would need to recreate the app's powerful and intuitive algorithmic feed to continue this. TikTok's team grew and evolved in a hyper-competitive environment where replication is imminent. Such a team enabled TikTok to get to where it is. Oracle's developers and management have simply not been in such a position where speed and innovation are critical to combat competitors and replication, specifically within the social app industry. Within the industry, key players are also influencers. Vine's relationship with and the ultimate lack of appeasement for influencers who garnered large followings was another reason for their failure. Celebrities and influencers ultimately seek opportunities where they can best gauge their audience and in turn, earn income. According to Daniel Saynt of casting agency Socialyte, Vine's lack of innovation and integration killed it, "The allure of it has dropped off completely."



Directly affecting influencers and their decisions. In a 2016 report by Markerly, the firm found that the top 50% of users on Vine frequently posted their content first

on other platforms such as Facebook, Instagram and YouTube. In 2016, CEO of Viral Nation (influencer marketing agency), Joe Gagliese said "Facebook and Youtube have much larger scale than Vine, so you can reach more people and make the most money there…[Lots of my clients] turned all their attention to Facebook because it allows for way better analytics and os always innovating which is what I feel Vine doesn't do,". In the US, TikTok currently does not offer users a direct way to earn money. Influencers are subject to leave if the audience and money is better elsewhere, which is something Vine experienced. Vine failed to develop an ecosystem for top creators and influencers. Specifically, Youtube and Facebook have also incentivized influencers onto their platforms and into their ecosystems by providing perks such as professional studio space, tools and education to help them reach more people in addition to offering social stars lucrative contracts to produce live videos. Further helping the influencers grow their following, brand and ultimately ROI.

Considering the actual operational challenges which TikTok will need to mitigate and overcome in the short-term to even enable their growth and stability in their US operations and attempting to manage the rapidly changing regulatory environments from countries across the world creates issues and uncertainty for TikTok's US operations. Finally, hyper-politicization and competing business interests within a potential divestiture of the US operations with Walmart and Oracle pose too many obstacles and barriers for the app to successfully divest its American operations. Further drawing on similar challenges Vine faced from their business model and operations, TikTok has too much going on and it's improbable for a US version of the app to succeed or even sustain itself now, and in the near future.

Exclusive Interview:

Mylene Tu And Lumaki Labs

WBR: All startups build their missions around a problem they first identified. Could you tell our readers more about your own story in entrepreneurship, and the mission behind LumakiLabs?

It's been an unconventional path for sure -- I never knew what entrepreneurship was before entering university. Waterloo has a large focus on building entrepreneurial mindset, and what drew me in was the ability it offered to make a social impact. You should always build something that will help people, and something that is solving a problem. Entrepreneurship isn't easy, especially when you're a student, and having that why in the form of a social impact piece helps you to keep going even when things get difficult.

Lumaki Labs is an edtech startup that builds software to make work-integrated learning easier. Our mission is to fill the gaps in education through experiences. We want students to have a clearer understanding of what their futures look like, with internships, co-op and experiential opportunities being key to that.

However, not all companies have been able to adapt to the virtual space. So, the idea behind Lumaki Labs really started when things started to shift online. Firstly, we realized that as a team of students, we're very privileged at the University of Waterloo to have such a big network to do virtual internships in general. Secondly, we wanted to treat this pandemic as a way to level out the playing field so that students can access opportunities. Virtual internships are a way to do that because you don't have to face some of those physical barriers.

The way that we drive this mission forward is we build software to make it easier for employers. Right now the product we're building out is a platform to help employers manage and track the progress of their interns, focusing specifically on the onboarding, tasks management side. By doing so, employers can better manage the interns they already have.

Could you tell us a little bit more about what it's been like to lead a team, where your product is in the product-development stage?

This semester, I actually took an e-coop to get the feel of what it's like to work full time on a business. There's this really great article by Paul Graham that talks about the maker versus manager schedule. It suggests

that a maker schedule is that of a typical developer -- where makers get into a flow state as they engage with and solve problems. As a maker, getting interrupted by meetings is a bad thing because it takes away from that process. A manager schedule is built by different little blocks of time which might involve intermittent meetings. Ultimately, you have to find a balance between the two to make things work. For example, on Mondays, Wednesdays, and Fridays I will dedicate to taking meetings, and on Tuesdays and Thursday is just for heads down work, whatever I need to do uninterrupted.

