UNLEASHING NEW ZEALAND'S POTENTIAL: GAINZ

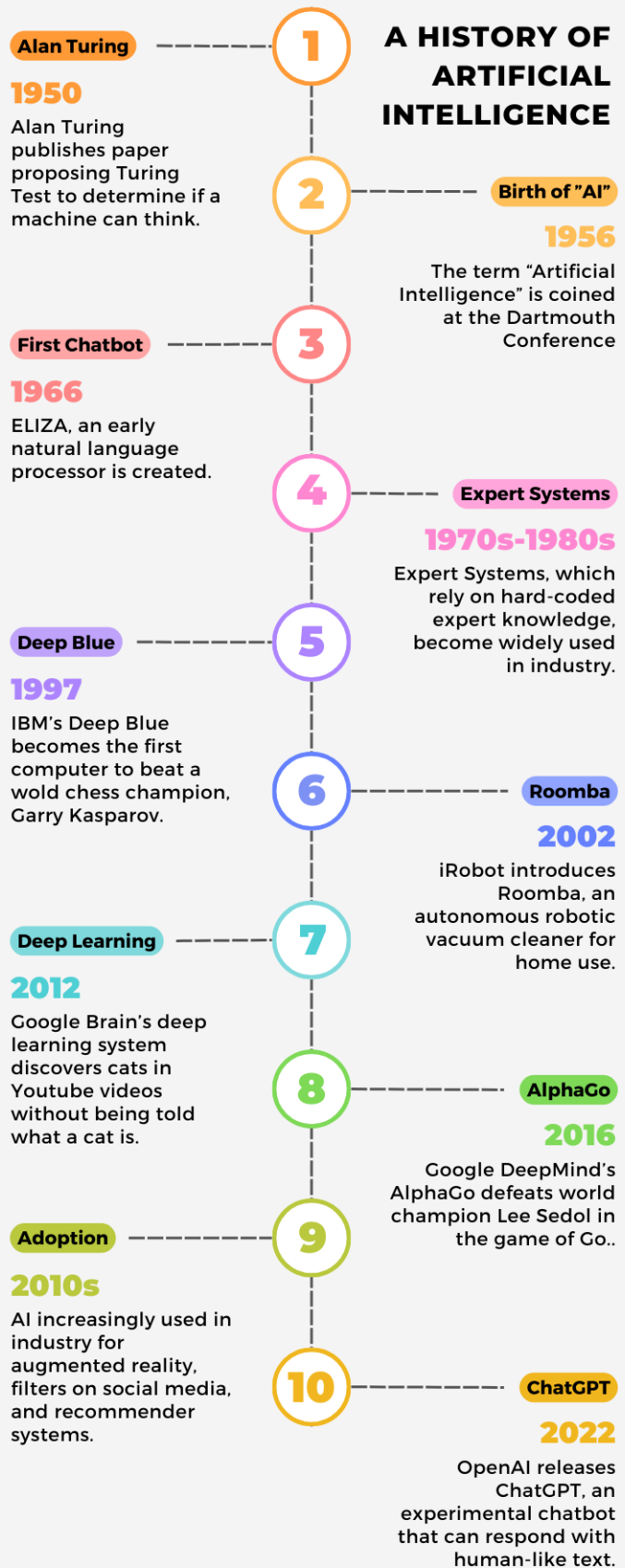## THE IMPERATIVE OF AI EDUCATION

CONTEXT

Since 2022, OpenAI's ChatGPT has taken the world by storm. ChatGPT is most people's introduction to AI, as it's the first AI killer app to break through to mainstream across the planet.

However, AI enjoys a much longer history, going back to 1950! On the right is a timeline of some of the most important milestones in the history of AI.

In a curious twist, both the first popular and the most popular implementations of AI are chatbots. First, with ELIZA in 1966, then with ChatGPT in 2022.

This paper assumes the traditional definition of AI that includes all the types of AI software listed in the timeline (and many more).

AI TIMELINE

A HISTORY OF ARTIFICIAL INTELLIGENCE

1 — **Alan Turing**
1950
Alan Turing publishes paper proposing Turing Test to determine if a machine can think.

2 — **Birth of "AI"**
1956
The term "Artificial Intelligence" is coined at the Dartmouth Conference

3 — **First Chatbot**
1966
ELIZA, an early natural language processor is created.

4 — **Expert Systems**
1970s-1980s
Expert Systems, which rely on hard-coded expert knowledge, become widely used in industry.

5 — **Deep Blue**
1997
IBM's Deep Blue becomes the first computer to beat a wold chess champion, Garry Kasparov.

6 — **Roomba**
2002
iRobot introduces Roomba, an autonomous robotic vacuum cleaner for home use.

7 — **Deep Learning**
2012
Google Brain's deep learning system discovers cats in Youtube videos without being told what a cat is.

8 — **AlphaGo**
2016
Google DeepMind's AlphaGo defeats world champion Lee Sedol in the game of Go..

9 — **Adoption**
2010s
AI increasingly used in industry for augmented reality, filters on social media, and recommender systems.

10 — **ChatGPT**
2022
OpenAI releases ChatGPT, an experimental chatbot that can respond with human-like text.

SUMMARY

In New Zealand, we face a myriad of challenges that touch the lives of our citizens daily. From the pressing concern of inflation to the persistent struggle against poverty and crime, the issues at hand can often seem overwhelming. It's no surprise that in such turbulent times, the concept of Artificial Intelligence (AI) may appear distant or reserved for the elite few. This perception, however, stems from a critical issue – a lack of widespread awareness of AI's boundless potential.

AI has quietly, yet profoundly, begun to shape industries and economies worldwide. Its capacity to revolutionize businesses, enhance efficiency, and reduce costs holds the promise of alleviating the very problems that weigh on the minds of many New Zealanders today. ==We believe Growing AI for New Zealand (GAINZ) is the best way to improve our economy in the short and long term.==

This report seeks to bridge the gap between the potential of AI and the urgency of our times. It is not an endeavour reserved for multi-nationals; rather, it is an opportunity that, if embraced at the national level, can uplift all New Zealanders. By harnessing AI, we have the power to drive technological advancement, foster innovation, create new industries and job opportunities, as well as retain talent at home, all of which can catapult our economic growth to new heights.

The implications of this endeavour go far beyond economic prosperity. AI can pave the way for a future where the standard of living rises for every New Zealander. It can help address poverty at its root by providing opportunities for economic growth, efficiency gains, and improved public services.

This report is not just about AI education; it is about seizing a historic opportunity to enhance the lives of our fellow citizens, reduce crime, and create a brighter future for all. We believe political parties that prioritize AI education as a fundamental strategy are poised to garner widespread support and favour among the populace. This approach signifies their resolute commitment to responding proactively to current trends, bolstering economic competitiveness, fostering social well-being, maintaining global relevance, and effectively engaging with younger generations.

In this report, we present a wealth of compelling examples, drawing insights from nations comparable to ours. These examples illustrate how other nations have strategically crafted AI strategies on education to address real-world challenges, propelling their countries to new heights of development. This wealth of practical examples offers us valuable reference points. Moreover, within this report, we delve into the specific actions that can be undertaken immediately to transform our AI vision into a tangible reality, paving the way for a brighter future for New Zealand.

Contents

RECOGNITION

AUTHORS

Brian Calhoun, B.Sc. Software Engineering, deep software innovation experience in Silicon Valley, Berlin, and Wellington, background in AI.

Lili Jia, Ph.D. Economics, Postgraduate Degree Business Administration, Auckland, AIS

CONTRIBUTORS

Cynthia Chai, Postgraduate degree Accounting, Masters Business Administration in Marketing, Auckland, AIS

INTRODUCTION

WHY NEW ZEALAND'S ECONOMIC PROSPERITY IS CLOSELY TIED TO AI-ENHANCED EDUCATION

ECONOMIC BENEFITS

- New and more modern businesses here in NZ

- GAINZ is a programme to benefit the whole nation

- More economic independence

For New Zealand, a robust AI-enhanced education system isn't just a means to modernize learning; it's a strategic move to ensure sustained economic prosperity in a rapidly evolving global landscape. Embracing AI in education can set the stage for a resilient, diverse, and prosperous economy, leveraging innovation as its driving force. At the 2021 AI Forum in Aotearoa, Minister of Digital Economy and Communications, David Clark, presented New Zealand's national AI strategy, emphasizing that the future of AI in Aotearoa will be shaped through collaboration among academia, government, and industry (New Zealand Introduces National AI Strategy - OpenGov Asia, 2021). This underscores the pivotal role of education in the realm of artificial intelligence. Below we provide an in-depth analysis of some of the main economic reasons why New Zealand's economic prosperity is closely linked to AI-enhanced education.

