

Perceptions and Governance of Emerging Technologies in New Zealand: Preparing the Next Generation for an IT-Driven Future

Full research paper

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Abstract

In the era of Industry 4.0, the world is rapidly evolving with emerging technologies like Artificial Intelligence and the Internet of Things. These technologies bring various benefits to sectors, such as healthcare, education, governance, and transportation, but they also raise concerns about privacy, security, and usability. To maximise the advantages and minimise negative effects, appropriate policies and regulations are crucial. Understanding public perceptions of emerging technologies is vital for their acceptance and effective governance. This research focuses on New Zealand, aiming to comprehend public perceptions through a survey conducted in three stages: literature review, survey instrument development, and empirical data collection. Initial findings from the survey of 450 responses indicate that the public shows moderate support for emerging technologies in New Zealand. However, addressing concerns related to data privacy and accountability is essential. Future work involves testing correlations between knowledge levels and perceptions/concerns, revising the survey instrument, and conducting a nationwide survey with a demographic and ethnicity-based approach to gauge public sentiment.

Keywords: *Emerging Technologies, Artificial Intelligence, Facial Recognition, Virtual Reality*

1. Introduction

The pursuit of technological advancement has driven human development, opening up new opportunities and transforming society. The Industry 4.0 revolution, characterised by digital transformation and innovative technologies like Artificial Intelligence (AI), Virtual Personal Assistants (VPAs), and immersive technologies, has significantly enhanced organisational productivity and addressed commercial and societal challenges (Castello & van der Meulen, 2018). A recent study from New Zealand found that more than 50% of the organisations polled thought AI would significantly affect individuals, society, and the industry or that it has already had this effect (Robb et al., 2020). New Zealand government, commercial, and educational sectors have embraced emerging technologies to increase productivity and efficiency at work

(Chen & Chang-Richards, 2022). However, for these emerging technologies to make a significant impact, they must first emerge, grow, and be adopted by society.

Although the word ‘emerging technologies’ is typically used to describe a new technology, it can also apply to an existing technology that is still being developed (Rotolo et al., 2015). The term is commonly reserved for technologies that have, or are anticipated to have, substantial societal or economic implications. In Aotearoa New Zealand (NZ), emerging technologies, such as the Internet of Things (IoT), blockchain, big data, cybersecurity, robotics, and Augmented Virtual Reality (AVR) have been steadily integrated into everyday activities. AI is being used, for instance, in the healthcare industry to facilitate the diagnosis and treatment of chronic illnesses (Jiang et al., 2017). 3D printing can significantly cut carbon emissions and aid in recycling used materials (Ikram, 2022). The NZ government leverages big data to develop precise and efficient climate action strategies (Yukich Clendon et al., 2023).

Recent implementations of facial recognition by NZ police is an example that highlights the importance of public perceptions of emerging technologies in NZ (Block, 2019). Facial recognition technology offers benefits, but also raises privacy concerns over data collection for individuals (Shufeng, 2021). For use in NZ, facial recognition technology must undergo a high level of scrutiny and testing on its accuracy as mistakes in identifying a person could be damaging to individuals (Lynch et al., 2022). Other significant risks include: (1) AI having embedded ethnic, religious, or social biases that disadvantage a particular person or group (Gavighan et al., 2019; Soleimani et al., 2021); (2) risks to privacy inherent in AI systems as they collect enormous volumes of data, which can extract patterns and information from the data (Bulchand-Gidumal, 2020); (3) automated analysis utilising machine learning (ML) algorithms that access consumer data and which can increase the risks to individual privacy (Kopalle et al., 2022; Kathriarachchi et al., 2024) by connecting diverse data sources; and (4) automated and augmented decision making by AI and ML, which raises issues of accountability and transparency over how and why decisions are made (Mittelstadt et al., 2016).

As a result, researchers, scientists, and decision-makers are seriously debating the societal ramifications of these emerging technologies (Zhang & Dafoe, 2020). Numerous studies, including that of West et al. (2019), argue that the general public should play a significant role in influencing the development and use of such technologies, given the risk factors. It is crucial to understand how the general public, including stakeholders (i.e., corporations, governments, and researchers), view these technologies and their effects to allow relevant agencies to inform and engage the public about emerging technologies’ features, prospects, and pitfalls and develop and implement appropriate policies (Zhang & Dafoe, 2020; Kathriarachchi et al., 2024).

