Foresighting Viable Open Alternatives to Address OER's Existential Threat from Commercial Generative AI: Confronting the Unspoken Challenge for Pacific Small Island Developing States

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The development of full artificial intelligence could spell the end of the human race[1]

– Stephen Hawking

Abstract

Commercial generative artificial intelligence (GenAI) poses significant challenges to Open Educational Resources (OER) as digital public goods, particularly for Pacific Small Island Developing States (SIDS). The rapid adoption of GenAI in education, with many students using it for study purposes, raises concerns about copyright, model training practices, and ownership of generated content. High costs of training and maintaining GenAI models further disadvantage Pacific SIDS, which lack the resources to develop their own systems. Dependency on commercial GenAI services introduces risks, including vendor lock-in and unaffordable costs, while open models bring their own complexities, such as defining openness and the complexity of the AI technology stack.

Two strategic scenarios offer alternatives for Pacific SIDS. The "digital sufficiency" approach emphasises affordable, essential digital tools and Free and Open Source Software (FOSS), fostering local autonomy and reducing reliance on high-tech solutions. The second scenario advocates for the use of open, small language models (SLMs) and shared open prompts to produce and share generative educational content.

Collaboration through a commons-based cooperative, enabling resource sharing and expertise exchange is key to sustainable success. A collective Free and Open Source Software Digital Learning Ecosystem Commons (FOSSDLE Commons) is proposed to strengthen local capacity and reduce costs. By leveraging cooperative solutions, Pacific SIDS can ensure sustainable, autonomous education in a GenAI-driven world.

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[1] Cellan-Jones, R. (2014, December 2). Stephen Hawking warns artificial intelligence could end mankind. *BBC News*. https://www.bbc.com/news/technology-30290540

1. Introduction – Facing OER's elephant in the room

Open Educational Resources (OER) are likely approaching an existential crisis because rapid advances in generative Large Language Models under the banner of 'artificial intelligence' (AI) could erode their competitive advantage as a public good when compared to commercial content. This looming threat is the elephant in the room for sustainable future OER development, particularly for Pacific Small Island Developing States (SIDS).

In the case of digital resources, 'all rights reserved copyright' gramted by governments who are signatories of the Universal Copyright Convention creates artificial resource scarcity by restricting the reproduction and distribution rights (Linford, 2020). With OER, however, the use of open licenses offers a competitive advantage: access to these resources is free and the legal permission to reuse, adapt, and modify materials for local contexts significantly reduces production costs. The advent of generative pretrained transformer models (Yenduri et al., 2023), hereinafter referred to as Generative Artificial Intelligence (GenAI), have the potential to produce high quality education materials at a fraction of the cost of traditional OER development. Wiley, for example, argues that GenAI will be more effective in expanding access to educational opportunities than OER, because it can "provide access to dramatically more resources than the current bespoke OER authoring process" (Wiley, 2024a).

The potential demise of OER-as-product arising from GenAI is not necessarily inevitable, nor do the threats to its survival justify discouraging the use of these emerging technologies in education for development, given their transformative potential for humanity. However, it is prudent to consider the probability that OER could be replaced by commercial GenAI solutions at the expense of Digital Public Goods [2]. This probability is not zero, and could, for instance, be high enough to warrant the exploration of alternatives that can be implemented as parallel solutions beyond those offered by a small number of large, profit motivated technology corporations.

Planning for the future of open education is challenging because the likelihood of the material uncertainties associated with GenAI's impact on open education occurring is much higher than the probability of historical OER trends continuing unchanged. Pioneered by the Royal Dutch Shell group to navigate the turbulent oil crisis of the 1970s, 'foresighting' and scenario planning methodologies have proven to be powerful strategies that industry have successfully been useing over the decades (Schoemaker 1998; Schoemaker & Van der Heijden 1992; Kahane 2001). Navigating these uncertain futures for OER requires robust foresighting approaches to move towards a more strategic approach to GenAI and open education.

This paper outlines the current context, highlighting selected trends, risks, and challenges posed by GenAI for Pacific Small Island Developing States (SIDS) in the context of education as a public good. It then introduces a scenario planning framework based on two key uncertainties, offering a structure for open alternatives that do not depend on corporate GenAI solutions.

Just as community gardens operate alongside the agro-industrial complex, enabling individuals and communities to collectively learn, grow, harvest, and share crops, this paper seeks to explore open solutions that can coexist alongside commercial GenAI. In this way, SIDS will have options to deploy open solutions that promote autonomy, cost-effectiveness, resilience, self-determination, data sovereignty, as well as respect for and celebration of the local.

[2] Digital Public Goods: A digital public good is defined by the UN Secretary-General's Roadmap for Digital Cooperation, as: "open-source software, open data, open AI models, open standards and open content. https://www.un.org/en/content/digital-cooperation-roadmap/

2. Key contextual challenges in considering plausible strategic alternatives

Both,business and academia are increasingly focused on the transformative potential of GenAI. ChatGPT became one of the fastest-growing consumer applications ever, reaching one million users in just five days and 100 million users within two months of its launch. Compare this with TikTok which reached this milestone in nine months and Instagram, which took two and a half years (Aagaard & Tucci, 2024). Consequently, there has been a surge in research on AI driven business model innovation (Jorzik et al., 2024; Kulkov, 2023; von Garrel & Jahn, 2023).

The majority of post-secondary students are using GenAI. According to a recent survey of 8,028 Australian students, 83% are using AI to support their studies (Bearman et al., 2024) compared with 70% of high school students in the United States utilising LLMs (Zhu et al., 2024). A recent survey, although very limited in size, reports that some 40% of Science, Technology, Engineering, and Mathematics college students have used GenAI to help with exam questions (Wang, F. et al., 2024). Therefore, it is not surprising that the education sector is closely analysing the opportunities and challenges that GenAI can present (Giannakos et al., 2024; Chiu, 2023).

In the Pacific region, the use of AI in higher education institutions is growing, increasing reliance on commercial AI services. The Australasian Council of Open and Digital Education (ACODE 2024) recently surveyed its member institutions across Australia and New Zealand using the JISC AI Maturity Model for Education (JISC, 2024) as a framework to gauge AI implementation in the region. The model illustrated in Figure 1 below has five stages.