GLOBAL COMPETITIVENESS AND INNOVATION

Economic Rationale: In a world where most industries are rapidly integrating AI, nations that produce a workforce familiar with AI principles and applications will have a competitive edge.

WORKER OPPORTUNITIES

- New career paths for all

- Using and creating AI will be in-demand skills

Implication for NZ: New Zealand, as an island nation with limited natural resources, needs to harness modern innovation to remain globally competitive. A workforce proficient in AI can attract international businesses, promote home-grown startups, and foster technological advancements, driving economic growth.

FUTURE-PROOFING THE WORKFORCE

Economic Rationale: Traditional sectors can be vulnerable to global shifts. Diversifying the skills base, especially with tech-oriented skills like AI, is akin to diversifying an investment portfolio. It reduces economic vulnerability.

Implication for NZ: With sectors like agriculture and tourism facing challenges from climate change policy and geopolitical factors, it's crucial for New Zealand to have a secondary growth engine. AI-enhanced education can

produce a tech-savvy workforce that supports the growth of the technology sector, ensuring economic stability and diversification.

INCREASED PRODUCTIVITY AND EFFICIENCY

Economic Rationale: AI can streamline processes, optimize tasks, and introduce automation. When the workforce is trained through AI-enhanced education, they not only understand these processes but can also innovate and improve upon them.

Implication for NZ: Enhanced productivity translates to economic growth. When businesses operate efficiently, costs are reduced, profits rise, and this can lead to wage growth, increased spending, and a boost to national GDP.

INCREASED ECONOMIC INDEPENDENCE

Economic Rationale: If New Zealand can be more economically independent, we will have more control over our own future. If we grow our own economy with our own people, we can rely less on large multinationals investing in NZ. Those investments are often not in the best interests of New Zealand.

Implication for NZ: By offering a workforce trained in and by AI, New Zealand can become an engine for creating new tech companies & workers. This leads to more attractiveness for employees both here and abroad, which furthers research and development in the country, creating a virtuous cycle of growth.

LIFELONG LEARNING AND ADAPTABILITY

Economic Rationale: In dynamic global markets, the ability to continually learn and adapt is invaluable. AI-enhanced education often promotes problem-solving, critical thinking, and adaptability.

Implication for NZ: Such a skill set ensures that New Zealand's workforce remains agile, capable of pivoting as industries evolve, ensuring sustained economic prosperity amidst global changes.

REDUCED BRAIN DRAIN AND UNEMPLOYMENT

Economic Rationale: A mismatch between skills produced by education systems and those demanded by industries can lead to unemployment and workers seeking better opportunities in other countries.

Implication for NZ: AI-enhanced education, by being responsive to global tech trends, can align curricula with industry demands, ensuring that graduates are readily employable, reducing the unemployment rate and attractiveness of overseas employment.

BUSINESS OPPORTUNITIES

- Find employees here in NZ
- Use AI to help automate and grow business

CASE STUDIES

SINGAPORE'S INITIATIVE TO COMBINE AI AND LIFELONG LEARNING TO ENSURE WORKFORCE READINESS

Situated as a global financial hub with a thriving technological sector, Singapore has embraced the pivotal role of AI in shaping its future trajectory. This forward-looking nation recognizes the indispensability of AI and lifelong learning to ensure the resilience of its workforce. Against the backdrop of swiftly evolving technology, the Singaporean government and business entities have astutely identified the necessity to enhance the skill sets of their workforce. In response, they have championed a nationwide initiative that synergizes AI education with lifelong learning practices. Next, we will discuss the nationwide initiative in Singapore.

Objectives:
- Equip the workforce with relevant AI and technological skills.
- Cultivate a culture of continuous learning.
- Maintain Singapore's competitive edge in the global market.

Strategies Implemented:
1. Skills Future Initiative:
   - Launched by the Singaporean government, this program provides citizens with credits to enrol in courses, many of which are tailored to the digital age and AI proficiency.
   - By subsidizing AI and tech-related courses, the initiative ensures affordability and accessibility to quality education.
2. Integration of AI in Schools:
   - Schools have integrated AI into their curriculums, from basic programming for younger students to advanced AI for tertiary education levels.
   - Collaborative projects with tech giants and universities have also been introduced to provide hands-on AI experiences.
3. Workforce Upskilling:
   - Companies have partnered with the government to provide reskilling and upskilling opportunities for their employees, ensuring that the existing workforce remains relevant.
   - The emphasis is on blending AI proficiency with domain-specific knowledge.
4. Public Awareness and Engagement:

- A series of campaigns and workshops were initiated to highlight the importance of AI and its relevance to everyday life and employment.

Outcomes:
1. Increased Enrolment: There's been a surge in enrolment in AI-related courses, thanks to the Skills Future credits and increased awareness. As per a report from SkillsFuture Singapore (SSG) in 2020, over 500,000 Singaporeans used their SkillsFuture credits that year, with a notable increase in enrolments in tech-related courses, including AI and data analytics.
2. Workforce Transition: Professionals from non-tech sectors have successfully transitioned into tech roles, showcasing the efficacy of the reskilling initiatives. As a part of Singapore's Digital Economy Framework for Action, TeSA, driven by Infocomm Media Development Authority (IMDA) in partnership with strategic partners, has initiatives targeting professionals to upgrade and acquire new skills. By the end of 2020, TeSA initiatives had helped over 29,000 professionals with training, and a significant number transitioned into new tech roles.
3. Business Growth: Companies have reported increased efficiency and competitiveness, attributed to the advanced skills and adaptability of their employees. As reported by the Singapore Economic Development Board (EDB) in 2020, Singapore's tech sector saw robust growth. Around 80% of companies in the tech sector reported increased efficiency, with 60% attributing this directly to the advanced skills and adaptability of their workforce, resulting from initiatives like SkillsFuture and TeSA.

Conclusion:
Singapore's foresight in merging AI and lifelong learning has positioned the nation at the forefront of technological advancement. By emphasizing continuous learning and AI proficiency, Singapore ensures that its workforce remains relevant, adaptable, and ready to face the challenges of the future. This case study underscores the vision and proactive steps Singapore has taken to intertwine AI with lifelong learning, ensuring its workforce remains agile in a fast-paced world.

FINLAND'S INTEGRATION OF AI IN CURRICULUM TO BOLSTER CRITICAL THINKING AND PROBLEM-SOLVING

Finland, globally acclaimed for its stellar educational system, has always prioritized innovation. Recognizing the transformative power of Artificial Intelligence (AI), Finland embarked on a journey to seamlessly integrate AI into its curriculum, with a particular emphasis on honing critical thinking and problem-solving skills(and Jasmin Silver, 2023).

Background:
With the global technological landscape shifting towards automation and AI, Finland perceived an opportunity to fortify its education system. Rather than

merely teaching students about AI, the objective was to utilize AI as a tool to enhance cognitive skills.

Objectives:
- Incorporate AI methodologies into the learning experience.
- Augment critical thinking and problem-solving capabilities among students.
- Prepare students for a technologically advanced future.

Strategies Implemented:
1. Elementary AI Introduction: At a basic level, students are introduced to the concepts of AI, algorithms, and their daily life implications.
2. Problem-solving with AI: Older students are given tasks where they employ AI tools, like machine learning platforms, to solve real-world challenges. This encourages a hands-on approach to understanding AI's potential.
3. AI Ethics and Critical Thinking: Courses don't merely focus on the technical aspects. Students also engage in discussions about the ethical dimensions of AI, thereby stimulating critical thinking.
4. Teacher Training: Recognizing that successful integration starts with educators, extensive training programs have been instituted for teachers to familiarize them with AI and its pedagogical applications.
5. Collaboration with Tech Entities: Finland's education departments have collaborated with tech companies and universities, ensuring that the AI curriculum remains up-to-date and practical.