This study aims to promote a comprehensive understanding of emerging technologies (AI, AVR, facial and voice recognition, IoT, and robotics) in NZ, focusing on how the public perceives their impact, including benefits and risks. The paper is organised as follows: the next section will provide an overview of related regulations, followed by section 3, the literature review which discusses the development of the survey. Section 4 presents the results of the survey followed by conclusions and recommendations for future research.

2. The New Zealand Context

The government of Aotearoa New Zealand (NZ) is tightening its restrictions on using emerging technologies. Proper governance is crucial to maximising the advantages of employing emerging technologies while minimising their drawbacks. Instead of developing specific regulations to restrict the use of AI, the NZ government, for instance, is looking at progressively

including AI controls into existing policies and laws as they are revised and updated (Stuart, 2020). The following are three examples of current and possible regulatory responses to the employment of algorithms in emerging technologies that worry the NZ government¹. Firstly, the **Opaque Nature of AI Decision-making**: “If we cannot understand how a decision has been made, we cannot check whether it is accurate or biased” (New Zealand Legislation, 1982). According to Section 23 of NZ’s Official Information Act 1982, when a public service agency, Minister of the Crown, or organisation makes a decision or recommendation in respect of any person, the person has the right to and shall be given a written statement of the findings on material issues of fact, a reference to the information on which the findings were based, and the reasons for the decision or recommendation (New Zealand Legislation, 1982). If so, the justifications must be provided in writing with any conclusions and a mention of the data that served as the foundation for the results. Secondly, **Privacy**: As revealed by the New Zealand Human Rights Commission (2018), privacy concerns are common in the information age. AI-driven decision-making systems gather data from diverse sources, including non-personal and personally identifiable information in the AI algorithm context. The New Zealand Privacy Act 2020 (New Zealand Legislation, 2020) can be the starting point for data collection and use regulations. Finally, **Biases in Algorithms**: for instance, because of the lack of female voices in the training datasets, some speech recognition algorithms may handle female sounds less accurately than male voices (Tatman, 2016). Current regulations in NZ do not cover algorithmic decision-making. However, the concerns about algorithmic biases are not limited to this situation and may involve more broad and existing NZ legal obligations (Gavighan et al., 2019).

Public opinion is crucial for the NZ government to adopt or revise policies related to emerging technologies. Ignoring public views, including those of researchers, technologists, corporations, and governments, can lead to social, governance, and technology-related problems. Understanding the public's perception of emerging technologies and their governance is essential for creating informed policies and promoting public awareness about the opportunities and challenges they present (Zhang & Dafoe, 2020). With this in mind, the current research aims to explore the public perceptions of emerging technologies in NZ, and how they vary in terms of knowledge level, support, concerns, and governance for emerging technologies. The research study is divided into two distinct phases, with this paper focusing on Phase 1. In Phase 1, the research team undertook three crucial stages: a comprehensive literature review, the development of a survey instrument, and a pilot study. The literature review provided essential insights into emerging technologies and public perceptions in NZ. Building on this knowledge, the researchers crafted a well-structured survey instrument to capture the public's perspectives on these technologies. To test the effectiveness of the survey, a pilot study was conducted, gathering 450 responses for analysis. This paper presents a descriptive analysis of the pilot survey findings, shedding light on the public's knowledge, attitudes, concerns, and governance preferences regarding emerging technologies. Phase 2 will involve a full-scale survey to delve deeper into the data collected, enabling policymakers and researchers to make informed decisions and establish appropriate policies and regulations for the optimal utilisation of emerging technologies in NZ.

3. Literature Review

To conduct a structured literature review, relevant literature was identified using three academic databases (Scopus, Web of Science, and Discover) to search for peer-reviewed journal articles

¹ <https://www.mbie.govt.nz/dmsdocument/5754-artificial-intelligence-shaping-a-future-new-zealand-pdf>

published from 2020 to 2022. The chosen time frame aimed to capture the rapid developments and trends in public perceptions of emerging technologies. After eliminating duplicates and excluding irrelevant articles based on abstracts, 148 related papers were identified. Out of these, 59 papers were considered relevant after examination of their full texts. Of the relevant studies, 32 incorporated surveys to gauge public perceptions (Table 1), with 25 of them utilising survey questionnaires. Among the technologies studied, Artificial Intelligence (AI) emerged as a prominent topic, with a focus on healthcare, and predominantly from the United States.