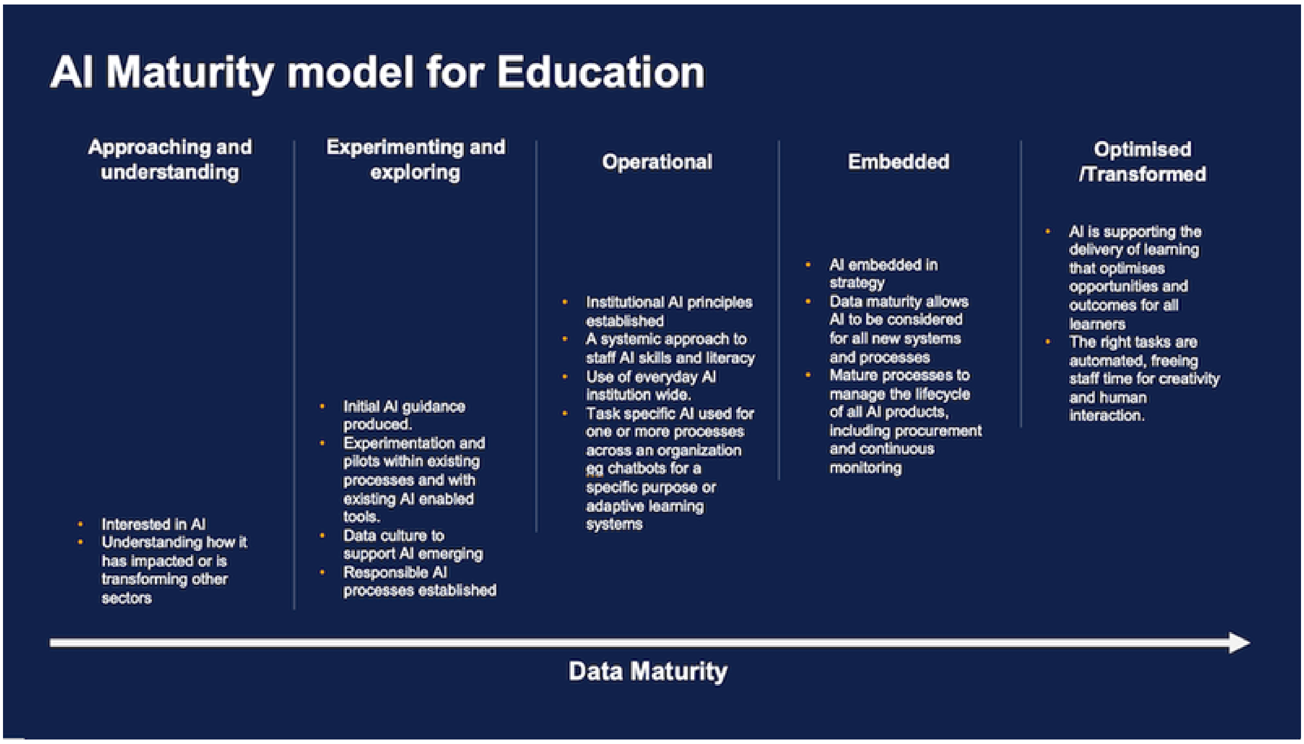


Figure 1 JISC 2024 AI Maturity Model for Education

The overwhelming majority of respondents positioned themselves at stage two, and the authors conclude that "many universities are showing a growing commitment to AI" (ACODE 2024). Published literature on the adoption of AI in Pacific SIDS is scarce; however UNESCO's Global Education Monitoring Report 2024 for the Pacific notes that adoption is accelerating. The report highlights policy concerns regarding the ethical use of AI and need for research evidence on AI's impact on learning in the region (UNESCO 2024). The report also notes that higher education institutions in the Pacific are developing capacity in GenAI citing a pilot project where the Commonwealth of Learning collaborated with the National University of Samoa to provide online learner support using GPT-powered technology (UNESCO 2024).

Despite the cautious optimism about GenAI in the education sector, there is an underlying assumption that the integration of GenAI, especially commercial service offerings, is inevitable.

From an OER-as-product perspective, the evolving landscape — including copyright complexities related to GenAI, the considerable risk of premature reliance on commercial GenAI services in the absence of proven business models, unresolved challenges with open-source AI in education, and the unique complexities faced by Pacific SIDS — calls for scenario planning strategies to explore a range of possible futures. This section will examine these contextual challenges to inform a framework that promotes strategic flexibility and options for the region.

2.1 OER as a public good and GenAI copyright complexities

OER is predicated on copyright provisions that enable open licensing, allowing for reuse and adaptation, which transforms it into a public good. Copyright originated in response to new technology and was intended to strike a balance between monopoly control and the public good. As GenAI develops, new copyright concerns are emerging, raising the question of whether history will repeat itself with new copyright reforms in favour of public interests.

The invention of the printing press in the mid-15th century, a transformative technology that revolutionised the production and distribution of information, catalysed the creation of the first copyright act (Khong, 2006).

The Statute of Anne of 1710 is widely accepted as the origin of modern copyright. Contrary to popular belief that it strengthened the copyright holder's rights, its original purpose was to break the monopoly of the London Stationers Company. The Statute of Queen Anne 1710, entitled '*An Act for the Encouragement of Learning*' was enacted to encourage "learned [people] to compose and write useful books" (Tallmo, n.d.) and included a number of provisions serving public interests. Notably, it limited the duration of the controllers' rights, previously held indefinitely, ensuring that works would enter the public domain. Additionally, the statute required that nine copies of printed books be deposited in the Royal Library and several university libraries for their use (Rimmer, 2007).

The legal copyright implications of using GenAI remain uncertain. Although several cases have been filed, these proceedings are still in the early stages, and it will be some time before we know how the courts will apply intellectual property laws to this technology.

Consider, for example, that an all rights reserved text does not prevent individuals from learning from it. In the context of training GenAI models, once training is complete, the original training data — including any copyrighted material — is no longer required. The model retains the information as 'weights,' which are internal parameters used to generate outputs from user prompts (Poulos, 2024). Consequently there is no 'copy' of the copyrighted work within the model itself (Poulos, 2024).

OpenAI, the company behind ChatGPT, argues that training AI models on publicly available internet materials constitutes fair use under US copyright law. However, they will respect publishers who choose to opt out from allowing their public information to be used for training models (OpenAIa 2024). It is important to note that fair use provisions vary worldwide. Notably, Version 1 of the Open Source AI Definition permits the use of 'unshareable' and third party copyrighted data in training open source models (Open Source Initiative, 2024). In contrast, the Copyright Alliance offers a nuanced perspective, stating that the determination of fair use for training GenAI models is highly fact dependent.

