



ICT FOR BETTER EDUCATION IN THE PACIFIC

MAY 2018

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Cover: Students avail e-learning resources in Samoa.

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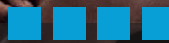
Students at the Solomon Islands Nguvia Secondary School use Kio Kit tablets loaded with learning resources.

Foreword

We are on the cusp of a technological revolution that is fundamentally altering the way people live, work, and interact with one another. In the Pacific region, the potential of information and communication technology (ICT) can be a game changer, if we are prepared to capitalize on it and ensure that the benefits of ICT applications are effectively extended to our most vulnerable regions and people.

As such, Pacific countries must begin a comprehensive preparation to ensure strategic benefits from ICT. This report takes a high-level look at how ICT has been incorporated into the education sector in the Pacific region, and provides recommendations on focal areas to drive further progress. It is intended to support Pacific education stakeholders and decision makers to engage strategically in ICT, and to ensure that their investments optimize the use of the limited resources in the sector.

Ma. Carmela D. Locsin
Director General
Pacific Department
Asian Development Bank



School children in the outskirts of Honiara, Solomon Islands on their way home.

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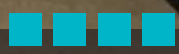
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Abbreviations

ADB	Asian Development Bank
DFAT	Australian Department of Foreign Affairs and Trade
e-learning	digital learning
EMIS	education management information systems
ERP	enterprise resource planning
ICT	information and communication technology
ICT4E	information and communication technology for education
LAN	local area network
SEN	student enrollment number
SIN	student identification number
SPC	Secretariat of the Pacific Community
TVET	technical and vocational education and training
USP	University of the South Pacific
USPNet	University of the South Pacific Satellite Communication Network
WAN	wide area network

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Secondary students of Samoa St. Mary's College study in the Schoolnet Resource Center.

A secondary student of Samoa Safata College uses game-based e-learning resources.



Introduction

Education sectors across the Pacific are changing rapidly. The region is witnessing significant growth in postsecondary participation rates, and an overall shift in the focus of sector development efforts from access to quality. At the same time, Pacific countries are undertaking major reforms to their telecommunication sectors, and many have begun developing their national information and communication technology (ICT) policies.

By 2021, all major Pacific island countries are expected to get their submarine cable connections installed and operational, signaling a rapid increase in connectivity rates across the region. These developments imply a huge shift—both in terms of demand for human capacity, and the need for cross-sector collaboration—to capture the full range of benefits that ICT can produce in the education sector. If managed effectively, sector developments in the areas of ICT and education can strengthen the region’s most valuable resource—its human capital.

The central reason for implementing any information and communication technology for education (ICT4E) intervention is, ultimately, to provide better learning opportunities for students. To this end, ICT4E supports stakeholders—ranging from teachers and students to policy makers—in planning, developing, managing, and delivering improved education programs and resources.

ICT4E interventions include (i) establishing and leveraging ICT networks, to share information and support collaboration;¹ (ii) using software, hardware, and connectivity to collect and analyze data, to manage the education sector and its institutions more efficiently; and (iii) developing and using educational materials, such as digital learning (e-learning) programs and digital knowledge repositories, to improve teaching and learning outcomes, and support research activities.

This rapid assessment report provides an overview of ICT4E developments in the region, based on analysis of available literature; site visits to Fiji, Samoa, and Solomon Islands; and review of a leading education provider in the region—the University of the South Pacific (USP). The report identifies focal areas to support ongoing ICT4E developments, and provides eight recommendations for the consideration of relevant ministries, development partners, institutions, and educators.

The findings of the report are organized into the following sections: (i) policy, finance, and collaboration; (ii) networks and connectivity; (iii) sector and institution management; (iv) applications of ICT for teaching and learning; and (v) human resources. The recommendations are provided on pages 2–3.

¹ In this publication, the term “ICT network” refers to connections used to link electronic devices, for the purpose of sharing information.