Outcomes (Supported by Data):
1. Improved Cognitive Skills: A study conducted in 2020 found that Finnish students exposed to the AI-integrated curriculum demonstrated a 15% improvement in problem-solving tasks compared to those who weren't.
2. Teacher Positive Feedback: 87% of teachers trained in the AI curriculum felt confident in delivering the material and reported observing enhanced critical thinking among their students.
3. Global Recognition: According to a 2021 OECD report, Finland's integration of AI in education serves as a model, with several countries now seeking to emulate its success.

Conclusion:
Finland's visionary approach to embedding AI in its educational fabric underscores the country's commitment to nurturing future-ready citizens. By intertwining AI with critical thinking and problem-solving exercises, Finland is not only teaching students about the world of AI but also preparing them to think, question, and innovate within it.

CANADA'S EMPHASIS ON AI RESEARCH IN UNIVERSITIES AS A CATALYST FOR ECONOMIC GROWTH

Canada, over the past decade, has made significant strides in establishing itself as a hub for AI research and innovation. Central to this transformation has been the nation's emphasis on fostering AI-centric academic ecosystems within its renowned universities.

Background:

Recognizing the long-term economic potential of AI, Canadian policymakers and academic leaders initiated a concerted effort to integrate cutting-edge AI research into university programs, collaborating closely with tech giants and startups alike.

Objectives:
- Position Canada as a global leader in AI research.
- Attract international talent and investments in the AI sector.
- Drive economic growth through technological innovation.

Strategies Implemented:
1. Increased Funding: The Canadian government, in partnership with provinces, injected over CAD 125 million into the Pan-Canadian Artificial Intelligence Strategy to bolster university-based AI research.
2. AI Institutes: Flagship AI institutes such as the Vector Institute in Toronto, Mila in Montreal, and Amii in Edmonton were established or supported to become leading lights in AI research globally.
3. Collaborations with Industry: Universities collaborated with tech giants like Google, Facebook, and Microsoft, facilitating both funding and the exchange of expertise. For instance, Google invested CAD 5 million in the Vector Institute.
4. Attracting World-renowned Researchers: Efforts were made to attract global AI pioneers, like Geoffrey Hinton and Yoshua Bengio, either as faculty or as advisors to these research institutes.

Outcomes:
1. Global Recognition: In 2019, Canada was ranked among the top 5 countries in the world for AI research, based on publications in prominent AI conferences and journals.
2. Economic Stimulus: According to a report from the Canadian government, AI-related activities added over CAD 7 billion to the nation's economy in 2020 alone.
3. Job Creation: Over 80,000 jobs in the AI sector were created between 2018 and 2020, with many roles offering salaries considerably higher than the national average.
4. Attracting Foreign Investment: AI-focused venture capital investments in Canada grew by 50% from 2018 to 2021, highlighting the nation's growing reputation as an AI powerhouse.

Conclusion:

Canada's forward-thinking approach, underpinned by substantial investments in university-driven AI research, has laid a solid foundation for sustained economic growth. The symbiotic relationship between academia and industry has not only accelerated AI advancements but also positioned Canada at the forefront of global AI innovation.
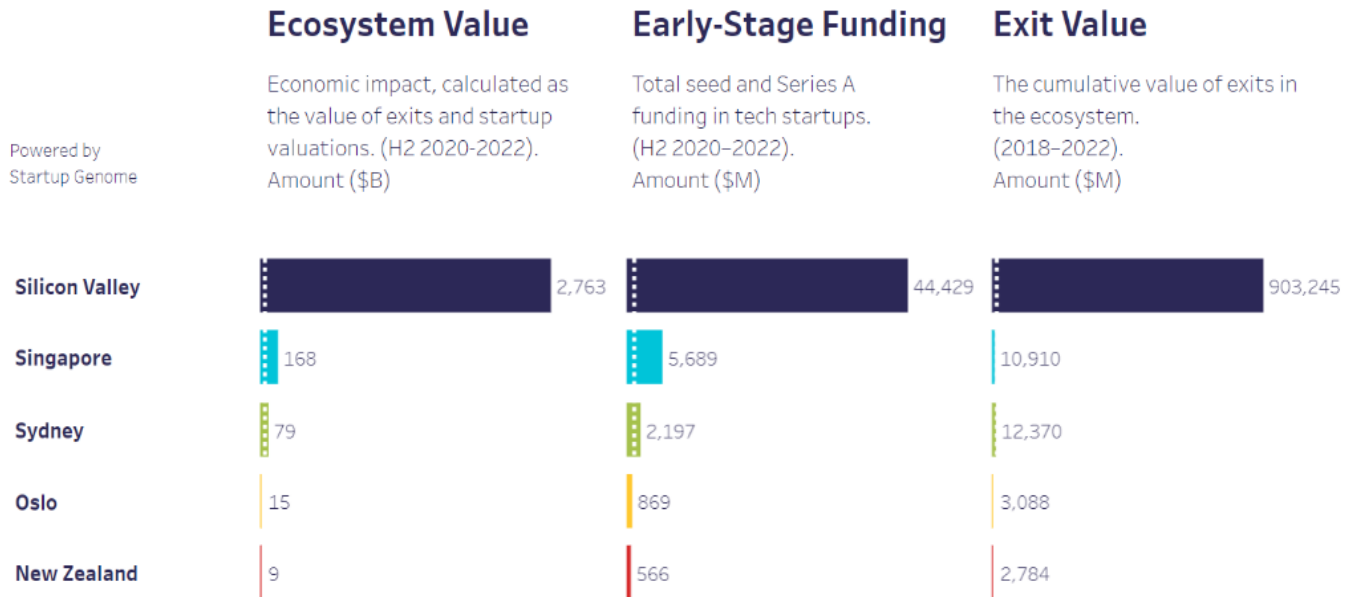
EDUCATION LANDSCAPE

THE ECONOMIC IMPLICATIONS OF NEW ZEALAND'S CURRENT TRAJECTORY IN AI-ENHANCED EDUCATION

The integration of AI in education is not just a technological leap; it's an economic strategy. Let's discuss the economic implications of New Zealand's current trajectory in AI-enhanced education based on the available policy and observable trends:

1. Boosting the Digital Economy:
   - The increased emphasis on AI in education is instrumental in nurturing a workforce that's equipped to participate in and contribute to the digital economy.
   - Data Point: According to the New Zealand Tech Industry Association, the tech sector is the country's third-largest exporter, and by integrating AI into education, New Zealand can aspire to move its ranking higher, considering the global appetite for AI solutions.
2. Attracting International Talent and Investments:
   - By establishing itself as a hub for AI education and research, New Zealand can attract international students, researchers, and investments.
   - Example: The University of Auckland's AI research initiatives have garnered international attention and collaborations, boosted the university's rankings, and attracted global talent.
3. Reskilling and Upskilling the Workforce:
   - The economic implications extend to existing workers too. As industries evolve with AI and automation, the need for reskilling becomes paramount.
   - Case: The New Zealand Productivity Commission, in a report on technology and the future of work, emphasized the importance of lifelong learning and the ability to adapt to technological advancements and changes in the workforce.
4. Spurring Entrepreneurship and Innovation:
   - With a foundation in AI education, there's potential for increased entrepreneurship in tech sectors.
   - Data: According to Startup Genome, Auckland is an emerging hub for tech startups, with AI being a significant focus area. Auckland's startup ecosystem value was pegged at $9.1 billion by

Startup Genome. This figure indicates the city's rising importance in the global startup scene. When juxtaposed against the global average of $34.6 billion, New Zealand's figure is significantly lower. This indicates that, in terms of sheer value, New Zealand's ecosystem is smaller than many of its international counterparts.