In addition to academic sources, NZ-specific information was gathered from various sources, including government, university, and organisation websites, such as Digital.govt.nz and Data.govt.nz. Notably, AI was a dominant theme in NZ sources, with articles discussing its current use, benefits, regulatory issues, and future prospects, underscoring the significant role and potential of AI in the country's context^{2,3}. Moreover, the researchers closely monitored the usage of emerging technologies in NZ, particularly by the government, by referencing recent mass media reports⁴ (e.g., Radio New Zealand).

#	Citation	Description	Technology	Country	Area	Questionnaire available? (Y/N)
1	(Chatterjee & Sreenivasulu, 2021)	Impact of AI regulation and governance	AI	India	On the Internet	Y
2	(Banerjee et al., 2021)	Impact of AI on clinical education	AI	The UK	Healthcare	Y
3	(Abouzeid et al., 2021)	Role of Robotics and AI in Oral Health	Robotics and AI	Saudi Arabia	Healthcare	Y
4	(Crockett et al., 2020)	Public perceptions of AI applications	AI	The UK	No specific area	Y
5	(Kankanamge et al., 2021)	AI-driven disaster management	AI	Australia	Natural disaster	Y
6	(Yeh et al., 2021)	AI and Sustainable development	AI	Taiwan	ustainable developme-r	Y
7	(Lund et al., 2020)	Academic librarians' perceptions of AI	AI	International	Academic library	Y
8	(Yoon et al., 2021)	AI adoption in libraries	AI	The US and Canada	Academic library	Y
9	(Yüzbaşıoğlu, 2021)	Attitudes of dental students towards AI	AI	Turkey	Healthcare	Y
10	(Keser & PEKİNER, 2021)	Future of AI in Oral Radiology	AI	Turkey	Healthcare	Y
11	(Tang et al., 2021)	IoT for smart parcel locker logistics	IoT	China	Logistic	Y
12	(Jain, 2021)	IoT Medical Devices for Anemic Pregnant Women	IoT	India	Healthcare	Y
13	(Abdullah & Fakieh, 2020)	AI applications in healthcare employee	AI	Saudi Arabia	Healthcare	Y
14	(Khanagar et al., 2021)	AI in dental students' perceptions	AI	Saudi Arabia	Healthcare	Y
15	(Aggarwal et al., 2021)	Patient perceptions on AI in Health Care Data	AI	The UK	Healthcare	Y
16	(Hervieux & Wheatley, 2021)	Academic librarians' perceptions of AI	AI	Canada and US	Library	Y
17	(Leenhardt et al., 2021)	Perception and Expectations in Capsule Endoscopy	AI	Europe	Healthcare	Y
18	(Ganji & Parimi, 2021)	User perception of IoT healthcare devices	IoT	India	Healthcare	Y
19	(Lozano et al., 2021)	Perception of AI in Spain	Robots and AI	Spain	No specific area	Y
20	(Lai & Rau, 2021)	Public perception model of facial recognition	Facial recognition	China	No specific area	Y
21	(Chen et al., 2020)	Perception of Automated Vehicles	Automated vehicle	Taiwan	Transportation	Y
22	(Jiang & Cheng, 2021)	Robotic applications in public health	Robotics	China	Healthcare	Y
23	(Zhang & Dafoe, 2020)	US public opinion on AI governance	AI	The US	No specific area	Y
24	(Seng et al., 2021)	User perceptions of facial recognition	Facial recognition	The US and Canada	Not specific area	Y
25	(Cui & Wu, 2021)	Public perceptions of AI in China	AI	China	N specific area	Y
26	(Robb et al., 2020)	Public perception of robotics in danger zone	Robotics	The UK	In danger activities	N
27	(Kim et al., 2020)	Students' perceptions of AI teaching assistants	AI	The US	Education	N
28	(Kashive et al., 2020)	User perception of AI-enabled e-learning	AI	India	Education	N
29	(Kassens-Noor et al., 2021)	Public perceptions of an AI-mediated future	AI	The US	No specific area	N
30	(Antes et al., 2021)	Perceptions of healthcare technologies with AI	AI	The US	Healthcare	N
31	(Zhang & Yencha, 2022)	Perceptions towards hiring algorithms	AI	The US	Hiring	N
32	(Esmaeilzadeh et al., 2021)	Patients' perceptions toward AI in healthcare	AI	The US	Healthcare	N

Table 1 Papers using surveys as an instrument

Before designing the final questionnaire, a group of government agencies were surveyed with the cooperation of the Multi Agency Research Network (MARN)⁵. MARN members provided their views on: 1) Preferred emerging technologies for the survey; 2) Important aspects of public

² AI Forum NZ, "Artificial Intelligence: Shaping a Future New Zealand." Available: <https://aiforum.org.nz/reports/artificial-intelligence-shaping-a-future-new-zealand/>

³ C. Gavighan, A. Knott, J. Maclaurin, J. Zerilli, and J. Liddicoat, "Government use of artificial intelligence in New Zealand." Available: <https://ourarchive.otago.ac.nz/handle/10523/9372>.