The ownership of the outputs of GenAI, especially if these outputs are themselves copyrightable, is not straightforward. Currently the large GenAI technology companies including OpenAI, Microsoft, Github, and Anthropic do not claim ownership of the output generated from their models (Poulos, 2024). The US Copyright Office (USCO) is of the view that "copyright can protect only material that is the product of human creativity." (Copyright Registration Guidance:Works Containing Material Generated by Artificial Intelligence, 2023). Consequently, if a prompt is used to generate learning materials where the resulting text is primarily generated by the technology, it would not be eligible for copyright protection (Poulos, 2024) including open licenses. However, GenAI outputs can contribute to the creative process, when these outputs are arranged and modified in a sufficiently creative way, the resulting work may qualify as an original work of authorship. However, according to USCO, "copyright will only protect the human-authored aspects of the work, which are 'independent of' and do 'not affect' the copyright status of the AI-generated material itself" (Cited by Poulos. 2024).

Traditional copyright, originally designed for print materials, is arguably no longer suited to regulate content usage rights in a digitally produced GenAI landscape. It can be argued that GenAI diminishes the need for copyright, as the abundance of creative content it generates reduces the necessity for restrictive laws protecting creative works (Miyara et al., 2024). Furthermore, the effectiveness of open licensing in expanding and protecting the commons is diminished in this new context. In the absence of bold copyright reform that prioritises public goods, the open education community would benefit from exploring alternative ways, beyond open licensing, as the primary enabler to broaden access to educational opportunities.

2.2 Risks of early commitment in uncertain GenAI business models

The cost of training foundational language models and inference[3] are considerable. For example, the Chief Executive of Anthropic, a commercial AI company, anticipates that the cost of training models could reach $100 billion within the next three years (Morales, 2024). Despite efficiency gains as the technology matures, the inference cost of GenAI remains "a significant barrier to adoption, especially for businesses that need to generate large volumes of content" (Huang, 2023).

This level of investment is unaffordable for Pacific SIDS, so developing their own large language models is not an option. Moreover, indigenous languages and cultures are not codified in ways that would facilitate easy training of local models for the region. Given these barriers, Pacific SIDS will need to rely on GenAI services from commercial providers, who are themselves trialing ways to establish sustainable business models to recoup their substantial investments in GenAI.

For instance, Microsoft Asia recently announced that Copilot, an AI-powered assistant, will be incorporated into all Microsoft 365 Personal and Family subscriptions in Australia, New Zealand, Malaysia, Singapore, Taiwan, and Thailand when users update to the latest version with a corresponding price increase of $5AUD per month for personal subscriptions, but the account will be limited to a monthly allotment of AI credits

[3] The process by which a trained language model interprets a prompt and generates a response based on patterns it has learning.

(Bott, 2024). This appears to be a trial for global price increases to Microsoft 365 Personal and Family subscriptions following poor uptake of the Copilot Pro model, previously marketed separately (Warren, 2024).

Some technology journalists are suggesting that the GenAI boom is “unsustainable, and will ultimately collapse” (Zitron, 2024). Gartner places GenAI into the ‘Trough of disillusionment” phase of its 2024 Hype Cycle for AI, indicating that the technology has yet to meet expectations, requiring AI corporations to focus on viable and sustainable real world applications (Jaffri, 2024). At this phase of maturation, educational leaders need to carefully assess risks and mitigation of corresponding technical debt as the technology matures (Jaffri, 2024).

Approximately 80% of Pacific SIDS have national populations below half a million people (World Bank, 2022). Small population size limits public services, leading to complexities—most notably, diseconomies of scale resulting in fiscal pressure in providing public goods like education (UNDP, 2014). The challenges in providing public services are particularly acute for the nine small Pacific Island Countries (PIC-9) — Kiribati, Marshall Islands, the Federated States of Micronesia, Nauru, Palau, Samoa, Tonga, Tuvalu, and Vanuatu. The PIC-9 countries rely heavily on a narrow range of economic activities, and the high cost of delivering public services to remote islands creates a precarious dependence on foreign assistance amid the region's growing geopolitical complexity (Gould & Wai-Poi 2023). This challenging context raises concerns about the future affordability of commercial GenAI services for Pacific SIDS as prices continue to rise, increasing the risk that GenAI will widen the digital divide.

While Pacific islanders currently have free access to OpenAI’s ChatGPT4o model, the number of messages that free users can send are limited (OpenAIb, 2024). With no proven business model, and companies like OpenAI struggling to control training and operational costs (Isaac & Griffith, 2024), significant increases in paid subscription fees for commercial GenAI services are inevitable. For example, documents sent by OpenAI to investors in late 2024 indicate that the company plans to increase its $20 monthly subscription fee for individuals by $2 by year-end, with an aggressive increase to $44 over the next five years (Isaac & Griffith, 2024).OpenAI’s pricing for premium subscriptions, such as 'ChatGPT Enterprise' and 'ChatGPT Edu,' is not published on the company website. However, reports suggest that subscription prices could reach up to $2,000 per month (Palazzolo & Woo, 2024). Although these discussions are not yet finalized, this suggests price increases will be a necessary feature of a sustainable business model. In addition, a growing number of media reports suggest that OpenAI plans to abandon its non-profit status and transition to a for-profit model as the next phase of its development (Seetharaman, 2024, O’ Brien et al., 2024), raising the probability of price increases.

In a scenario planning context dealing with uncertain futures, it is conceivable — given the challenges large AI providers face in building sustainable business models — that significant cost increases for corporate AI services, along with business strategies that generate dependence and vendor lock in through high switching costs, present a plausible risk. AI’s evolving business model could be mirroring the business development approach of social media companies, a process which Doctorow labels as “enshittification” to describe a three stage process of how platforms decay: First, platforms are good to their users – for instance, providing free access to a valuable service; then they abuse their users to make things better for their business customers – for example, building in high switching costs making it difficult to leave a product or service to retain advertising revenue; and finally, maximising profit extraction over user value, for example, algorithmic bias for paid content or reducing features available in ‘free’ tiers of proprietary software services (Doctorow, 2024a & 2024b).

Pacific SIDS that build educational systems, processes, and content dependent on corporate GenAI solutions risk facing unaffordable price increases or losing access to key features if these are removed from affordable subscription tiers. Given these risks and uncertainties, Pacific SIDS should also consider viable strategic alternatives that do not rely on GenAI from corporate 'Big Tech' providers.

2.3 Complexities of using open-source GenAI solutions for OER

There is a strong symbiotic relationship between Free and Open Source Software (FOSS) and OER. Lane and Goode (2021) point out that the "5Rs" of OER — reuse, revise, remix, redistribute, and retain (Wiley, 2014b) — are derivatives of the four essential freedoms of free software (Free Software Foundation, 1996-2021; Wiley, 2014a). Predating UNESCO's Recommendation on OER (UNESCO 2019), the Cape Town Open Education Declaration states:

> "*[O]pen education is not limited to just open educational resources. It also draws upon **open technologies** that facilitate collaborative, flexible learning and the open sharing of teaching practices that empower educators to benefit from the best ideas of their colleagues"* (Cape Town Open Education Declaration, 2007, emphasis added).