Ecosystem Value

Economic impact, calculated as the value of exits and startup valuations. (H2 2020-2022). Amount ($B)

Early-Stage Funding

Total seed and Series A funding in tech startups. (H2 2020–2022). Amount ($M)

Exit Value

The cumulative value of exits in the ecosystem. (2018–2022). Amount ($M)

Powered by Startup Genome

	Ecosystem Value	Early-Stage Funding	Exit Value
Silicon Valley	2,763	44,429	903,245
Singapore	168	5,689	10,910
Sydney	79	2,197	12,370
Oslo	15	869	3,088
New Zealand	9	566	2,784

Source: https://startupgenome.com/ecosystems

By comparing New Zealand's ecosystem values to these four countries (or cities), insights can be seen from countries with mature ecosystems, countries that have outdone themselves due to their size, and countries with direct regional comparisons. This will provide a holistic view of where New Zealand stands and where it can focus its efforts to further strengthen its startup ecosystem.

Ecosystem Value:

New Zealand's Ecosystem Value (H2 2020 - 2022): The total value of New Zealand's startup ecosystem during this period was $9.1 billion. Comparison with Global Average: When juxtaposed against the global average of $34.6 billion, New Zealand's figure is significantly lower. This indicates that, in terms of sheer value, New Zealand's ecosystem is smaller than many of its international counterparts. However, it's essential to keep in mind that New Zealand has a smaller population and economy compared to larger countries, which can account for the disparity.

Total Early-Stage Funding:

New Zealand's Total Early-Stage Funding (H2 2020 - 2022): Startups in New Zealand secured a total of $566 million in early-stage funding during this period.
Comparison with Global Average: The global average early-stage funding stands at $970 million, making New Zealand's total lower by over $400 million. This suggests that while New Zealand's startups are attracting

investment, there's room for growth in early-stage funding relative to the global average.

Exit Amount:

New Zealand's Exit Amount (2018 - 2022): Over a span of four years, the combined exit amount of New Zealand's startups stands at $2.7 billion. Insight: The exit amount reflects the total value realized when startups are sold or go public. A figure of $2.7 billion over four years is considerable, indicating that several startups have either been acquired or had successful IPOs, demonstrating the viability and potential profitability of the country's startup scene.

5. Economic Diversification:
   - While New Zealand's economy has historically been reliant on primary industries like agriculture, AI-enhanced education can pave the way for economic diversification.
   - Example: Rocket Lab, a private aerospace manufacturer and small satellite launch service, showcases how tech-based industries can thrive in New Zealand, given the right skills and environment.
6. Global Collaborations and Trade Opportunities:
   - Being at the forefront of AI education can open doors to international collaborations, be it in academia, research, or business.
   - Example: New Zealand's collaboration with countries like Singapore under the Digital Economy Partnership Agreement (DEPA) can be further strengthened with an AI-ready workforce and education system.
7. Addressing Economic Disparities:
   - AI education can be a means to bridge economic disparities by offering equal opportunities for students across regions.
   - Challenge: There's a need to ensure that AI resources are evenly distributed and not just concentrated in urban centres, which might otherwise lead to further economic disparities.
8. Economic Risks:
   - While there are many positives, it's also crucial to note potential economic challenges. Over-reliance on technology and automation might lead to job displacements in traditional sectors.
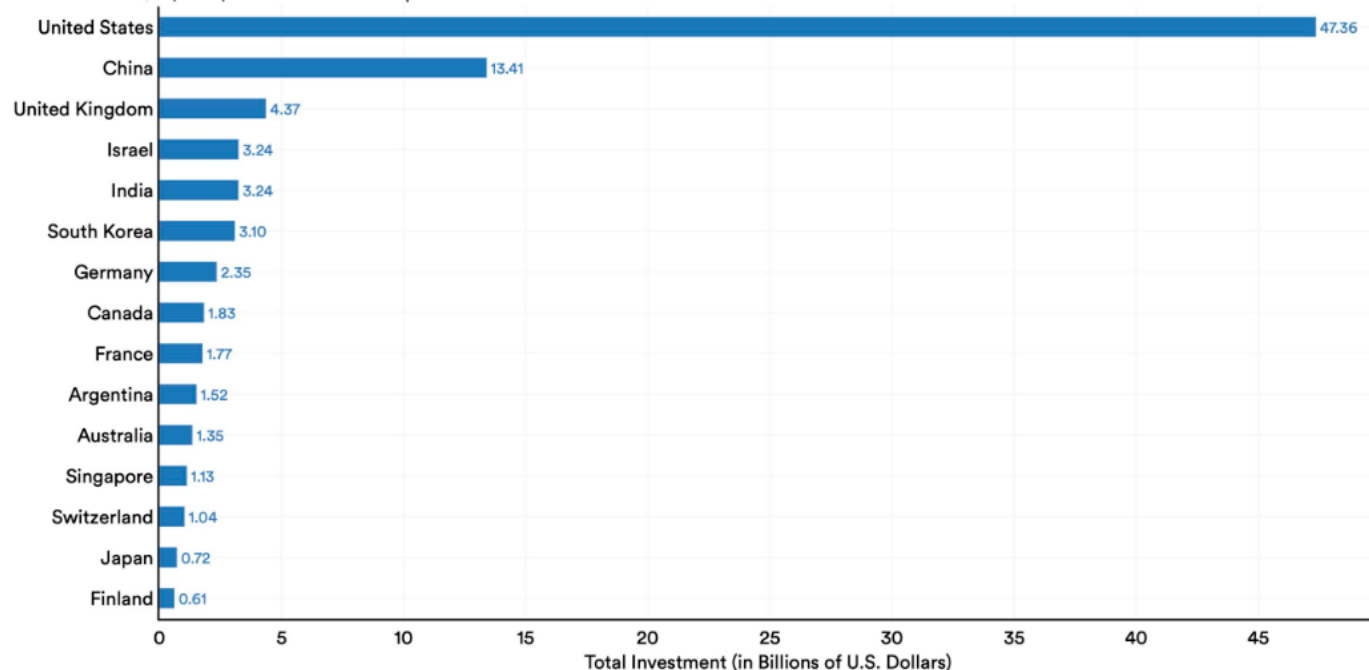
AI'S PRESENCE IN NEW ZEALAND'S EDUCATION SECTOR VS. OTHER COUNTRIES

New Zealand has been proactive in introducing AI into its education system; however, there's a noticeable gap when compared to the scale, speed, and depth of integration seen in some of the world's leading nations in AI education. Nevertheless, NZ's holistic approach, coupled with its agility due to its smaller size, positions it well to make rapid advancements in the coming years.

1. Scale and Speed of Implementation:
   - New Zealand: NZ introduced the Digital Technologies Curriculum in 2017 for students in years 1 to 13. This was a forward-looking step, but the speed and scale of AI-specific integration are relatively moderate compared to some global leaders.
   - Leading Countries: Nations like China and the U.S. have been particularly aggressive in their push for AI education. For instance, China announced plans in 2018 to introduce AI courses in primary and secondary schools, with several AI textbooks already launched.

2. Tertiary Education and Research:
   - New Zealand: More and more Universities offer specialized AI courses, and there's active research in the domain. Such as University of Auckland, University of Waikato, and University of Canterbury so on.
   - Leading Countries: Top-tier universities in the U.S., Canada, UK, and China have comprehensive AI faculties, extensive research projects, and collaborations with leading tech companies. Canada, particularly, has been a global leader in AI research with pioneers like Geoffrey Hinton advancing the field.

3. Government Support and Funding:
   - New Zealand: New Zealand government has begun several initiatives to support the integration of AI in education and research. For example, The Ministry of Business, Innovation & Employment also offers funding and support programs to build a high-performing science and innovation system in New Zealand. However, direct funding for AI research and education-specific programs is limited compared to global peers. Additionally, the MBIE funding is currently aimed at traditional sources of R&D (universities) whereas the modern software and AI industries rather see innovation happening outside these traditional arenas.
   - Leading Countries: In countries like the U.S., South Korea, and China, significant funds have been allocated directly to AI research, education, and startups. According to a report by Stanford University, the private investment in AI in 2021 totalled around $93.5 billion globally (AI Index Report 2023 – Artificial Intelligence Index, n.d.). Countries like the United States and China lead the world in both total private investment in AI and the number of newly funded AI companies.