In terms of leading a team, it's tough because nobody teaches you how to do it. Every team you encounter is different. For me, it was about how I could build the culture I wanted to see in my company.

That meant some tough decisions. People don't really talk about the people management involved with being on the leadership team of a company. You're managing your team, your business advisors, and external stakeholders, which can be hard on you at times. People generally think that if you're a CEO, you're working for yourself. At the same time though, you're also tending to the needs of your team. Finding a balance between that and knowing how to make your decisions is tough, but the e-coop term has allowed me to learn more about that just through the exposure.

How has your background as an engineering student at Waterloo helped you in launching Lumaki?

Waterloo is the largest co-op employer in North America, so leveraging our identity as student engineers gave us a new level of credibility because we know what internships look like. For example, Gerry, our lead of technology is studying mechatronics engineering. At Lumaki Labs, he's been doing software engineering. The reason he's so passionate about the company is because these co-ops have given him an opportunity to explore beyond his academic career. I think that's the same for myself as well. The last 2

co-ops before starting Lumaki Labs were edtech start-ups, and that gave me the exposure to start my own company in the same space. It really came down to the hands on experience on that front. Similarly, myself and Fatimah are both in management engineering. Part of the tool we're building does entail internship management, so the education has helped us in developing that.

What role as Velocity and the Founder Institute helped Lumaki's growth and success?

We've been a part of a few different programs now, including the League of Innovators Lab Accelerator, the Epicenter Venture Woman Program, as well as the Founder Institute.

When I was working on Fem in Stem, I was also engaged with Waterloo's Velocity community, from their residence to their pitch competitions. We've also used the concept coaching program they offer, which has also been incredibly helpful. We've been very lucky to build an external network of support. Looking at the Founder Institute, we started the program five weeks ago, and the biggest takeaway has been the network effect. As an entrepreneur, being able to expand your network is key. That could mean having connections to people that have different domains of expertise, and or even getting introductions to new people in your industry.

What was the biggest challenge when it came to launching your business?

As a student entrepreneur, it has always just been balancing my time and learning along the way. As a student, you always feel like you have to prove yourself because you aren't finished your degree yet, and you might encounter imposter syndrome.

I was hesitant about doing an e-Coop to begin with because I thought I could just work in industry. But then I realized I would ultimately be aiming for a product management role anyways. I figured if I run my company, I am basically becoming my own product manager because I'll have a chance to ship a product that I have designed myself, allowing me to gain an accelerated experience in the role than if I were in industry. For me, my thought process is you just have to go out there and start learning because the biggest barrier is yourself thinking you're under qualified.

Do you have any advice for students and young women interested in pursuing their own entrepreneurial venture?

Firstly, always question why. Ask yourself: "Why your business?", and "Why should you be pursuing this idea?" Tying your business with a social impact will reap a lot of benefits long term because when things get tough you'll know why you're doing something.

Secondly, continue to ask that question but with other people. One of the best questions you ask somebody is why they decided to do something. For example, I was talking with this other founder in theeducation space and I asked him, "Why are you working in the education space?"

He told me this incredible story about how after undergrad he had to decide between pursuing a master's degree or pursuing a gap year. What he did was he made his own master's degree spending twelve months pursuing twelve different ideas and bringing them to life. Things like that allow you to find inspiration in new ways.

Finally, if you're a young entrepreneur, don't let people put you down or tell you that you're too young- whether that be before you've even started or after you've begun your journey in entrepreneurship. People will always have their own opinions, but at the end of the day you have the capability to look past those comments and make an impact.

To learn more about the Lumaki Labs and Mylene, you can visit their website at https://www.lumakilabs.com/ or connect with her on LinkedIn https://www.linkedin.com/in/mylenetu/

Waterloo Business Review aims to use the Alumni Insights initiative to gauge experiences and takeaways from past students and curate them into unique articles, ultimately supporting our mission to

Educate, Engage, & Empower.

Alumni Insights

waterloo-business-review

A School of Accounting and Finance Student-Run Initiative

WATERLOO BUSINESS REVIEW

Alumni Insights:

Passion, Breadth And Opportunity:

With Alumnus; Nitish Sharma

Illustrated By:
Lyn Michelle Cruz

Interview: Nitish Sharma, InstarAGF Asset Management Inc.