More recently, negotiated by 193 member states, the United Nations' Global Digital Compact (GDC) asserts that:

> "digital public goods, which include **open-source software**, **open data**, **open artificial intelligence models**, **open standards**, and **open content** that adhere to privacy and other applicable international laws, standards, and best practices and do no harm, empower societies and individuals to direct digital technologies to their development needs and can facilitate digital cooperation and investment (United Nations, 2024, emphasis added)"

According to this definition of digital public goods, OER, as open content, qualifies as a digital public good and should ideally prioritise the use of FOSS and seek GenAI solutions based on open AI models. However, this approach involves several challenges, outlined in this section.

Regarding the question of Pacific SIDS creating and deploying open GenAI solutions, challenges arise in defining what qualifies as open, as well as what is affordable, achievable, and poses an acceptable level of risk. The fundamental challenge is that "while a handful of maximally open AI systems exist, which offer intentional and extensive transparency, reusability, and extensibility– the resources needed to build AI from scratch, and to deploy large AI systems at scale, remain 'closed'—available only to those with significant (almost always corporate) resources (Widder et al., 2023).

For example, with reference to the complexities in defining what constitutes an 'open GenAI model': is releasing only the model weights enough for it to be considered 'open', or should open GenAI models also require open licensing of the training data? Additionally, if the model's development relies on proprietary code components, would it still qualify as 'open'? Furthermore, do proprietary code dependencies in running an open model pose challenges to its openness?

Unlike a single FOSS application, as alluded to above, the AI technology stack includes multiple components and dependencies. This complexity is further heightened in education due to the rapid advancements in GenAI, resulting in a widespread lack of understanding of how the technology functions. As Korseberg and Elken (2024) note, "uncertainty breeds uncertain responses," particularly in strategic decision-making, policy development, and operational implementation of GenAI for OER.

A detailed explanation of the GenAI technology stack falls outside the scope of this paper, but for the purposes of illustrating the breadth and complexity of the stack Mozilla and the Columbia Institute of Global Politics convened 40 learning scholars and practitioners working on openness and AI and produced a framework categorizing components of the stack (Mozilla 2024):

- *Product and user interface:* Output settings, application programming interface (API), prompting engines, user/model interaction, and telemetry[4].
- *Datasets*: software and licensing issues relating to the data and code used for pre-training including fine-tuning the datasets and evaluating the datasets.
- *Code:* used for data (pre)processing, inference, training, evaluation, fine-tuning, and back-propagation, supporting libraries and model architecture.
- *Model weights:* including base weights, intermediate training checkpoints weights, downstream task adaptation weights, and compressed weights.
- *Infrastructure:* including drivers, compilers, libraries, and storage used in training and hosting of GenAI systems.

There are varying degrees of openness possible for each of these components in the stack. For instance, LLaMA-2 an 'open-weight' model released by Meta, is available for free download and was labeled as 'open source' by the company. It uses a custom license developed by the company which the Open Source Institute – custodian of the Open Source Software Definition – stated was not open source (Widder et al., 2023). One of the concerns is the lack of transparency in the data used to train the model, so it would not be possible for suitably qualified technologists to recreate the model. In another example, on the compute side, large foundational models require massive computational power for training. This ultra fast processing hardware, like Nvidia's GPU[5]s, or Google's 'TPUs'[6]. These super computers are reliant on code used for training of GenAI foundational models that is closely tied with specific proprietary hardware severely restricting mobility in creating 'open' models (Widder et al., 2023).

The Open Society Initiative (2024) has released Version 1 of the Open Source AI Definition, which illustrates a binary approach to determining what qualifies as 'open source' and what does not. In contrast, 'gradient' approaches have been put forward to classify levels of access to GenAI systems: "fully closed; gradual or staged access; hosted access; cloud-based or API access; downloadable access; and fully open" (Solaiman 2023). The Digital Public Goods Alliance is working on updating its Digital Public Good Standard to better account for open source AI systems to adhere to the principles of openness, inclusivity and responsibility (Taneja et al., 2024). Achieving a stable understanding of 'open' in GenAI systems will take time. For now, however, Pacific SIDS should remain aware of the risks associated with proprietary corporate interests and dependencies in technologies misleadingly marketed as 'open'.

Open-weight foundational models provide opportunities for Pacific SIDS to host their own GenAI solutions, but this option may be neither affordable nor risk-free. Researchers at Stanford University set up a live chatbot demonstration of a small language model for the public based on Meta's LLaMA model, called Alpaca (Germain, 2023). Alpaca was relatively cheap to build (Schwartz, 2023) and its training data and the code for fine-tuning the model was published under an open software license (Quach, 2023). However, Stanford University took the Alpaca GenAI demonstration down after only a few days citing concerns about safety of responses and escalating cost making it untenable to continue (Quach, 2023, Schwartz, 2023).

[4] The dynamic process of collecting, measuring and analysing usage of AI services
[5] Graphical processing units
[6] Tensor Processing Units are Google's custom integrated circuits used to accelerate machine learning workloads.

Although the best open-weight models, based on benchmark performance, have lagged the best closed Large Language Models (LLMs) by 5 to 22 months, the most notable AI models released between 2019 and 2023 were open, with the model hosting platform HuggingFace hosting over 1 million open models. “In the long term the economic value of open frontier models is a key uncertainty ... [and] if training costs grow to billions of dollars and beyond” it will be hard for open models to compete with Big Tech (Cottier et al., 2024).

That said, there is a growing groundswell of support for Public AI that “promotes public goods, public orientation and public use throughout every step of AI development and deployment ... because we can’t rely on a few companies to build everything our society needs from AI, and we can’t afford the risk that they won’t” (Marda et al., 2024). Despite frequently cited safety risks of open-source AI being misused by bad actors, a careful analysis of the evidence supports a strong case for the 'responsible open-sourcing of near- to mid-term GenAI models' (Eiras et al., 2024). For-profit companies will likely focus on commercially profitable market segments, often at the expense of developing more customisable and sustainable small language models more suitable for low resource contexts (Marda et al., 2024). For instance, model compression techniques such as pruning, quantisation, and knowledge distillation hold considerable potential for reducing the complexity and size of GenAI models. These techniques could enable the deployment of lightweight models in developing countries (Vuruma et al., 2024), where open-source approaches can thrive.

While the future prominence of open-source GenAI is uncertain, Pacific SIDS should consider this option in their strategic planning.