Private Investment in AI by Geographic Area, 2022

Source: NetBase Quid, 2022 | Chart: 2023 AI Index Report

Country	Total Investment (in Billions of U.S. Dollars)
United States	47.36
China	13.41
United Kingdom	4.37
Israel	3.24
India	3.24
South Korea	3.10
Germany	2.35
Canada	1.83
France	1.77
Argentina	1.52
Australia	1.35
Singapore	1.13
Switzerland	1.04
Japan	0.72
Finland	0.61

The U.S. led the world in terms of total amount of AI private investment. In 2022, the $47.4 billion invested in the U.S. was roughly 3.5 times the amount invested in the next highest country, China ($13.4 billion). The U.S. also continues to lead in terms of total number of newly funded AI companies, seeing 1.9 times more than the European Union and the United Kingdom combined, and 3.4 times more than China.

Source: AI Index Report 2023

4. Private Sector Involvement:
   - New Zealand: Collaboration between schools and tech companies is budding, and there's growing interest in EdTech startups.
   - Leading Countries: In nations like the U.S. and China, there's massive private sector involvement. Companies like Google, Microsoft, and Tencent have significant AI education initiatives, tools, and platforms tailored for education.

Private Investment in AI, 2013–22
Source: NetBase Quid, 2022 | Chart: 2023 AI Index Report
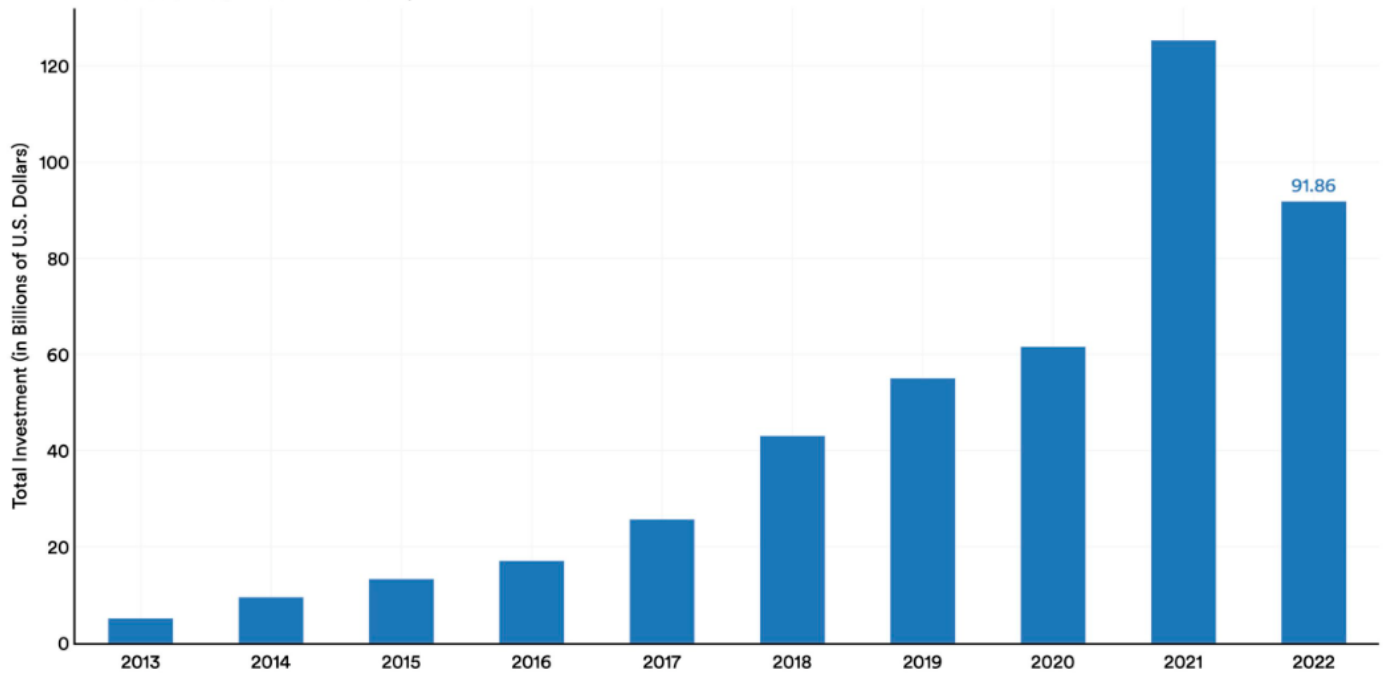
Global AI private investment was $91.9 billion in 2022, which represented a 26.7% decrease since 2021. The total number of AI-related funding events as well as the number of newly funded AI companies likewise decreased. Still, during the last decade as a whole, AI investment has significantly increased. In 2022 the amount of private investment in AI was 18 times greater than it was in 2013.

Source: AI Index Report 2023

5. Geographical and Structural Advantages:
   - New Zealand: Being a smaller nation, New Zealand has the advantage of agility. Changes in the curriculum or the introduction of new technologies can be implemented more uniformly across the country.
   - Leading Countries: Larger countries, especially federations like the U.S., often have varied adoption rates due to state-level decision-making in education. However, the sheer scale in these countries means a larger absolute number of students benefiting from AI education initiatives.
   - Challenges and Concerns:
     - New Zealand: The focus is not just on adoption but also on understanding the implications like data privacy and cultural sensitivity.
     - Leading Countries: Countries like Finland and Singapore have been recognized globally for their holistic approach to AI education, ensuring that ethical considerations are integrated from the start.

CHALLENGES & OPPORTUNITIES

IDENTIFYING KEY BARRIERS TO THE INTEGRATION OF AI IN NEW ZEALAND'S EDUCATION

- Infrastructure & Technological Gaps: Despite New Zealand's advancement in technology, not all educational institutions have the necessary infrastructure to support AI-driven solutions. There might be disparities in access to high-speed internet, updated computer hardware, and software between urban and rural schools.
- Lack of Trained Educators: While there are pockets of expertise, there remains a shortage of educators trained in effectively integrating AI tools into the curriculum. This gap could potentially be addressed by involving non-profit funds and charitable organizations to support these initiatives.
- Cost Implications: Some AI solutions can be expensive. The initial setup, ongoing maintenance, and necessary training can strain already tight education budgets.
- Cultural & Societal Resistance: There can be a reluctance from both educators and parents, fearing AI might replace the human touch in education or lead to over-dependence on technology. Example of how to overcome: when electricity was discovered, Edison gave practical applications (lightbulb) and public demonstrations to show that electricity can be used safely.

ECONOMIC AND SOCIETAL BENEFITS AWAITING NEW ZEALAND WITH STRATEGIC AI INTEGRATION IN EDUCATION

Building upon the previous analysis of the potential of AI to transform the global educational landscape, we have thoroughly examined the economic advantages associated with such reform. Now, focusing on the current situation in New Zealand, let's delve into an assessment of the economic and societal benefits that await the nation through strategic integration of AI in education.

- Tailored Learning Experiences: AI can personalize learning, catering to each student's pace and style, potentially leading to improved academic outcomes.

- Preparing for the Future Job Market: By embedding AI in education, New Zealand can prepare its youth for a future where AI will be prevalent in many job sectors, ensuring they're competitive on the global stage.
- Enhanced Educator Efficiency: Teachers can use AI to automate administrative tasks, allowing them more time to focus on teaching.
- Boost to the Tech Industry: A generation trained in using and understanding AI can lead to a surge in local tech startups and innovations, contributing to economic growth.
- Societal Upliftment through Inclusivity: AI-driven tools can be particularly useful in providing equal learning opportunities for students with disabilities or learning difficulties, ensuring a more inclusive society.

Data Point: According to a report by PwC, AI could contribute up to NZD 53 billion to the New Zealand economy by 2035 (Ryan, n.d.). but there needs to be more education around the technology, says a new report. A considerable portion of this can be achieved by preparing a future workforce through AI-enhanced education.

