Future Pathways Policy Team
Ministry of Business, Innovation and Employment
PO Box 1473
Wellington 6140

[by email: FuturePathways@mbie.govt.nz]

16 March 2022

Re: AWS comments on *Te Ara Paerangi – Future Pathways* Green Paper (2021)

Dear Madam/Sir,

Thank you for the opportunity to respond to the *Te Ara Paerangi Future Pathways* Green Paper (2021). Amazon Web Services New Zealand Limited (AWS) welcomes this important and timely consultation on future directions for research, science and innovation in New Zealand. We have very much enjoyed participating in the broad-based and vibrant consultation to date and we are grateful for the opportunity to submit written comments at this time.

Background

By way of introduction, AWS has been operating in New Zealand for eight years with offices in Wellington and Auckland, and employing more than 100 staff in roles such as solutions architects, account managers, professional services consultants, and cloud experts and engineers. In September last year, AWS announced that it will launch an AWS Region in Auckland in 2024, which will bring world-class cloud computing infrastructure onshore to New Zealand.[1]

The Auckland AWS Region will bring advanced cloud computing services and solutions in-country, which could deliver significant additional value to the country's research and science community.[2] This investment of an estimated NZD$7.5 billion will create 1,000 new jobs and contribute an estimated NZD$10.8 billion to New Zealand's GDP over the next 15 years. The investment can also help to unlock further technology and science driven innovation across New Zealand's economic and social sectors.

[1] An AWS Region is made up of a cluster of data centres in groups called "availability zones" (AZ). Each AWS Region consists of multiple, isolated, and physically separate AZs within a geographic area. AWS infrastructure Regions meet the highest levels of security, compliance, and data protection. Each AZ has independent power, cooling, and physical security and is connected via redundant, ultra-low-latency networks. AWS customers focused on high availability can design their applications to run in multiple AZs to achieve even greater fault-tolerance.
[2] See introduction to cloud computing.

Cloud offerings have grown significantly from storage, compute, networking and database offerings to a wide range of advanced services and solutions. Today, AWS for example offers more than 200 fully featured products from its data centres, including advanced services of direct relevance to the science and research community, such as data lakes and analytics, machine learning and artificial intelligence, quantum computing, high performance computing clusters, robotics, and a range of edge computing services, including internet of things and private 5G networks.

The choice of Auckland for an AWS Region investment underscores our belief in the exciting long-term data and digital opportunities that lie ahead for New Zealand. At the same time, the broad-based review of the future of research through the Te Ara Paerangi process presents an opportunity to position New Zealand's research and science sector as a leader in benefiting from world class cloud technologies and digital research skills.

Our present comments focus on the research workforce and research infrastructure sections of the Green Paper. We would welcome the opportunity to discuss these comments further as appropriate, and also to engage in greater depth as and when the consultation focuses in more detail on digital infrastructure and digital capabilities questions in due course.

Comments

Chapter 5: Te Hunga Mahi Rangahau – Research Workforce

Across New Zealand's science, research and innovation ecosystems, the current and future workforce will need to update and improve their digital technology skills continuously to stay abreast with latest technology developments. The development of skills on relevant technologies used worldwide by researchers will serve to increase international collaboration opportunities with overseas research networks, and will support an increasingly distributed research workforce in the future. Investments in data and digital technology skills for the research workforce will unlock new opportunities for innovation, and will enable new insights from existing and future datasets.

By building workforce capacities to use rapidly evolving technologies such as cloud computing services, researchers will be able to leverage data analytics, artificial intelligence and machine learning tools more easily to deliver deeper research insights, faster. By building and harnessing skills in cloud services and open source, researchers can more easily collaborate and share technologies, tools, approaches with others to accelerate scientific discovery. They can also gain easier access to – and share - datasets on open data repositories on the cloud such as the Registry of Open Data or the AWS Sustainability Data Initiative.[3]

We see a real opportunity for the consultation process to explore how New Zealand can grow the overall availability and impact of digital and cloud training resources for researchers through more collaboration between the technology industry and research and scientific institutions. To maximise the opportunities provided by industry-driven digital skills and training programmes, we recommend a workstream be

[3] See the Registry of Open Data or the Amazon Sustainability Data Initiative

established to explore collaboration between technology training providers and the research and science sectors This workstream would seek to understand how industry-provided digital skills training and certification programmes can align with the whole-of-career digital skilling needs and requirements for researchers in New Zealand.

Industry training programmes span the full range of digital skills development from digital literacy to advanced training such as on data analytics[4] and machine learning.[5] Offerings are online and in-classroom and include both free and paid programmes, and can lead to professional certifications. Such a workstream could also focus on how to ensure the reach of industry training offerings can be extended to historically under-served communities so that they can be greater participants in deriving value from their data and knowledge in the digital era. In New Zealand, it is particularly important that training be more readily available to Māori researchers and ensure Māori communities and Iwi are able to achieve their digital and data aspirations. AWS is committed to being a significant contributor to the skilling of New Zealanders in the coming years and is actively looking for opportunities to support the education, science and research community with its training offerings. We would welcome the opportunity to discuss this further.