3. Strategic scenarios for open solutions in Pacific SIDS: Navigating GenAI challenges

A key strategic question for many resource-constrained Pacific island countries, which may not be able to sustain commercial GenAI solutions, is whether there are alternate pathways that can be implemented .alongside the dominant commercial solutions being adopted in the industrialised world. This is crucial from a risk management perspective to ensure autonomy while reducing reliance on national digital education solutions that are not managed or controlled by the Pacific nations themselves.

Scenario planning is a methodology that offers a mental framework for envisioning plausible alternative futures for Pacific SIDS, particularly those prioritising digital public goods that can coexist internationally with the dominance of commercial AI solutions emerging in high-income countries.

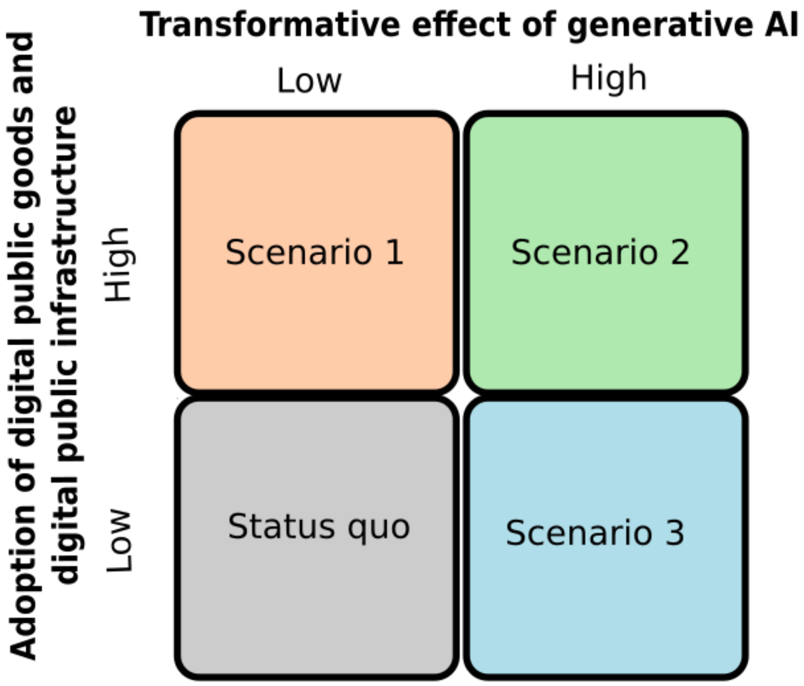
This section presents two distinct scenarios that do not rely on commercial GenAI solutions. Both highlight the need for cooperation, supported by FOSS to address the diseconomies of scale associated with individual SIDS.

3.1 A scenario planning matrix

In scenario planning, uncertainties are factors that can significantly affect operations but whose future outcomes in Pacific SIDS remain unpredictable. For this paper, two uncertainty axis have been identified:

1. *Adoption of digital public goods and digital public infrastructure in higher education* – Digital public goods refers to open-source software, open data, open artificial intelligence models, open standards, and open content, while digital public infrastructure refers to shared digital systems (United Nations 2024). Eventual adoption rates are uncertain.

2. *Transformative effect of Generative AI.* GenAI may have a limited impact on higher education if, for example, corporate developers are unable to establish sustainable business models to recoup the excessive costs in developing foundational models. Conversely, widespread adoption could lead to a revolutionary transformation of higher education systems in the future.



3.1.1 Defining plausible scenario quadrants for Pacific SIDS

The concept of 'open' in 'OER', along with its wide usage in many contexts has led to new and inconsistent interpretations, substantially undermining the value of the term (Pomerantz & Peek, 2016). For example, "OpenAI" is a non-profit company that created a for-profit subsidiary to raise capital for developing ChatGPT and has plans to convert to a for-profit entity (Francis et al., 2024). The definition of 'Open' in its name is unclear, but is inconsistent with past meanings, like suggesting open source or openly licensed. More recently, the concepts of 'Digital Public Infrastructure' and 'Digital Public Goods' are infiltrating the discourse of open education, making it essential to clearly define their meanings and their relationship to OER.

Digital public infrastructure is an evolving concept. For the purposes of this paper, digital public infrastructure is defined as "society-wide, digital capabilities that are essential to participation in society and markets as a citizen, entrepreneur, and consumer in a digital era. Because it is essential, digital public infrastructure should be guaranteed by public institutions to be 1) inclusive, 2) foundational, 3) interoperable, and 4) publicly accountable, as it is deployed in countries around the world (Eaves & Sandman, 2023).

OER is based on the principle that educational resources developed with public funds should be released under an open license for the benefit of citizens. Similarly, if digital public infrastructure is publicly funded, it would be reasonable to expect it to be openly licensed as well. While digital public infrastructure are the infrastructures that enable society to engage in public and civil life, "our digital infrastructures are only accidentally public infrastructure" (Zuckerman, 2020) because the vast majority of this infrastructure is designed and run by large for-profit corporations.

The Digital Public Goods Alliance GovStack Community of Practice (2022) have published a report outlining relationships between digital public infrastructure, building blocks, and digital public goods which are relevant for the vertical axis of the scenario planning matrix, specifically that:

- *Digital public infrastructure* may include the implementations of multiple proprietary and/or open-source solutions
- *Building blocks* which refer to software code, platforms, and applications should be interoperable using open APIs and Open API specifications.
- *Digital public goods* must demonstrate the use of an approved open license[7] and platform independence from closed components.

The vertical axis of digital public infrastructure and digital public goods identifies two distinct states of utilisation, differentiated by the extent of private versus public influence in education as a public good. **Low utilisation** is marked by educational resources treated as private, rivalrous goods, with a high proportion of proprietary solutions integrated into digital public infrastructure, leading to significant corporate influence and control over 'public' goods. In contrast, **high utilisation** is characterized by most educational resources being digital public goods, shared under open licenses, with strong community agency and limited dependence on corporate services for public goods.

Scenario 1 reflects the current state, where most educational resources in post-secondary education in Pacific SIDS, are all-rights-reserved, closed content, and currently there is minimal adoption of GenAI solutions in the region.

The horizontal axis explores the transformative impact of GenAI on Pacific SIDS, presenting two distinct pathways for educational technology in the region. Low adoption is characterized by limiting the digitisation of education to solutions that are affordable and sustainable without relying on GenAI. High adoption envisions the integration of GenAI into educational technology across the Pacific.

While GenAI has the potential to be transformative in high-income economies, it is not guaranteed that Pacific SIDS will have sustainable access to these technologies. These nations lack the financial resources to train their own foundational models, cannot afford the computational costs required to run chatbots for large language models in real-time, or simply do not have the budget to pay for corporate service subscriptions. Moreover, the commercialisation of GenAI and the concentration of power among a few large tech companies present a significant risk for SIDS. This dynamic raises concerns that profit may take precedence over educational outcomes, with AI tools being designed to generate revenue rather than enhance learning (Bozkurt et al., 2024). Consequently, Scenario 3 is not a viable option for many Pacific SIDS due to the likelihood of high costs associated with corporate GenAI solutions and the significant dependency risks they entail.