Looking at Finland, which has integrated AI into its curriculum, students not only learned about AI but also used AI to learn other subjects. This led to improved critical thinking and problem-solving skills. If New Zealand takes a similar path, it could reap substantial societal and economic benefits.

STRENGTHENING NZ'S AI ECOSYSTEM

THE ROLE OF SCHOOLS, UNIVERSITIES, AND VOCATIONAL TRAINING CENTRES

The dynamic landscape of AI education in New Zealand is shaped not just by formal institutions but also significantly influenced by charitable organizations working in the sector.

Schools: Schools in New Zealand provide the foundational literacy that is crucial for understanding advanced topics like AI. The introduction of digital technology standards in the school curriculum means students are now exposed to computational thinking and digital outcomes from a young age. This ensures that they have a fundamental understanding of how technologies, including AI, function.

Universities: New Zealand's universities are at the forefront of AI research and application. Institutions like the University of Auckland have research centres dedicated to AI, which play a pivotal role in pushing the AI envelope, both in terms of research and its application in real-world scenarios.

Vocational Training Centres: These centres provide hands-on and applied skills, often vital for the immediate application of AI in industries. By offering courses that bridge the gap between theoretical knowledge and practical application, they ensure a workforce ready to harness AI's potential.

Charitable Organizations: The role of charities, like us, cannot be overstated. By providing resources, funding, and support to underrepresented groups & topics, they democratize access to AI education. Charities often cater to niches that might be overlooked by more extensive institutions – be it marginalized communities, specific age groups, those in remote areas, or providing training not covered by other avenues. By running awareness campaigns, workshops, and training sessions, charities ensure a wider reach of AI literacy, making the New Zealand AI ecosystem more inclusive and diverse.

For example, Be More Human Charitable Trust's first initiative at Wellington High School is working with year 9-13 students. We are increasing awareness of (and literacy in) real-world AI techniques and tools used to create AI. By collaborating with local schools, the charity manages to integrate both foundational and applied AI skills, benefiting dozens of students in the past 6 months alone.

Schools, universities, and vocational training centres lay down the structural framework for AI education in New Zealand, charitable organizations provide the necessary fillip to ensure a holistic and inclusive AI ecosystem. Their combined efforts are crucial for New Zealand to maintain its competitive edge in the global AI landscape.

IMPORTANCE OF PUBLIC-PRIVATE PARTNERSHIPS FOR FOSTERING AI INNOVATION IN EDUCATION

Public-private partnerships (PPPs) play a vital role in fostering progress across various industries worldwide, and the realm of AI education is certainly no exception. The collaborative efforts between government agencies and private entities hold the potential to significantly amplify the reach, efficiency, and overall impact of AI initiatives in education.

In New Zealand, these PPPs specifically focused on AI education serve as a pivotal connection point between pioneering concepts and their practical implementation. By synergizing the unique strengths inherent in both public and private sectors, these partnerships not only expedite the infusion of AI into educational frameworks but also guarantee its ongoing pertinence, accessibility, and efficacy. As New Zealand continues to steer its path towards global pre-eminence in the realm of AI, such collaborative undertakings will undoubtedly play a pivotal role in shaping an education system that stands poised and prepared for the demands of the future.

1. Leveraging Resources:

Public-private partnerships allow for the pooling of resources. While the government can provide infrastructural support, regulatory framework, and initial funding, private entities often bring in cutting-edge technology, expertise, and additional financial backing.

2. Ensuring Curriculum Relevance:

With rapid technological changes, educational curricula can become outdated quickly. Partnering with private entities, which are at the forefront of AI innovation, ensures that the educational content remains relevant, practical, and in tune with industry requirements. Universities like the University of Waikato have engaged in partnerships with tech firms to ensure their AI programs align with current industry needs.

3. Accelerating Research:

Joint research initiatives between academic institutions and tech companies can push the boundaries of what's possible in AI. An example is the collaboration between the University of Canterbury and IBM, focusing on AI-driven environmental research, which has resulted in significant breakthroughs and practical applications for New Zealand's unique biodiversity challenges.

4. Broadening Access:

PPPs can democratize access to AI education. The government's reach combined with the scalability solutions offered by private entities can ensure AI education permeates even the remotest parts of New Zealand. Tech giants like Google have partnered with local entities in New Zealand to roll out AI training programs in underserved areas.

5. Facilitating Real-world Application:

Collaborations often result in pilot projects where AI solutions can be tested in real educational settings. These pilots provide valuable insights and pave the way for more widespread adoption. For instance, an Auckland-based start-up, in association with local government bodies, piloted an AI-driven learning management system in select schools, showcasing tangible improvements in personalized learning outcomes.

A CASE FOR MULTIDISCIPLINARY LEARNING: MERGING TECHNOLOGY WITH HUMANITIES, ARTS, AND SCIENCES

The integration of technology with traditional academic disciplines like humanities, arts, and sciences has never been more crucial. Such a convergence cultivates holistic thinking, where students can approach problems with both analytical and creative mindsets. Here, we explore global and New Zealand-specific instances of this multidisciplinary learning approach:

Global Examples:

1. MIT's Media Lab (USA):

Massachusetts Institute of Technology's Media Lab epitomizes the convergence of technology with arts and humanities. Here, researchers work on projects ranging from AI-driven music compositions to biomechanics studies inspired by art. This confluence underscores the lab's emphasis on combining scientific rigour with creative exploration.

2. The STEAM Movement:

STEM (Science, Technology, Engineering, Mathematics) evolved into STEAM, with the 'A' signifying Arts. Schools across the world, notably in the USA and Europe, have integrated arts into their tech-driven curricula, believing that creativity is essential for genuine innovation.

3. Imperial College London's Tech Foresight (UK):

This initiative pairs technological insight with a humanistic perspective, producing visions of potential technological futures inspired by humanities. It exemplifies how technological advancement can be guided by ethical, cultural, and social considerations.

New Zealand Examples:

1. Victoria University of Wellington's Digital Humanities Initiative:

This program offers a multidisciplinary space where digital tools and methods get employed alongside traditional humanities research. It has led to projects like the digital mapping of historical events, combining technological tools with historical data.

2. The University of Auckland's Creative Thinking Project:

This initiative brings together faculties of arts, engineering, and business to foster creative problem-solving skills in students. The project emphasizes the importance of interdisciplinary approaches to address complex real-world problems.

3. Techweek NZ:

While primarily a technology and innovation festival, Techweek NZ often emphasizes the importance of integrating Māori perspectives, arts, and humanities into technological discussions. This approach helps to ensure that technological advancements in New Zealand are deeply rooted in our unique cultural and social fabric.

These examples underscore the growing global realization that to truly harness the potential of technology, it must be understood and employed within broader humanistic and creative contexts. New Zealand, with its rich cultural heritage and forward-looking educational institutions, is well-placed to champion this multidisciplinary approach on the world stage.

POLICY RECOMMENDATIONS

Given the swift advancements in AI and its growing impact on numerous industries, New Zealand is at a pivotal juncture. To optimally leverage the capabilities of AI and guarantee its positive influence in the education sector, we propose the following policy recommendations:

INVESTING IN TEACHER TRAINING FOR AI-ENHANCED EDUCATION

Rationale:
- Teachers form the bridge between AI innovations and students. To leverage AI's full potential, educators must be comfortable with these tools, understand their functionalities, and discern the best methodologies for classroom integration.
- Effective teacher training ensures that AI is used optimally, avoiding potential pitfalls or misapplications that can detract from learning.

Recommendation:
- Nationwide Training Programs: Initiate comprehensive training programs across the country, designed in collaboration with tech companies, relevant non-profits, and pedagogical experts. These programs should blend theoretical understanding with hands-on workshops.
- Continuous Learning Modules: Given the rapid advancements in AI, periodic refresher courses should be made available to ensure that educators are always abreast of the latest developments.
- Collaborative Learning Platforms: Establish online platforms where educators can collaborate, share insights, experiences, and innovative methodologies related to AI tools. These platforms can also host webinars and expert sessions.
- Resource Centres: Set up dedicated AI resource centres within educational institutions, equipped with the latest tools, software, and reference materials. These centres can also serve as hubs for conducting workshops and seminars.
- Evaluation and Feedback Mechanisms: Post-training, mechanisms should be in place to evaluate the effectiveness of the training programs. Feedback from educators should inform the continuous improvement of these initiatives.