Waterloo Business Review had the privilege of sitting down with alumnus Nitish Sharma to speak to him about his experiences in middle market infrastructure private equity, management consulting, as well as his time at the School of Accounting and Finance (SAF). Nitish graduated from the Mathematics and Chartered Professional Accountancy (Math/CPA) program in Fall 2013 and is currently serving as an Associate Vice President at InstarAGF Asset Management in the middle market infrastructure investments group in Toronto. He previously worked as a Senior Consultant at Oliver Wyman in their Toronto office upon graduating from the University of Waterloo.

Early on, when considering possibilities regarding his post-secondary education, Nitish was looking for an opportunity to enter a program in Mathematics, a discipline and subject he deeply enjoyed. In addition to expanding his knowledge and developing his mathematical aptitude, Nitish also wanted to apply that knowledge within a business context, which brought him to the Math/CPA program at the University of Waterloo. Similar to many students, Nitish was unsure of his end goal when coming into school. However, he was quickly drawn to the world of accounting and became interested in the idea of working for a prestigious accounting firm, which ultimately led him to completing his four co-op placements with Ernst & Young (EY) in their assurance practice auditing financial institutions.

Although Nitish didn't continue working with EY when entering the workforce as a full-time professional, he credits the firm for providing him with the opportunity to further his business acumen. Additionally, Nitish mentioned, "Accounting knowledge truly forms the backbone of most things in not just finance, but the general business world. Being able to understand financial statements and how accounting was completed by the companies we were supporting, provided me with a leg up compared to my peers in better understanding client needs or evaluating deals." The skills and abilities Nitish developed as an auditor truly supported him in his time in consulting and complements his skill set now in private equity.

During his time at SAF, Nitish had the opportunity to work with and learn from influential individuals and was involved

with extracurriculars such as the Accounting and Finance Student Association (AFSA) and the hEDGE Financial Services Conference. He held multiple leadership roles within AFSA, including President during his third year. He explained that AFSA, "gave me the opportunity to take on leadership roles and work on my communication and relationship skills in a way that would not have been possible within the day to day academic experience."

Nitish also attributes his success to the University of Waterloo and the greater SAF community, as they played a key role in his growth and development. He explained, "Formally, the school provided lots of opportunities by way of in-class learning experience, the ability to participate in events such as case competitions, the Student Investment Fund, and plenty of sponsored conferences to learn about finance. However, the absolute highest value opportunity was that of the co-op program which I think offers outsized value compared to other schools, where you're given the option of working with a wealth of companies every term."

Through his experiences in SAF, Nitish discovered other interests and his career took a different path from what he had originally envisioned when he started working in the assurance practice at EY. He explained, "I learned that accounting was but one facet in the world of business and a good starting point to understand the backbone of all things finance, but not where I necessarily wanted to spend the rest of my career." He explained that he always viewed investing as interesting, which guided him towards participating in a variety of extracurricular activities like stock pitch competitions, the School of Accounting and Finance Student Investment Fund (SIF), and personal investing. In addition, Nitish also began thinking about his career more broadly and came to the realization that the CPA designation was something that he was not intending on using in the long run. As a result, he began preparing for a role within management consulting.

A career in consulting was enticing to Nitish because it gave him the opportunity to solve some of the most critical problems that C-Suite executives of major companies face. Additionally, consulting was a career that provided him with the opportunity to gain a breadth of experience which would help him to gain exposure to a variety of industries and elements of business. Furthermore, a career in consulting also greatly helped Nitish develop a

problem-solving mindset explaining, "Working in consulting results in a mindset where you're thinking of structuring problems to be able to effectively address them. Many companies can draw simple insights from data, but the management consulting mindset really does help provide clarity and draw true insights from the data that is provided."

After spending 3 years at Oliver Wyman serving financial institutions, technology, media, telecom (TMT), and non-profit clients, Nitish began to think about next steps in his career knowing that he was not necessarily best-suited for a long-term career in client services. With his interest in investing and desire to work in a buy side role at an investment firm, Nitish prepared for his second major career change. By leveraging his experience at Oliver Wyman, Nitish joined InstarAGF Asset Management Inc. as an Analyst in their middle market infrastructure private equity group in 2017, where he is now an Associate Vice President. With regard to his professional goals, Nitish hopes to continue to advance within the private investment field and is looking to expand his knowledge and technical ability within the deal making environment by taking on increasingly important roles within fundraising and other disciplines. When asked about how he measures success in relation to his goals, Nitish explained that it is very important for professionals to set goals and monitor their progress, but at the same time individuals must also evaluate other opportunities that are presented and keep an open-minded thought process.