This paper does not oppose the use of GenAI in education, recognising its immense potential benefits for humanity. Resources in the public domain meet the criteria of both the UNESCO definition of OER (UNESCO, 2019) and the Digital Public Goods Standard (Digital Public Goods Alliance, 2020). Despite the copyright complexities surrounding GenAI, as previously mentioned, the leading commercial GenAI companies do not claim ownership of the generated output (Poulos, 2024). As a result, these outputs are practically in the 'public domain' and should be used for widening access to educational opportunity. In this context, dedicated national funding for OER is unlikely to increase, while reliance on commercial GenAI services is expected to grow, potentially undermining local autonomy and agency. This paper proposes two

[7] For software, digital public goods must use an OSI approved license, while open content collections are encouraged to use Creative Commons licenses that permit derivatives and commercial use (CC-BY and CC-BY-SA) but more restrictive licenses that do not allow for commercial use will be accepted (CC-BY-NC and CC-BY-NC-SA).

viable alternatives for Pacific SIDS that promote diversity alongside the emerging Big Tech monocultures in GenAI.

3.1.2 Scenario 1: Digital sufficiency and scaling down educational technology

The competitive advantage and incentive for growth of public investment in OER by Pacific (SIDS) decreases because generative AI can produce cheaper and higher-quality educational resources more efficiently than traditional development and remix by educators. In the absence of sustainable funding for OER (Action Area 4 of the UNESCO OER Recommendation, 2019) in the region, this scenario prioritises digital sufficiency through cooperative regional solutions to generate cost savings for reallocation to support digital public goods, rather than investment in corporate techno-solutionist approaches. – This option involves little to no reliance on either proprietary or open-source GenAI solutions.

In this scenario, OER is no longer an attractive model for securing public funding, as global interest shifts toward GenAI solutions provided by Big Tech corporations, an approach that is unsustainable for Pacific SIDS institutions. Given the barriers and risks for SIDS adopting corporate GenAI solutions, they must consider alternative strategies for digital public goods to support higher education in the region.

Drawing on the recent COVID-19 experience of emergency online remote teaching and students' limited access to technology in Pacific SIDS, this scenario is a response to concerns that future education reforms reliant on excessive digital consumption could exacerbate social inequalities. It is necessary to frame an alternative approach:

> *"[D]iscussions around sustainable development need to move away from default assumptions that the continued digitization of education is an inherently "good thing". This is not to say that digital technologies have no place at all in desirable future forms of education — rather this is a call to **re-imaging** educational technology in a **scaled-back** and **slowed-down** forms that might be deemed appropriate for an era of continuing social upheaval and climate collapse"* (Selwyn 2023a, emphasis added).

This scenario is based on scaling down excessive technology consumption in education and instead focusing on digital sufficiency by using only affordable essential digital tools. In the Pacific SIDS, this should prioritise convivial technologies fostering local autonomy— that is tools which are fully understandable, manageable, and controllable by the individuals and communities that rely on them (D'Alisa et al., 2014). FOSS tools, as digital public goods, provide the required autonomy. An 'Ed-Tech within limits' (Selwyn 2021) strategy advocates withdrawing from manipulative technologies, resisting the pressure to follow Big Tech, and focusing instead on retaining convivial technologies (Selwyn 2023a). Selwyn (2023a) offers examples of how 'degrowth' approaches could prioiritise:

1. Reusing, repairing, and recycling digital hardware within education settings and local communities. These can utilising FOSS operating systems including lightweight systems that run efficiently on older hardware without requiring recurring software licensing costs while extending their useful life substantially, counteracting the proprietary industry approach of 'planned obsolescence'
2. Retention of existing forms of educational technology that support creative, collaborative, and caring ways for individuals to self-direct their learning activities through the commons previously referred to as 'personal learning networks' or 'open knowledge networks'.
3. Utilising simple technologies that can be easily produced, maintained, and repurposed on a local basis, for example: mini-computers like the Raspberry Pi[8].

[8] https://www.raspberrypi.org/

Regarding emerging convivial technologies for the future, Pacific SIDS, with their small populations and diseconomies of scale, could benefit from the maturation of FOSS federated technologies, known as the 'Fediverse'. These technologies are designed for decentralisation – a collection of small instances locally managed that interact with each other as a 'network' through shared protocols like ActivityPub. For example, Mastodon is a decentralised social media platform that can be administered by local communities while connecting with other instances around the world, allowing all their users to interact.

In conclusion, digital sufficiency offers Pacific SIDS the opportunity to reimagine the organisation of educational technology provision through cooperative solutions, a topic further explored in Section 4.

3.1.3 Scenario 2: Small-scale, open solutions for generative AI

The rapid adoption of GenAI is transforming higher education worldwide, reshaping practices through innovations such as adaptive curriculum generation, intelligent tutoring systems, and automated grading and feedback. (Rudolph et al., 2024). In this scenario, Pacific SIDS prioritise the utilisation of affordable open-weight, Small Language Models (SLMs), and the sharing and remixing open prompts as 'OER' for generative educational content while striving to reduce depdency on corporate GenAI solutions. To mitigate costs and distribute risk, Pacific SIDs collaborate by establishing a Commons-based Open Cooperative. This cooperative offers an observatory service for open-source AI and open-weight models including shared public infrastructure and facilitates the exchange of expertise, knowledge, best practices, as well as professional development. – This option involves low to medium reliance on both open-source and proprietary GenAI solutions

SLMs could be leveraged to "cultivate home-grown AI tools and foster supportive local ecosystems" (UNESCO 2023), particularly in countries with limited digital infrastrucutre and resources. SLMs are significantly smaller in size, typically containing millions to a few hundred million parameters, compared to Large Language Models (LLMs), which usually have hundreds of billions of parameters and require substantial computational resources for training and inference. For instance, the LLaMA 3.1 model contains 405 billion parameters and was trained on 16,000 H100 GPUs over 54 days (Wang, K et al., 2024). Due to their size and high GPU memory requirements for inference, LLMs are typically hosted in the cloud, making them costly to operate. In contrast, SLMs can be trained to operate on standard hardware, for example personal computers or small servers, without needing high-end GPUs. In conclusion:

> "*SLMs excel in efficiency, cost, flexibility, and customization. They provide significant computational savings in pre-training and inference with reduced memory and storage needs, which is vital for applications requiring efficient resource use. ... Despite the commendable performance of SLMs, it is crucial not to overlook their credibility issues, such as the risks of producing hallucinations and privacy breaches*" (Wang, K. et al., 2024).