⁴ We searched government websites such as <https://www.digital.govt.nz/>, academic websites such as <https://www.otago.ac.nz/caipp/index.html>, and organisational websites such as <https://aiforum.org.nz/>.

⁵ The Multi Agency Research Network (MARN) brings together New Zealand government agencies who are interested in research collaboration between each other and NZ universities.

perceptions towards emerging technologies; 3) Recommended sources for the project; and 4) Awareness of similar publicly available questionnaires. In the initial survey, we received 14 valid responses from different NZ government agencies (see Fig 1). They expressed interest in various emerging technologies, with the top eight being AI, facial recognition, robotics, IoT, voice recognition, the metaverse, AVR, and 5G. They recommended asking the public about their knowledge level, information sources, opinions on technology use, concerns, satisfaction with regulations, and suggestions for government regulations. Additionally, participants provided relevant sources for the research.

Based on the review of the related literature, and the results of the initial survey from the 14 respondents, we designed a questionnaire with 36 questions to capture the public’s perceptions of emerging technologies . We divided the questionnaire into four sections. The first section collects the demographic information about participants. Everyone living in NZ above the age of 18 was eligible to fill out the questionnaire.

Section 2 examines participants' knowledge of selected emerging technologies (AI, AVR, facial and voice recognition, IoT, and robotics) and their trusted information sources. Section 3 focuses on participants' perceptions of these technologies, rating benefits, challenges, and potential usage in various contexts. Section 4 explores participants' concerns regarding privacy, security, and data sharing with government agencies. In the final section, participants' awareness and satisfaction with regulations on these technologies are assessed. Overall, the questionnaire aims to understand public knowledge, perceptions, concerns, and governance preferences for emerging technologies.

To assess the questionnaire's effectiveness and gain initial insights into New Zealanders' perceptions of emerging technologies, we conducted a pilot survey, receiving 450 valid responses. The survey explored demographic information, participants' knowledge of the technologies, their attitudes toward the usage, and opinions on government regulations. The diverse participant pool provided valuable insights into prevailing sentiments and perceptions of these innovations.

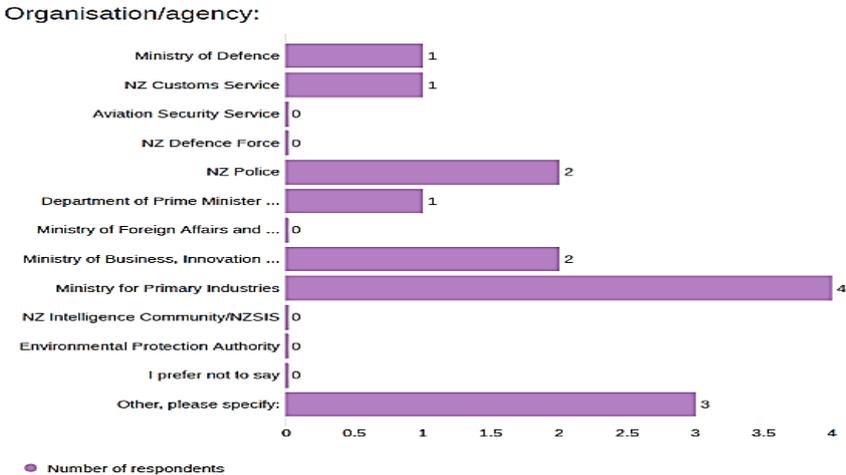


Fig 1: Number of respondents in the initial survey

4. Results and Discussion

In this section, we present an analysis of the survey responses gathered from the respondents. Before delving into the specific findings, it is important to understand the demographic background of the participants. We explore their age, education level, geographical distribution,

ethnicity, and gender to gain insights into the representation of the NZ population in the survey. Additionally, we assess the respondents' knowledge about the surveyed emerging technologies and their perceptions regarding the use of these technologies in the country. The section aims to provide a comprehensive overview of the public's attitudes and awareness concerning emerging technologies in NZ, with a focus on data privacy, willingness to share data with government agencies, and awareness of relevant regulations. By understanding these aspects, we draw valuable conclusions and recommendations for future decision-making and policy development in this domain.