In addition to the primary responsibilities in the various roles he has undertaken in his career, Nitish is also very passionate about creating social impact. He is currently a Director and Chair of the International Affairs committee for the World Parkinson's Program and also completed a non-profit project when he was at Oliver Wyman. When asked about how his career has helped him pursue this passion, he explained, "I would say my career has enabled skills in critical thinking, project management, and learning about how organizations work which has helped me navigate the environment of reaching out, securing, and helping fulfill medication needs for the various chapters I have worked with as part of the World Parkinson's Program." Nitish encourages students and young professionals with an interest in social impact to reach out to alumni and other professionals who've participated in charitable causes and seek opportunities to work with non-profit organizations through their employer. He

mentioned that accounting and finance professionals have strong budgeting and financial management skills that can be directly applied to the finance committees of non-profit organizations. Nitish also highlighted that balancing social impact and non-profit work with your career is not so much a balance as it is a prioritization. If an individual truly has a passion for social impact and providing meaningful change to the world, then they must make time for the causes they are interested in and put in the required effort to create the impact they will value.

Nitish also highlighted the significance of having a healthy work life balance in one's professional career. He elaborated to say, "It is always too easy to keep working for hours on end in the fields of work I am in. There are endless lists of tasks to complete and the people you might work for are often too busy with their own work to help you navigate what is high priority or not. I would say that maintenance of healthy work life balance comes through your personal prioritization and understanding of what you need to do versus what is nice to have. It may also result in times where you have to say 'no' to certain things or decide to push back." With regard to prioritization, Nitish mentioned that when he was an undergraduate student at the University of Waterloo, he would often try to do everything, whether that be participating in extracurricular activities, networking or competing in case competitions. As a result of his hard work, he was recognized by different organizations and professors at the university, but he was unable to maintain a healthy work life balance. He started to feel the effects of burnout and eventually had to turn down opportunities, but has since been applying various strategies to achieve a more healthy work life balance.

Looking back at his professional career and his time in the Math/CPA program at the University of Waterloo, one piece of advice Nitish would like to give current undergraduate students is to, "try and use the co-op experience as it is intended – to try out different things and think less about being at the top or in the lead of a specific company or area." In his personal experience, Nitish explained, "I thought it would be most important to quickly accelerate my career as an auditor, but now that I am in the workforce and have worked in three different industries and career paths, I realize that mindset is foolhardy because it would have hindered my growth in these other disciplines." Additionally, Nitish encourages students to heed the words of alumni and apply those teachings

and knowledge, "because the wisdom they are trying to impart is done with the goal of helping people navigate their careers." By doing so, students can avoid making the same errors as those professionals and can use their decisions to learn for themselves. Nitish also highlighted that students should understand that just because the options they see are available, doesn't mean that those are the only options out there. It is very easy to get caught up with predefined paths at Waterloo, but there are many opportunities to create your own path, as well.

September 2009

Began studies at the University of Waterloo in the Mathematics/Chartered Professional Accountancy program

January 2011

First of four work terms at Ernst & Young (EY) as a Staff Accountant within the Assurance practice - Financial Services & Insurance practice

September 2011

Elected President of the Accounting and Finance Student Association (AFSA), the largest business student society at the University of Waterloo, serving over 1500 students

June 2014

Began full-time at Oliver Wyman, Toronto, as Consultant covering Financial Services, TMT and Not-for-Profit consulting

November 2016

Appointed Chair of the International Affairs Committee for the World Parkinson's Program

September 2017

Began as an Analyst at InstarAGF Asset Management Inc., in Middle Market Infrastructure Investing

December 2020

Promoted to Associate Vice President at InstarAGF Asset Management, Inc.