Open-weight SLMs could provide an affordable and practical pathway for indigenous communities to develop their own models. For example, Lelapa AI, a South African research and product laboratory, trained InkubaLM—a 0.4-billion-parameter open-weight model designed for low-resource African languages (Lelapa AI, 2024). InkubaLM supports five local African languages and demonstrates capabilities such as machine translation, sentiment analysis, named entity recognition (NER), parts of speech tagging (POS), question answering, and topic classification.

The model's training was supported by compute credits from the Microsoft AI4Good lab (Lelapa AI, 2024). However, relying on grant credits from commercial entities for technological infrastructure comes with risks. For instance, Microsoft reduced its annual Azure Cloud computing grant for non-profits from $5,000 in 2023 to $2,000 in 2024, a 60% decrease (TCA SynerTech, 2023).

The systematic design and optimisation of input prompts for LLMs “can exert a notable influence on the output generated by a model”(Chen et al., 2024). Creating pedagogically effective prompts to elicit sophisticated behaviour from GenAI can require significant effort and skill, often resulting in prompts that are hundreds or even thousands of words long (Wiley, 2024b). Open prompts are prompts shared under an open license, making them digital public goods that can be freely reused and adapted. Consequently, Pacific SIDS could share 'open prompts' across the region, enabling effective recontextualisation for individual islands and communities. This approach would also support the adaptation and refinement of open prompts fine tuned for different SLMS.

Indigenous communities increasingly emphasise the ethical requirement for the design and development of GenAI to centre indigenous knowledge systems and adopt culturally appropriate technological practices (Lewis et al., 2020). For example, in the context of indigenous data sovereignty, the Te Kāhui Raraunga Charitable Trust in Aotearoa New Zealand has supported Iwi Māori (Māori tribes or confederations of tribes) in creating a distributed storage network. This initiative, known as Te Pā Tūwatawata, enables Iwi Māori to store, protect, access, and control their own data locally, rather than relying on offshore corporate data centres (Te Kāhui Raraunga Charitable Trust, 2024). Additionally, Te Pā Tūwatawata is building local expertise by investing in training and capability development, empowering Iwi to manage and maintain these data storage sites independently (Te Kāhui Raraunga Charitable Trust, 2024).

In conclusion, open-weight, and open-source SLMs offer Pacific SIDS affordable opportunities to leverage generative AI (GenAI) while supporting indigenous language models. Research shows that appropriately selected SLMs with sizes ranging from 1.7B to 11B parameters “are effective and can compete with, and even outperform, models like Gemini-1.5-Pro, DeepSeek-v2, GPT-4o-mini, and GPT-4o, despite being 10-20 times smaller” (Sinha et al., 2024). By working collaboratively, Pacific SIDS can share open prompts to facilitate more effective localisation across the region’s diverse cultures. Additionally, indigenous communities have demonstrated successful approaches to storing, protecting, accessing, and controlling their own technologies locally, while building ecosystems that foster skill development for managing and hosting these technologies. Cooperation will be critical for success in the Pacific region, and the paper will explore organisational strategies in the final section.

4. Reorganising educational technology in Pacific SIDS for uncertain futures

Both scenarios emphasise the importance for collective organisational solutions to reduce costs and strengthen local capacity for technology deployment in Pacific SIDS. Pacific SIDS can benefit by avoiding a techno-solutionist approach that prioritises excessive utilisation of commercial AI. Instead, they should “reimagine educational technology as a focus for collective action rather than individual gain” (Selwyn 2023a).

Despite the compelling potential of OER to expand affordable access to educational opportunities, two decades after UNESCO (2002) coined the concept, it has yet to achieve mainstream adoption worldwide. Most post-secondary institutions still rely predominantly on closed, proprietary content. While many supporters of OER envisioned a shift in power dynamics of the market producing educational content at public funded institutions, one of the unintended outcomes of the “increased use of open products and practices in education is the increased exploitation of individuals” (Selwyn, 2014). For instance, the early cost savings for students derived from open textbook initiatives have been undermined by commercial publishers introducing “inclusive access” models, which automatically bill students for access to proprietary digital materials as part of their tuition fees. These models can result in students paying more than they would for used or rented materials (InclusiveAccess.org, n.d.).

The OER field could be described as being at risk of experiencing cognitive dissonance, as the open values underpinning OER and corresponding open practices, are at odds with the widespread reliance on closed proprietary technologies to achieve its open goals. This is an example of systemic failure in the OER ecosystem, as most employees working on open content projects at post-secondary institutions lack the agency to choose the technologies they use.

The open education ecosystem will benefit from greater recognition and applying ‘prefigurative’ practices in the future. Prefigurative politics refers to “how activists embody and enact, within their activism, the socialities and practices they foster for broader society” (Fians, 2022). In other words, proponents of OER should choose strategies and practices to build open futures and effect change by not reproducing the social structures and practices that they oppose (Fians, 2022). In this context, open education projects should ideally adopt an ‘open first’ technology approach, prioritising the use of FOSS technologies for their operations to counter the risks of ethical conflict, cognitive dissonance, and cosystem degradation. For example, the technology infrastructure of many of the large OER content repositories have proprietary code dependencies which limit reproducibility and increase the risk of vendor lock-in. In the realm of GenAI, the lack of transparency — a core principle of openness — in training data presents significant challenges for reproducibility, as even skilled developers will not be able to replicate the AI model without access to the same training data. Therefore, when designing organisational frameworks for educational technology in Pacific SIDS, an 'open first' approach should be prioritised. This would involve establishing organisational structures that can operate alongside existing entities to support the adoption of FOSS technologies. These structures should also build capacity, enabling any Pacific country to replicate the technology stack without depending on commercial solutions or proprietary software licenses.

In the context of degrowth, which informs both scenarios, this approach offers an alternative — not necessarily a better or competing —framework for envisioning the use of digital technologies. It emphasises supporting networks rather than institutions and fosters autonomous, non-hierarchical communities of interaction (Selwyn, 2023b).

Commons-based open cooperativism, drawing on the principles of commons-based peer production, presents an alternative organisational framework to platform capitalism (Papadimitropoulos, 2021). Platform capitalism refers to a digital form of capitalism where digital platforms are used by monoplistic firms as a business model to extract profit “centred on extracting and controling immense amounts of data” (Steinberg et al., 2024). Derived from worker cooperatives, ‘platform cooperativism’ is an online business model that emphasises decentralisation, democratic co-ownership, and equitable value distribution (Scholz, 2016). Platform cooperativism is based on the notion of creating a “People’s Internet” whereby corporate owned platforms are replaced by “user-owned” cooperatives (Sandoval, 2019). However, platform cooperatives operate within the realms of traditional patents and all rights reserved copyright and are not “creating, protecting, nor producing a commons” (Papadimitropoulos, 2021). In contrast, commons-based open cooperatives are cooperatives founded on the principles of commons-based peer production.