4.1 Demographic information

The survey respondents consisted 10.22% of 18-24 year olds, 18% of 25-34 year olds, 15.11% of 35-44 year olds, 19.11% of 45-54 year olds, 15.56% of 55-64 year olds, and a 22%, and the highest count of 65 years and older. The higher proportion of 65 years and olds may be due to the wider age range covered (up to 90 years and over) and potential survey reach restrictions. Moreover, the survey's composition aligns well with NZ's demographic makeup⁶, suggesting no evident age bias found in the survey.

In terms of **educational background**, the highest number of people have a high school qualification (N=128, 28.44%), followed by a bachelor's degree (N=127, 28.22%). The lowest number of people have a PhD (N=10, 2.22%). Among the respondents, 96.65% possessed a high school education or higher, while 47.77% percent held a bachelor's degree or advanced academic qualifications. According to Education Counts (2021), the statistical results for 2021 indicated that 35% of NZ's entire population possessed a bachelor's degree or higher. The respondents in this survey displayed a slightly higher education level. However, considering that individuals with higher academic qualifications often have a better understanding of emerging technologies and are generally more willing to participate in such a survey, the educational distribution of respondents can be considered acceptable.

Regarding geographical distribution, the number of respondents from the Auckland region is 30.89% (N=139), from the Canterbury region 13.78% (N=62), and from the Wellington region 12.00% (N=54) respondents. The rest of the questionnaire respondents come from other smaller regions around NZ. According to stats.govt.nz, the population distribution in the survey aligns closely with the geographic distribution of NZ's population. Based on the survey responses the New Zealand European population constitutes the largest ethnic group (N=289), accounting for 64.22% of the total population. The Māori (N=52) and Asian (N=43) communities follow closely as the second and third-largest ethnic groups, respectively. According to stats.govt.nz, the population distribution in the survey aligns closely with the ethnic distribution of NZ's population. In terms of gender among the respondents, 51.33% identified as male (N=231), 48.22% as female (N=217), and there was an additional 0.44% who chose not to disclose their gender. This indicates a relatively even gender distribution, suggesting the survey results are unlikely to be biased due to gender-related factors.

4.2 Knowledge about surveyed emerging technologies

Regarding the overall knowledge level of emerging technologies (Fig 2), most respondents chose "moderately familiar" (N=692), followed by a similar proportion selecting "slightly familiar" (N=681). Over 80% of participants expressed at least "slight familiarity," while over 50% reported being "moderately familiar." Notably, 5% of respondents (N=118) stated they

⁶ <https://ecoprofile.infometrics.co.nz/new%20zealand/Population/AgeComposition>

were "extremely familiar" with these technologies. When examining specific aspects, facial/voice recognition technologies were the most familiar, with over 90% of respondents (N=413) having at least "slight familiarity." AI followed closely, with 86% of respondents (N=389) reporting the same level of familiarity. Conversely, IoT and AVR were less known, with 123 and 121 respondents, respectively, admitting no understanding of these fields, accounting for over 25% of total respondents for each technology.

Regarding the familiarity of respondents with emerging technologies, the findings align with the previous question. In total, 72.98% of respondents are at least "slightly familiar," with 43.51% being "moderately familiar" or more. However, a notable number of individuals are entirely unfamiliar with IoT and AVR technologies, with 183 and 165 people, respectively, falling into this category.

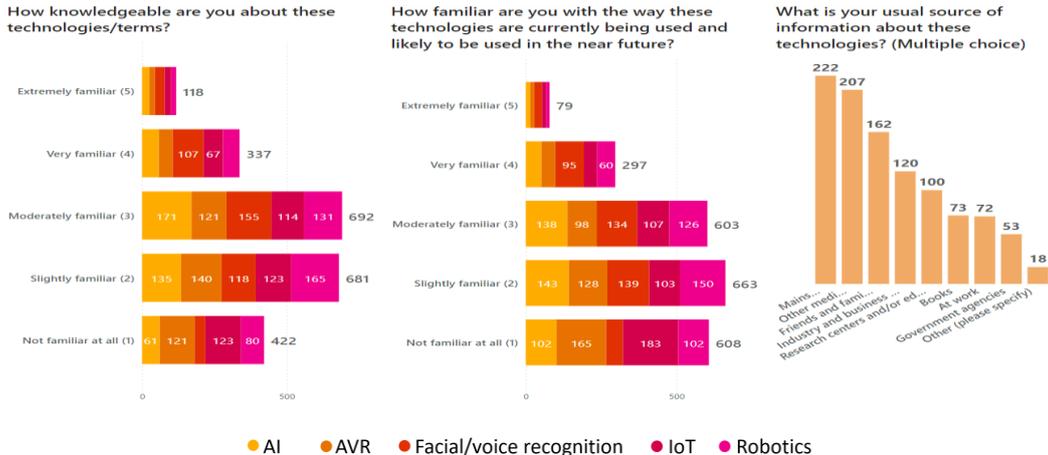


Fig 2: Left to right — How knowledgeable are you about these technologies? | How familiar are you with these technologies? | What is your usual source of information about these technologies?