Interview:

Measuring The Immeasurable:

With Entrepreneur; Aaron Paul

Illustrated By:
Lynn Zhu

Interview: Aaron Paul, TyltGO

Waterloo Business Review had the privilege of sitting down with former University of Waterloo student Aaron Paul to speak to him about his work experiences, his time in the Faculty of Engineering, and to gain insight into the world of entrepreneurship. Aaron was a student at the University of Waterloo from 2018-2019 in the Management Engineering program and is now serving full-time as the Co-Founder and Chief Technology Officer (CTO) with his company, TYLTGO.

TyltGO is an on-demand courier service, missioned to provide value to its three key stakeholders, enterprises, small businesses and drivers, done through the optimization and management of same-day delivery logistics to offer the best possible post purchase experience.. Beyond this, TYLTGO provides back-end data collection allowing for small businesses to strategically grow while also benefiting from competitive and cost-effective delivery solutions. TyltGO understands the challenges such businesses face and has a "reliable, flexible, fast, affordable and easy..." solution. With TYLTGO's quick growth and traction, now serving 10 cities in Southern Ontario, TYLTGO is looking to expand and deliver value-adding solutions.

Aaron came to the University of Waterloo knowing he wanted to start his own business and was captivated by the school's entrepreneurial culture which ultimately led him to the school. He largely credits the school for the avenues of learning it provided and further enabled. Specifically for him, it was the learning outside of the classroom that had the most impact of which was furthered by strong and ambitious peers. In his first year, his drive was further materialized on campus by seeing his peers work on complex problems with real-world applications. He knew Waterloo would be the place to start a company as he discovered friends working on a coding project. This motivated him to enhance his technical skills and he began pondering how to apply these skills to a business. His greatest takeaway was the importance and impact one's environment can place on an individual's skill development. Aaron highlighted the impact individuals can have when he explained, "One of the biggest things that the University of Waterloo brought me was the people."

Aaron's interest in entrepreneurship was further emphasized in his first co-op term, where he discovered his passion for impact. He explained, "I showed up at nine o'clock in the morning and left at five o'clock in the

evening because I didn't have any skin in the game. Whether I showed up the next day or not, [the company] would still move on. I didn't like that feeling and I wanted to have more impact. Launching and growing a startup really allows you to maintain impact at every level of the company, which is why I wanted to be an entrepreneur." During his first co-op, Aaron also met his partner Jaden Pereira