> *“From a commons standpoint, open cooperatives internalize negative externalities, adopt multi-stakeholder governance models, contribute to the creation of material (natural resources, technology) and immaterial (knowledge, culture) commons, and are oriented toward a broader socioeconomic and political transformation, all the while being locally based”* (Papadimitropoulos, 2021).

Commons-based open cooperatives (COCs) offer an appropriate organisational framework for Pacific SIDS to cooperate on leveraging digital technologies as a network of islands in a GenAI-driven world, whether focusing on digital sufficiency (Scenario 1) or implementing small-scale open GenAI initiatives.

COCs provide a contemporary approach to embody the Pacific concept of ‘Motutapu.’ In many Polynesian languages the concept is translated literally to mean ‘Sacred Island’, referring to the places of safety before continuing on journeys across the open sea (Johansson-Fua, 2020). It is a place to “allow locally contextualised negotiations to start projects” (Institute of Education, 2021) while engaging indigenous expertise in knowing what works in a local context. COCs reflect the Pacific values of reciprocity and respect as expressed by the sentiment: “let’s make good together — you have something, I have something, let’s do this together” (Institute of Education, 2021).

A key challenge for Pacific SIDS is the lack of reliable and affordable access to digital infrastructure necessary for building skills in technology-enhanced learning. Due to diseconomies of scale and dependence on foreign aid for public service provision, individual countries often cannot afford to establish such environments. These digital environments must also be free from commercial exploitation, such as ‘surveillance capitalism,’ and risks like vendor lock-in.

> **The solution is to create the digital equivalent of a 'Community Garden,' where ‘gardeners’ come together to gain new knowledge and skills, address immediate needs, and share maintenance responsibilities, all while fostering a supportive community of practice** (Commonwealth of Learning, 2022)**.**

A digital “Motutapu” space for Pacific SIDS, to foster locally contextualised collaboration guided by indigenous expertise, could be achieved at very low cost by establishing a Free and Open Source Software Digital Learning Ecosystem Commons (FOSSDLE Commons) for shared infrastructure. The cooperative would provide shared access to FOSS solutions to support Pacific SIDS in achieving digital sufficiency (Scenario 1), prioritising Fediverse applications that allow users to connect across independently hosted servers while ensuring interoperability and user control — thereby facilitating ease of replication as technical capabilities in Pacific SIDS improve. Alternatively, a FOSSDLE Commons could provide shared infrastructure for hosting and fine-tuning open-weight SLMs, as well as a repository for curating open prompts tailored to educational applications (Scenario 2). The shared infrastructure would also be utilised as a live training and mentoring environment in which in-country technologists can build expertise so they can support, and subsequently even replicate, these systems locally.

The FOSSDLE Commons would not be 'owned' or governed by any single country or organisation. Instead, Pacific countries and organisations would collaborate as a community for the cooperative's common good, with governance provided through a multi-stakeholder model.Within that, however, each country and organisation retains the freedom to implement their own systems in the ways they prefer.

As mentioned previously, the FOSSDLE Commons itself will operate as a mentoring model drawing on the principles of ‘Community Gardens’: that is shared spaces for growers to work with experienced gardeners, building relevant skills while working cooperatively on shared tasks (Göttl & Penker, 2020; Minchington, 2014). The community garden concept provides flexibility because participants can choose what ‘seeds’ they wish to grow or can start their own ‘garden spaces’ when they feel sufficiently confident to work on their own.

Drawing on the principles of sociocracy, the community can be organised as ‘Circles’ or groups of interest. Circles form the heart of a sociocratic organisation and this is where the day-to-day work is regulated and carried out (Rau, 2019). Typically ‘policy-makers’ and ‘workers’ of a circle interact with each other through transparent dialogue. The principle is that no decision impacting on the work of a circle is taken outside of the circle. It is based on the notion that those who are performing the work are the experts in that work and have the skills to govern the operations of the circle (Rau, 2019). Circles can be convened around a range of services and activities, and could for example include:

- Observatory service for SLMs that run on low-cost hardware and sharing open reviews for higher education institutions.
- Publishing and sharing technical guides for installing and maintaining open-source AI solutions.
- Developing and hosting a open repository for open prompts tailored to various open-source models utilising existing open-source versioning systems.
- Professional development support by creating and hosting selected open online courseson open-source AI applications and training in versioning repositories.

In closing, there is increasing global concern over the dangers posed by Big Tech - corporate-controlled internet technologies and their profit-driven business models, which threaten both citizens and democracies. This highlights the urgent need for digital public infrastructure funded by public resources rather than for-profit entities (Zuckerman, 2020). The FOSSDLE Commons offers Pacific SIDS a practical solution to leverage cooperative models for providing open digital public goods.

5. Conclusion

The adoption of technology in education, often justified by promises of improved efficiency and growth, is not necessarily inherently beneficial (Pueyo, 2018). For example, the significant environmental cost and bias challenges of GenAI call for consideration of more sustainable alternatives for Pacific SIDS. These futures could align with degrowth principles by promoting diversity of solutions in response to the uncertainties posed by the monocultures of corporate GenAI. This paper outlined two viable scenarios based on degrowth. Scenario 1 emphasises digital sufficiency, advocating for scaling down excessive technology use, while Scenario 2 focuses specifically on reducing reliance on the large language models by using scaled down, open-weight models. The two scenarios show that Pacific SIDS can prioritise education as a public good, rather than adopting neoliberal approaches to integrating corporate GenAI in education as a viable strategy.

Although the potential demise of OER due to GenAI may cause concern among open educators, this paper offers hope for Pacific SIDs by proposing alternate pathways to implement open solutions in parallel with the apparent global shift toward integrating commercial AI solutions in higher education.

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6.1 Critical review

Dave Lane, Open Source Technologist at the OER Foundation provided critical review of this paper.

6.2 Images

6.3 Content reuse and remix

Abstract

The initial draft of the abstract was generated by NotebookLM (Google, 2025) based on the submission of the full article text. The author subsequently refined the output.

Section 4: Reorganising educational technology in Pacific SIDS for uncertain futures

Portions of Section 4 of the article were adapted from the report *Improving the Efficacy of Mentorship with an Open Education Ecosystem* (Commonwealth of Learning, 2022), published under a Creative Commons Attribution-ShareAlike 4.0 International license.

6.4 Copyright

7. References

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