Potential Outcomes:
- Enhanced Classroom Experience: With well-trained educators, students can benefit from a more dynamic and personalized learning experience.

- Optimal Use of Resources: Financial investments in AI tools will yield better returns as they're used more effectively and efficiently.
- Positioning New Zealand as a Leader: By placing emphasis on teacher training, New Zealand can set a global benchmark for how AI in education should be approached, potentially attracting international collaborations and partnerships.

ENCOURAGING INDUSTRY PARTNERSHIPS TO KEEP THE CURRICULUM RELEVANT TO REAL-WORLD APPLICATIONS

Rationale:
- Future-proofing Education: A dynamic curriculum that resonates with industry needs ensures that students are job-ready and equipped with skills that are both current and valuable.
- Bridging the Gap: Active collaboration between educational institutions and industries ensures a smoother transition for students from academia to the professional world. It offers them insights into industry expectations and real-world challenges.
- Mutual Benefits: While students gain from up-to-date knowledge, industries benefit by having access to a skilled workforce that requires less on-the-job training.

Recommendation:
- Collaborative Curriculum Design: Involve industry experts in curriculum design and review processes. Their input can ensure that the curriculum is aligned with current industry needs and future trends.
- Industry-led Workshops and Seminars: Facilitate regular workshops, seminars, and boot camps led by industry professionals. This provides students with hands-on experience and exposure to real-world applications of AI.
- Structured Internship Programs: Partner with AI companies to create structured internship programs where students can work on live projects, gaining both experience and understanding of the industry.
- Incentives for Industry Participation: Offer tax breaks or other financial incentives to companies that play an active role in education, whether through guest lectures, curriculum development, or offering internships.
- Industry-Educator Exchange Programs: Encourage programs where educators spend time in the industry and industry professionals teach in educational institutions. This can ensure a bidirectional flow of knowledge and experiences.

Potential Outcomes:
- A Robust AI Workforce: Students graduating from these programs would be better equipped to contribute meaningfully to the AI industry from day one.
- Strengthening the National AI Ecosystem: By fostering strong academia-industry ties, New Zealand can position itself as a hub for AI innovation and excellence.

- Economic Growth: With a skilled workforce that's in sync with industry needs, the nation can attract more tech companies and startups, leading to job creation and economic growth.

ESTABLISHING A NATIONAL AI EDUCATION RESEARCH HUB

Rationale:
- Unified Vision: Centralizing research efforts under a national hub ensures that there's a unified vision and strategy for AI research in the country, leading to more impactful and cohesive advancements.
- Avoiding Duplication: By having a central repository, researchers can build upon each other's work, avoiding redundant projects and ensuring that resources are utilized efficiently.
- Promotion of Interdisciplinary Research: A national hub can encourage collaborations across various fields, recognizing that the future of AI is not just about technology but also its intersections with humanities, ethics, law, and more.
- Global Recognition: A centralized hub can enhance New Zealand's presence on the global AI map, attracting international collaborations, and positioning the country as a leader in AI research and education.

Recommendation:
- Repository of Resources: The hub should maintain a comprehensive and updated database of AI educational resources, research papers, case studies, and best practices, accessible to researchers, educators, and students nationwide.
- Collaborative Research Grants: Introduce grants that encourage universities and institutions to collaborate on research projects, ensuring diversity of thought and maximizing expertise.
- International Collaboration and Exchange: Promote and facilitate international research exchanges and collaborations, bringing global perspectives and expertise to New Zealand.
- Workshops and Conferences: Organize national and international AI conferences, workshops, and symposia, creating a platform for knowledge exchange, showcasing New Zealand's achievements, and fostering collaborations.
- Incorporate Māori Perspectives: Recognizing the importance of indigenous knowledge, the hub should actively seek input from Māori communities and ensure that AI research and applications are culturally sensitive and beneficial to all sections of society.

Potential Outcomes:
- Research Excellence: By pooling resources and expertise, the quality and impact of research can be significantly enhanced, leading to breakthrough innovations.
- Attracting Talent: The hub can act as a magnet, attracting top AI researchers and educators from around the world to New Zealand.
- Economic Benefits: Pioneering research can lead to the development of AI solutions and technologies that can be commercialized, driving economic growth, and creating jobs.

- Cultural Sensitivity: Incorporating Māori perspectives ensures that AI technologies and applications developed are inclusive and respectful of New Zealand's rich cultural heritage.

SCHOLARSHIPS AND FUNDING FOR STUDENTS PURSUING AI STUDIES

Rationale:
- Talent Development: By offering scholarships and financial support, New Zealand can nurture its homegrown talent, ensuring that potential leaders in AI are not held back by financial constraints.
- Global Competitiveness: Countries around the world are investing heavily in AI education. To remain competitive, New Zealand must ensure that its students have equal, if not better, opportunities to excel in this field.
- Diverse Participation: Scholarships can be targeted not just based on merit but also to encourage participation from underrepresented groups in the tech sector, ensuring a diverse and inclusive AI community.
- Economic Multiplicity: Investing in AI education now will yield manifold economic benefits in the future, with trained professionals driving innovation, research, and startups.

Recommendation:
- Tiered Scholarship Programs: Introduce scholarships at various levels – undergraduate, postgraduate, and doctoral – to support students throughout their academic journey in AI.
- Industry Collaborations: Partner with leading tech firms and startups in New Zealand and globally. Such collaborations can result in sponsored scholarships, internship opportunities, and even direct recruitment pathways for students.
- Research Grants: Apart from traditional studies, offer research grants for innovative projects in AI. This encourages practical, solution-based learning and can lead to tangible innovations.
- Support for Interdisciplinary Studies: Recognizing that the future of AI is at the crossroads of technology, humanities, ethics, and more, provide funding for students keen on interdisciplinary AI studies.
- Special Loans for AI Startups: Offer specialized low-interest loan schemes for students and young professionals aiming to launch startups in the AI sector. This not only supports their entrepreneurial spirit but also fosters innovation within New Zealand.
- Awareness Campaigns: Along with the introduction of scholarships, launch awareness campaigns in schools and universities, highlighting the opportunities in AI and the support available.

Potential Outcomes:
- Skilled Workforce: By supporting students financially, New Zealand can ensure a steady influx of trained professionals into the AI industry, future-proofing its economy.
- Innovation Drive: With financial barriers reduced, more students might be inclined to pursue innovative projects and research, positioning New Zealand as a hub for AI innovations.

- Economic Boost: In the long run, trained AI professionals can contribute significantly to the economy, either by joining the workforce, contributing to research, or launching startups that create jobs and solutions.
- Enhanced Global Reputation: Demonstrating support for AI education can enhance New Zealand's reputation on the global stage, attracting collaborations, investments, and international talents.

IMPLEMENTATION STRATEGY

For the strategy to be successful, it's essential for all stakeholders - the government, educational institutions, private sector, and the community at large - to be actively involved. Collaboration and adaptability should be at the core of New Zealand's AI education strategy.

SHORT-TERM AND LONG-TERM PLANS FOR AI INTEGRATION IN EDUCATION

Short-term (1-3 years):

These are practical and immediate actions that the New Zealand government can consider to kickstart a comprehensive AI education programme.

1. Launch a National AI Awareness Campaign for GAINZ:
   - ➢ Create a nationwide campaign to raise awareness about GAINZ (Growing AI for New Zealand): the importance of AI education and its relevance to New Zealand's future.
   - ➢ Collaborate with businesses, educational institutions, and non-profit organizations to promote the campaign through various channels, including social media, TV, radio, and community events.
   - ➢ Share success stories and case studies from countries with similar backgrounds to inspire and motivate New Zealanders.