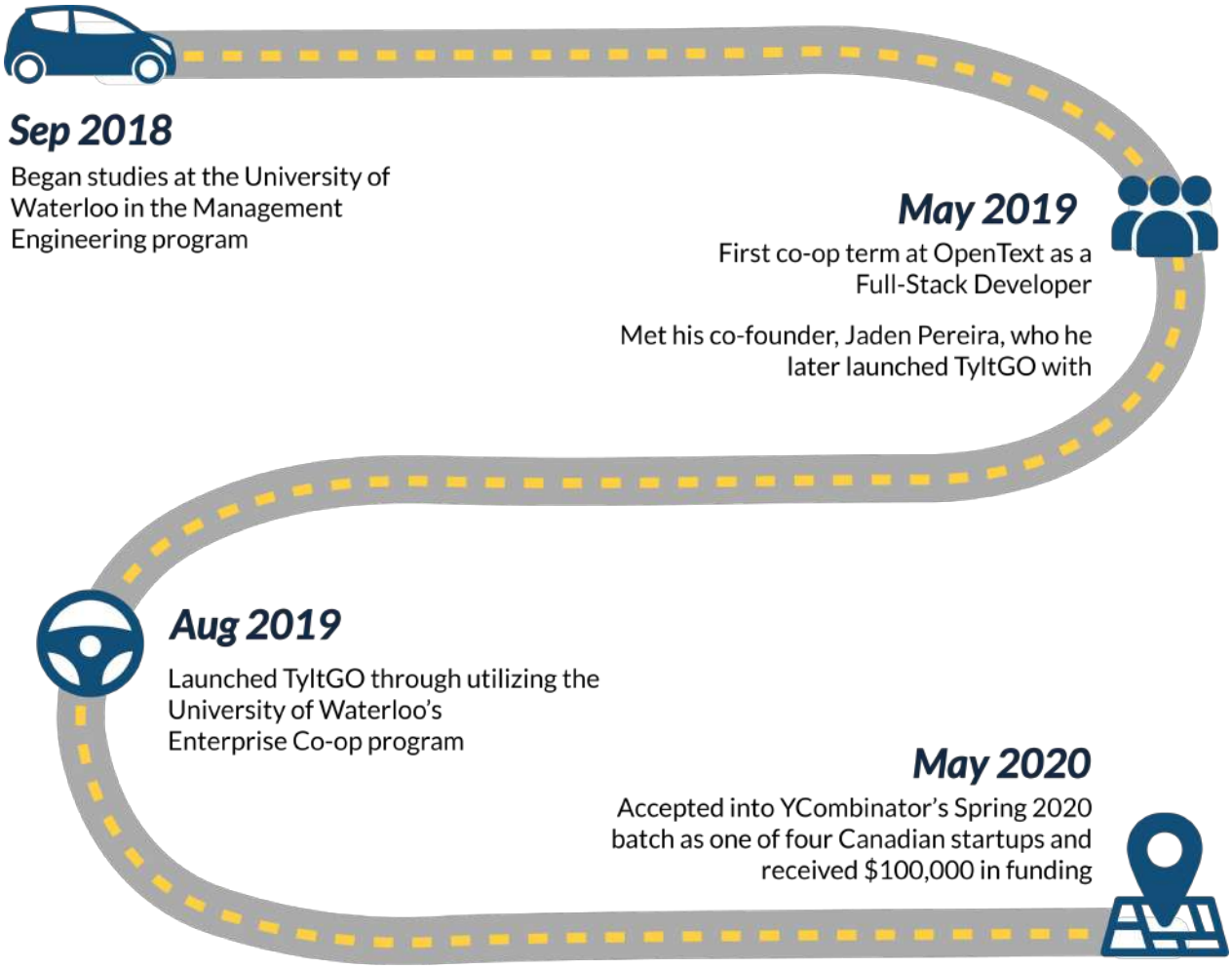
Leveraging the opportunities to learn, Aaron decided to opt for an Enterprise Co-op (E co-op). E co-op is an opportunity for students to pursue an entrepreneurial co-op offered through the Conrad School of Entrepreneurship and Business, at the University of Waterloo. Through this, he realized he wanted to work for himself and drive impact through entrepreneurship. Following his E co-op, he knew he wanted to dedicate himself to TYLTGO, knowing his education would serve as a barrier, Aaron took a leap of faith and invested full-time into TYLTGO. He explains, "We were gaining traction and I got to the point where I was nearing the end of my E Co-op where I was working on my own business and I knew that if I went back to school, the company would likely not continue." While first facing backlash from his parents, this was a necessary step in his personal, professional and business growth. Aaron explains, "this was a major hurdle that I had to jump personally in order to take TYLTGO to the next level."

In fact, before his first E Co-op term, he began researching current market trends before even meeting his future partner, Jaden. Aaron immediately knew that Jaden was the person he wanted to start a company with as he was extremely serious and dedicated to the idea. Jaden had already spun up something on Shopify and that's what showed me his seriousness and dedication. They started TYLTGO in August of 2019, with hopes of changing and improving the delivery industry by targeting small businesses in the Kitchener/Waterloo corridor, now serving more businesses than before including retailers such as Walmart. Although it took immense willpower and courage for Aaron to leave school and pursue an entrepreneurial venture full-time, Aaron has been able to gain knowledge and experience from his business that would not have been possible through any other co-op employers. In hindsight, he believes that starting his own business was the best decision because of the opportunity it provided him to learn more about current market trends and meet others with similar visions. Throughout this process, he kept his initial mindset and, along with his co-founder Jaden, continued taking on risks such as applying and getting Y Combinator funding,

which allowed the company to further expand into a more recognized name in the delivery industry.

Ultimately for Aaron, the impact is what keeps him going. The ability to control and manage his own business is what continues to provide him with motivation and continued inspiration. With regard to work-life balance, Aaron explained that he has so much passion for the work that TYLTGO does and the impact he is able to create as an entrepreneur that his work does not feel like work. However, Aaron also finds other ways to grow besides investing time in TYLTGO. Examples include engaging in personal

fitness activities in the morning and reading literature at night. When asked about advice he would give ambitious students, he emphasizes the importance of making a conscientious effort to meet amazing people. Without taking the risk to launch an idea, an idea is nothing more than just that.

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