Regarding the sources from which people obtain information about emerging technologies, the top two sources are mainstream media (N=222) and other media (N=207), encompassing newspapers, magazines, and social media, accounting for 41.77% of the total. Friends and family members, as well as industry and business websites, are also significant channels of information. In contrast, government agencies and other sources are less utilised, suggesting the need to enhance the government's role in information dissemination about emerging technologies.

4.3 Perceptions of the use of the surveyed technologies

4.3.1 Support Level

Regarding the support for the development and use of emerging technologies (Fig 3), combining five technologies, respondents showed the highest preference for "somewhat support" (N=712, 31.64%), while "strongly oppose" (N=142, 6.31%) received the least support. Meanwhile, over a quarter of respondents fell into the category of "neither support nor oppose" (N=606, 26.93%). In the breakdown of individual technologies, the results were relatively even, except for AI, which stood out with a higher level of support compared to other technologies. Approximately 231 individuals chose either "somewhat support" or "strongly support" for AI, accounting for over 50% of the respondents.

4.3.2 Concerns (Beneficial or Harm)

The survey also explored the perceptions of whether emerging technologies are **beneficial or harmful to the public**. Unlike the previous question, this one included 7 gradients ranging from "extremely harmful" to "extremely beneficial." Similarly, the results show a strong consistency with the previous question about support for these technologies. In the aggregate for all five technologies, the majority of respondents (N=590, 26.22%) chose "somewhat beneficial" as their perception. Following closely were those who maintained a neutral stance, considering the technologies neither beneficial nor harmful (N=513, 22.8%). The next group comprised those who believed the technologies to be beneficial (N=318, 14.13%). On the other hand, a total of 376 respondents (16.71%) expressed some degree of concern, indicating they see the technologies as somewhat harmful, harmful, or extremely harmful, with an additional 68 respondents (3.02%) considering them to be extremely harmful. Regarding individual technologies, the percentages were relatively even across the board.

4.3.3 Areas to Develop and Use

The survey further inquired about the **areas in which respondents believe the government can increase the use of technology**. In this multiple-choice question, the top three areas selected by the respondents were healthcare (N=264), national security (N=254), and education (N=243). The concentration of responses to this question reflects the consistent expectations of the public for using technology to bring about changes in the fields of healthcare, national security, and education.

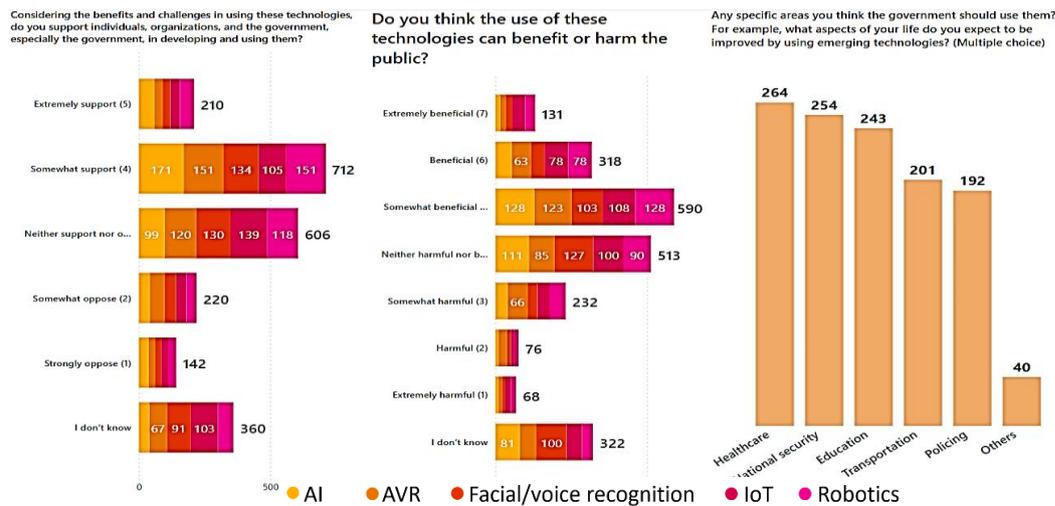


Fig 3: Left to right — Do you support individuals, organisations, and the government in developing and using them? | Do you think the use of these technologies can benefit or harm the public? | Any specific areas you think the government should use technologies?