2. Establish AI Learning Hubs:
   - ➢ Create AI learning hubs in major cities and regions where people can access AI courses and resources.
   - ➢ Collaborate with local businesses, universities, and non-profits to provide physical spaces for AI education in community centres or disused office/retail space.
   - ➢ Offer free or low-cost introductory AI courses at these hubs to attract a diverse audience.

3. AI Mentorship Programs:
   - ➢ Encourage AI professionals and experts to volunteer as mentors for learners.
   - ➢ Establish mentorship programs that connect students and aspiring AI practitioners with experienced professionals.
   - ➢ Foster a culture of knowledge sharing within the AI community.

4. AI in Schools:

➢ Integrate AI concepts into the school curriculum at various levels.
➢ Provide training and resources for teachers to effectively teach AI-related topics.
➢ Organize AI competitions or projects for students to apply their knowledge.

5. Business and Non-profit Partnerships:
➢ Incentivize businesses to offer internships, apprenticeships, or work-study programs related to AI.
➢ Partner with non-profit organizations that specialize in AI education to expand outreach efforts.
➢ Create tax incentives for companies that invest in AI training for their employees.

6. Government Grants and Scholarships:
➢ Establish government grants and scholarships for students pursuing AI-related degrees or certifications.
➢ Provide funding to educational institutions and training providers to develop AI courses and materials.
➢ Similar to Singapore's Skills Future Initiative Credits, provide credits to allow anyone to take AI classes.

7. Regular Progress Monitoring:
➢ Set up a monitoring and evaluation framework to track the progress and impact of AI education initiatives.
➢ Continuously assess the effectiveness of different programs and adjust as needed.

8. Public-Private Collaboration:
➢ Facilitate partnerships between the government, businesses, and non-profit organizations to jointly fund and support AI education initiatives.
➢ Create a task force or advisory board with representatives from these sectors to guide the implementation of AI education.

9. Accessibility and Inclusivity:
➢ Ensure that AI education initiatives are accessible to people of all backgrounds, including those in rural areas and individuals with disabilities.
➢ Offer scholarships or subsidies to underrepresented groups to encourage their participation.

By taking these immediate actions, New Zealand can jumpstart AI education efforts, leveraging the strengths of various sectors within the community. The government's role is to coordinate, facilitate, and support these initiatives to ensure a rapid and effective response to the urgent need for AI education.

Longer-term (3-10 years):
➢ Advanced Curriculum Development: Progress from basic modules to more advanced AI courses at higher education levels. This would involve practical applications, research methodologies, and ethics in AI.

- ➢ Research and Development: Promote AI research through grants, collaborations with international institutions, and partnerships with private companies.
- ➢ Integration with Other Sectors: Encourage the integration of AI knowledge in sectors other than IT, such as healthcare, agriculture, and finance. This multi-disciplinary approach ensures holistic growth.
- ➢ Global Collaborations: Foster student exchange programs, joint research projects, and collaborations with leading AI institutions worldwide.

Candidate metrics for success and review mechanisms:
- ➢ Enrolment and Completion Rates: Track the number of students enrolling in and completing AI-related courses. A steady increase would indicate successful integration.
- ➢ Teacher Training Metrics: Monitor the number of teachers undergoing AI training and their subsequent performance in delivering AI content.
- ➢ Research Publications and Innovations: A higher number of AI-related research publications, patents, and innovations from New Zealand would indicate successful long-term implementation.
- ➢ Economic Impact: Track the economic contributions of AI sectors, including startups, job creation, and international collaborations.
- ➢ Feedback Systems: Establish robust feedback mechanisms for students, teachers, and industry professionals. Their insights can guide iterative improvements.
- ➢ Global Rankings: Monitor New Zealand's position in global indices related to AI research, innovation, and education.
- ➢ Periodic Reviews: Conduct annual or biennial reviews of the AI education strategy, adjusting based on global advancements, technological shifts, and local feedback.

CALL TO ACTION

Opportunity is the intersection of preparation and timing. In the era of rapid technological advancements, New Zealand stands at this intersection. But to seize this moment, a unified, collective action is required.

THE COLLECTIVE RESPONSIBILITY OF POLICYMAKERS, EDUCATORS, AND INDUSTRIES

- Policymakers: It is incumbent upon our government officials to not only frame policies but also ensure they are effectively implemented. The adoption of AI in education isn't just about innovation; it's about future-proofing our economy and society. We cannot afford policy inertia or a lack of alignment with the ground realities of our educational system. Every policy, every guideline, must be rooted in the aspiration of creating a globally competitive AI-educated workforce.
- Educators: They are the torchbearers of this revolution. As they familiarize themselves with AI, they not only impart knowledge but inspire a generation to think critically, innovate, and solve real-world problems. Their continuous professional development, feedback, and adaptability are the keystones to the success of AI-enhanced education in New Zealand.
- Industries: The private sector's role extends beyond just funding and sponsorships. They need to be active collaborators, ensuring the curriculum stays relevant, offering internships, apprenticeships, and real-world projects to students. Their insights into global market demands can streamline our education to be not just contemporary but also visionary.

NEW ZEALAND'S LEADERSHIP POTENTIAL IN AI EDUCATION & ECONOMIC BENEFITS

New Zealand, with its unique blend of diverse talent, quality education, and an innovative spirit, is poised to lead in AI-enhanced education. Our size, often seen as a limitation, can be our strength — allowing for agile policy changes, quicker implementation, and a closely-knit academic-industry collaboration.
- Economic Implications: Reducing "brain drain" must be a top priority and GAINZ directly addresses this issue.
- High-value Job Creation: A skilled workforce attracts high-tech industries, leading to job creation that can significantly boost our GDP.

- Global Collaborations: Being at the forefront of AI education can pave the way for international research collaborations, student exchange programs, and drawing global talent.
- Innovation Ecosystem: A strong foundation in AI can spur startups and innovations, attracting investments and positioning New Zealand as a global hub for tech entrepreneurship.
- Diversified Economy: AI's tentacles spread far and wide. From agriculture to healthcare, every sector can reap the benefits of AI integration, reducing our economic vulnerabilities and enhancing productivity.

The horizon of opportunities with AI is vast, but it requires immediate, collective, and strategic actions. Let's embark on this journey with clarity, conviction, and collaboration, ensuring New Zealand's rightful place on the global AI map.

REFERENCES

AI Index Report 2023. (n.d.). Artificial Intelligence Index. Retrieved from https://aiindex.stanford.edu/report/

E. (2021, December 15). NZ education technology poised to become major industry. EdTechNZ. Retrieved from https://edtechnz.org.nz/2021/12/15/nz-education-technology-poised-to-become-major-industry/

Government of Canada. (2018). Budget 2018: Chapter 2 – Progress. Retrieved from [gov.ca/link]

Infocomm Media Development Authority (IMDA). (2020). TechSkills Accelerator Annual Performance.

Jasmin Silver, V. A. (2023, March 30). Enhancing critical thinking skills with AI-assisted technology. World of Better Learning | Cambridge University Press. Retrieved from https://www.cambridge.org/elt/blog/2023/03/30/enhancing-learners-critical-thinking-skills-with-ai-assisted-technology/

New Zealand Introduces National AI Strategy. (2021, May 17). OpenGov Asia. Retrieved from https://opengovasia.com/new-zealand-introduces-national-ai-strategy/

OECD AI Policy Observatory. (2021). Canada's AI Strategy and Global Impact.

Ryan, H. (n.d.). Artificial Intelligence could add $53b to economy. NZ Herald. Retrieved from https://www.nzherald.co.nz/business/artificial-intelligence-could-boost-nz-economy-up-to-53b-says-report/565B4MHMPSQVYFWOHW5QKKN6UM/

SkillsFuture Singapore (SSG). (2020). Annual Report.

Smith, L. (2019). Canada's Rise as an AI Powerhouse. TechFuture Journal.

Singapore Economic Development Board (EDB). (2020). Annual Report on Tech Sector Performance.

Soocial. (2022, August 15). 20 AI in Education Statistics To Rethink How You Teach. Retrieved from https://www.soocial.com/ai-in-education-statistics/

Vector Institute. (2020). Year in Review Annual Report.