In a fast-evolving digital world, research collaboration is important across the government, academic and private sectors. Industry actors are publishing and funding technical research on as well as wider research topics such as fairness, accountability, transparency and ethics[6]. For example, Amazon is working with the National Science Foundation to make significant grants to research the issue of fairness in artificial intelligence (AI) over next three years.[7] We also support our AWS customers by producing research and public facing content on topics such as on explaining machine learning models[8], compliance with privacy considerations[9], identifying machine learning best practices[10] and for improving resiliency in the face of online threats.[11]

Chapter 6: Te Hanganga Rangahau – Research Infrastructure

The Future Pathways consultation presents a rare opportunity to envision a major transformation of the digital infrastructure that underpins New Zealand's research, science and innovation ecosystem. We recommend that the infrastructure workstream focus in some detail on this opportunity. As we have seen in other parts of the world, a digital research infrastructure that harnesses advanced cloud technologies will be well-positioned to:

- Enable a more highly distributed future New Zealand research workforce, including across regional New Zealand and internationally;
- Deliver extremely high levels of resilience, availability and security for the digital infrastructure and its assets such as databases and other digital collections;

[4] See https://aws.amazon.com/training/learn-about/data-analytics/
[5] See https://aws.amazon.com/training/learn-about/machine-learning/
[6] See https://www.amazon.science/research-areas
[7] See https://www.amazon.science/tag/national-science-foundation
[8] E.g. Model Explainability with AWS Artificial Intelligence and Machine Learning Solutions
[9] E.g. Using AWS in the Context of New Zealand Privacy Considerations
[10] E.g. Machine Learning Best Practices for Public Sector Organisations
[11] E.g. AWS Best Practices for DDoS Resiliency

- use security tools like advanced encryption services to keep sensitive data secure wherever it is stored and processed, along with access to that secured data from wherever authorized researchers may be located;
- offer almost unlimited scaling potential for ever growing research datasets, with the agility to scale compute capacity up and down rapidly, and provide highly cost-effective storage options;
- deliver highly configurable and reliable data access controls based on assigned roles;
- maintain compliance with security, data privacy and other regulations and policies;
- provide more equitable access to high end performance computing and other higher end technology capabilities that may have been restricted due to an inability to scale, including through "cloud bursting" approaches to using the massive compute power of the cloud to augment High Performance Computing (HPC) scaling limitations;
- enable faster innovation cycles that allow for faster, cheaper experimentation with advanced cloud technologies that are integrated with the underlying digital infrastructure such as machine learning, private 5G networks, Internet of Things and robotics;
- allow a shift away from uneven capital investment cycles that can drive reliance on legacy technology environments, which will increasingly struggle to scale to meet data demands and/or to cope with increasingly advanced computing requirements; and
- deliver on sustainability and climate goals by working with cloud service providers that are committed to delivering on 100% renewable energy
- take advantage of frequent innovations and the economies of scale that come from using cloud service providers that focus on delivering continuous optimization of performance, security, cost, resilience and other benefits in the design and management of cloud computing infrastructure.

AWS works closely with our customers – public sector and commercial, big and small - to advise and support them in designing and operating reliable, secure, efficient, and cost-effective systems in the cloud. These collaborative approaches help our customers in building trusted, secure and inclusive data ecosystems on AWS cloud.

In New Zealand, regionally and globally, we are working with research and scientific entities to support their modernization and digital transformation programmes. Today, we work with customers in the research and scientific communities in using cloud capabilities to:

- reduce analysis run times for large datasets by orders of magnitude and accelerate testing and prototyping at lower cost[12];
- increase the scalability and availability of on-demand compute capacity for high performance computing workloads[13];
- deliver machine learning supported research insights and reduce the manual workload of data scientists[14];

[12] For example, analysis of 'mega bio-banks' at CSIRO in Australia (https://aws.amazon.com/solutions/case-studies/csiro-case-study/)
[13] For example, genomic research at the University of Adelaide (https://aws.amazon.com/solutions/case-studies/university-of-adelaide-genomics-case-study/)
[14] For example, University of Oxford machine learning image recognition (https://aws.amazon.com/solutions/case-studies/oxford-case-study/)

- share and leverage open data through cloud resources such as the AWS Open Data Sponsorship Program[15];
- enable research teams to work and collaborate from virtually anywhere with secure access to storage, compute and analytics;
- use of internet of things (IoT) devices to support data collection and analysis[16];
- support research organisations to share data, and collaborate across institutions with ease and in line using their own policies and permissions frameworks[17];
- redeploy capital expenditures on developing and maintaining on-premises servers and reduce the time research institutions must spend on the undifferentiated business of maintaining computing capacity in favour of spending more time and resources on science and research.[18]

New Zealand has the chance to design for a new digital infrastructure for the future that draws on advanced cloud technologies to strengthen the research, science and innovation ecosystem for decades to come. With that opportunity in mind, we look forward to engaging with you in the future stages of consultation under the *Te Ara Paerangi Future Pathways* process as options and white paper positions are developed. As mentioned, we would be pleased to provide additional input or, as appropriate, meet with the consultation team on the transformational opportunity we see for re-imagining the digital future of New Zealand's research and science ecosystem. Please do not hesitate to contact me at Privacy - 9(2)(a) if you would like any further information.

Yours sincerely,

Paul Keating
Head of Public Policy, New Zealand
Amazon Web Services

[15] For example, climate and genomic open data (https://aws.amazon.com/blogs/publicsector/climate-data-koala-genomes-analysis-ready-radar-data-highly-queryable-genomic-data-latest-open-data-on-aws/)
[16] For example crop research to support precision agriculture at Bayer Crop Science (https://aws.amazon.com/solutions/case-studies/bayer-cropscience/) or population health studies (https://aws.amazon.com/solutions/case-studies/stanford-psso-keynote/)
[17] For example, virus research led by University of British Columbia (https://aws.amazon.com/solutions/case-studies/university-of-british-columbia/)
[18] For example, the University of Newcastle redeployment to AWS (https://aws.amazon.com/solutions/case-studies/university-of-newcastle-case-study/)