4.4 Governance of technologies

The survey also asked respondents about the governance of emerging technologies in NZ. Fig 4 shows box and whisker plots to illustrate the results. The bottom and top edges of the dark and light blue box represent the first quartile (Q1) and third quartile (Q3), respectively. The line inside the box represents the median or the second quartile (Q2). The whiskers extend to the minimum and maximum values of the data, representing the range. In the middle of each box, the pink circles with numbers represent the mean values. The box and whisker plot provides a visual representation of the distribution of the data, indicating the spread, central tendency, and

potential outliers.

4.4.1 Data Privacy

The survey on the importance of **data privacy** in the usage of five emerging technologies (Fig 4) reveals that people highly value data privacy, with average scores exceeding 75% and median scores above 80%. Furthermore, the third quartile for each technology is at 100%, indicating that at least 25% of the respondents selected the option of 100%, signifying extreme importance. Notably, facial/voice recognition and AI technologies stand out, with median scores around 90%. These findings indicate that the public places significant importance on information privacy and security. As these emerging technologies become more prevalent, it is crucial to prioritise data privacy concerns. Failure to address these concerns adequately could lead to a loss of public support and trust in these technologies.

4.4.2 Willingness to Share Data

The next survey question asked respondents about **their willingness to share data with government agencies**, where 100% indicated being extremely willing. The results show that 25% of the respondents gave a highly positive response, with their choices falling between 80% and 100%. More than 50% of the respondents selected values above 60%, i.e. somewhat willing. Only less than 25% of the respondents' choices were below 50%, with a tendency to be unwilling to share data with government agencies. This statistical analysis suggests that although data privacy is a widespread concern among the public, government agencies are still generally trusted and accepted by the majority of people. To some extent, they are willing to disclose their personal information to the government.

4.4.3 Awareness of Regulations or Laws

The next question was used to assess the **public's awareness of the regulations or laws** regarding to emerging technologies. It is widely recognised that robust and well-defined legal regulations are crucial to ensuring that emerging technologies operate within reasonable and beneficial boundaries, benefiting humanity and future generations. However, the statistics reveal that 50% of the respondents have very little awareness about such legal regulations, less than 20%. Moreover, 25% among them fall below 5%, indicating almost complete lack of awareness. Only 25% of the respondents indicated an awareness level exceeding 50%.

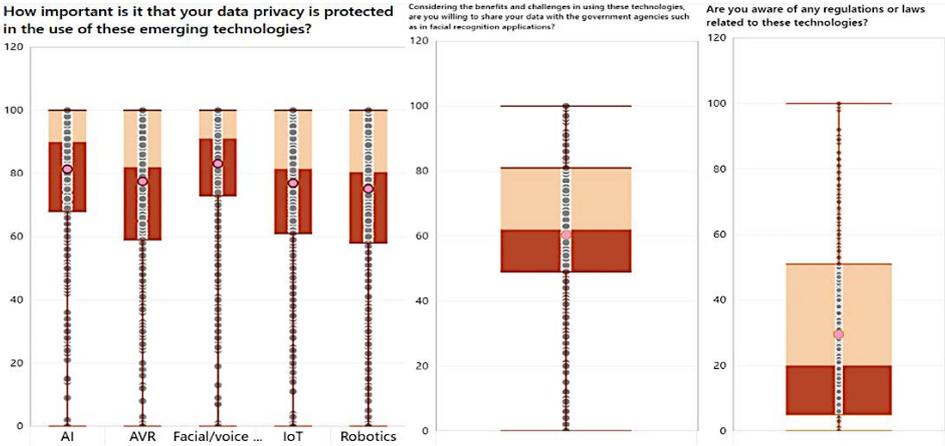


Fig 4: Perceptions of Data Privacy, Data Sharing, and Awareness of Regulations regarding Emerging Technologies.

This could be attributed to the incomplete nature of legal regulations concerning emerging technologies, or the limited public awareness of these regulations even if they exist. Establishing regulations or laws for emerging technologies is the responsibility of government agencies, and there is a long road ahead. It is essential for government agencies to work towards comprehensive legal frameworks and public awareness campaigns to bridge this gap and ensure that the public is well-informed about the legal aspects of emerging technologies. The actions respondents expect the government to take to regulate the use of these technologies include assuring security, transparency, and privacy, and preventing misuse of such technologies.

4.5 Correlation Analysis of Knowledge with Support and Concerns

Fig 5 shows a positive correlation between knowledge of **emerging technologies and the level of support**. For instance, the more knowledge the public has about robotics, the higher their level of support for this technology (correlation coefficient=0.27). Additionally, higher knowledge of AI is associated with higher knowledge of AVR (correlation coefficient=0.72), and this is reflected in the increased level of acceptance for AVR (correlation coefficient=0.23). From these findings, we can conclude that individuals with higher knowledge of one technology tend to have increased knowledge of other technologies, leading to greater support for their development. Public education and awareness programmes are essential strategies to garner support for emerging technologies.

Similarly, Fig 6 shows a positive correlation between **knowledge of emerging technologies and concerns**. The more knowledge the public has about robotics, the more they perceive this technology as beneficial (correlation coefficient=0.18). This trend is observed for AI, AVR, facial/voice recognition, and IoT as well. Although the correlation coefficient for concerns is slightly lower than for support (0.27), strengthening public education remains crucial to addressing concerns and fostering an informed and supportive society.

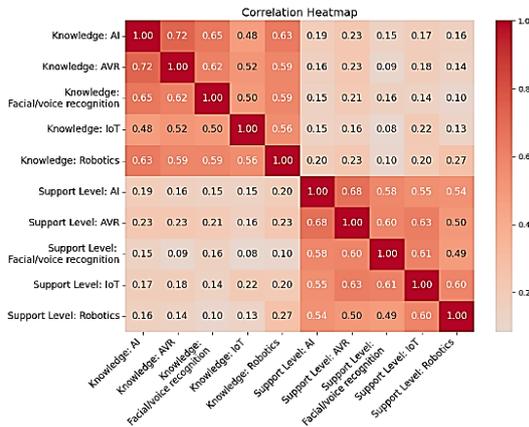


Fig 5: Correlation between knowledge of technologies and support level

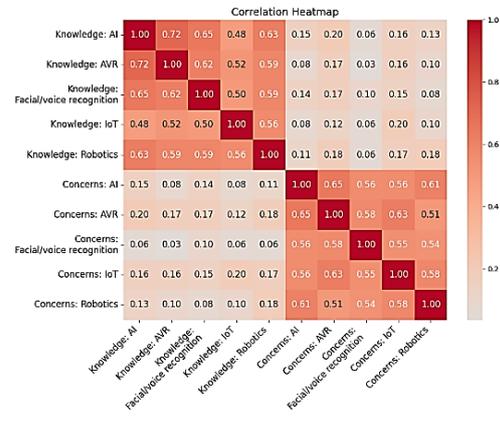


Fig 6: Correlation between knowledge of technologies and concerns (benefit or harm)

5. Conclusion and Recommendations for Future Work

This paper highlights the significance of understanding public perceptions of emerging technologies for their successful adoption and governance in New Zealand. The study includes a systematic literature review and the development of a comprehensive survey questionnaire to capture public viewpoints. Initial results from the pilot survey are also reported. The key

findings of the survey concluded that emerging technologies, such as AI, VPAs, and immersive technologies, have the potential to significantly affect society and various sectors. To ensure responsible development and use of these technologies, it is crucial to consider public perceptions and concerns. The pilot survey indicates that the public generally supports the development of emerging technologies, but data privacy and biases are important issues that need attention.

The New Zealand government's approach of incorporating AI controls into existing policies to regulate technology usage is a step in the right direction. However, more comprehensive legal frameworks and public awareness campaigns are needed to bridge the gap in public awareness of regulations related to emerging technologies.

To further enhance understanding, future research should explore demographic and ethnicity-based reactions to emerging technologies. Additionally, aligning stakeholder perceptions with government strategies is vital for effective governance. Delving into various related issues, such as Industry 4.0, civic participation, and national defence, will provide valuable insights for shaping policies and addressing societal challenges.

In conclusion, a well-informed and supportive public is crucial for maximising the benefits and minimising the drawbacks of emerging technologies in New Zealand. By prioritising data privacy, transparency, and accountability, the country can harness the potential of these technologies to drive positive societal changes. Continued research and engagement with stakeholders will play a pivotal role in shaping a sustainable and inclusive future for emerging technologies in New Zealand.

6. Funding information

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