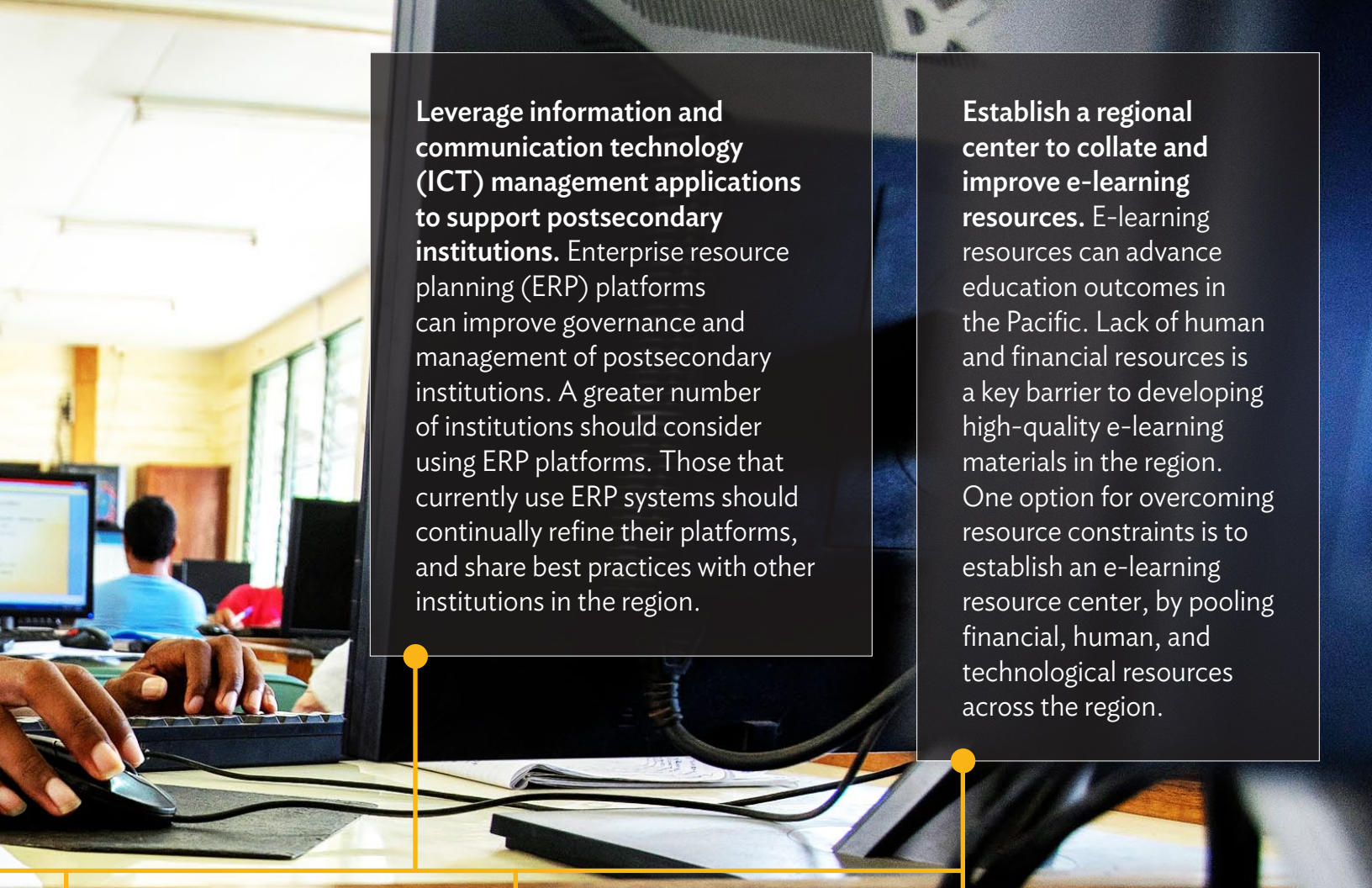
A student of the University of the South Pacific Solomon Islands studies at the campus' computer laboratory.

OVERVIEW OF RECOMMENDATIONS

Conduct upstream research. Information and communication technology for education (ICT4E) initiatives should be developed based on in-depth analysis of domestic circumstances and education sector goals. Research should examine the political economy of the education sector, and should analyze potential barriers to implementation, such as limited financial, technological, and human resources.

Review ICT4E policies in light of changing national circumstances. Telecommunication and education sectors across the Pacific changed considerably from 2012 to 2017 and, as such, there is a need to realign existing policy documents with national circumstances. Policy review should be cognizant of resource availability, and should seek to increase collaboration at all levels of the value chain.

Support effective use of education management information systems. Education management information systems can improve resource management and streamline administration across the education sector. Achieving these benefits will require improved capacity in the areas of data management and use. A greater number of capacity-building programs may be necessary to build skills in these areas.



Leverage information and communication technology (ICT) management applications to support postsecondary institutions. Enterprise resource planning (ERP) platforms can improve governance and management of postsecondary institutions. A greater number of institutions should consider using ERP platforms. Those that currently use ERP systems should continually refine their platforms, and share best practices with other institutions in the region.

Establish a regional center to collate and improve e-learning resources. E-learning resources can advance education outcomes in the Pacific. Lack of human and financial resources is a key barrier to developing high-quality e-learning materials in the region. One option for overcoming resource constraints is to establish an e-learning resource center, by pooling financial, human, and technological resources across the region.

Deliver ICT training programs for education stakeholders.

Knowledgeable human resources are an essential component of any ICT4E initiative. Training programs in the Pacific should seek to build ICT competencies for pre- and in-service teachers, principals, and educators. Postsecondary institutions in the region may be an effective resource for designing and providing appropriate training programs.

Increase access to university ICT networks.

A select few universities in the Pacific region operate private ICT networks. Exploring institutional collaboration, and opening access to these networks can reduce or distribute costs, and increase the number of students and educators that benefit from their use. Extending access to these resources will support more equitable distribution of learning resources and opportunities.

Develop national ICT4E networks.

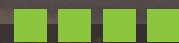
Given the small size of the education sectors in many Pacific countries, national education ICT networks are an efficient method of increasing ICT services for stakeholders across the sector. In cases where Pacific governments have already developed such networks, it is important to continue strengthening and building them, to meet growing demand for ICT resources.

Policy, Finance, and Collaboration

Developing successful information and communication technology for education (ICT4E) programs in Pacific island countries requires well-coordinated, realistic policies, and appropriate allocations of technical and financial resources. ICT4E policies need to be carefully aligned with broader education sector evolution, ICT sector reforms, and socioeconomic development strategies. Scarce financial and human resources in the Pacific emphasize the need for collaboration among ministries and between institutions, and highlight the importance of sequencing ICT4E interventions to be aligned with local circumstances.

Some of the key policy barriers to overcome are (i) limited coordination between ministries of education and other line ministries; and (ii) the narrow scope of ICT4E policies, which often focus on teaching ICT as a subject in school, as opposed to considering broader applications to support teaching and learning. Adopting an integrated approach within the education sector—and ideally, across sectors—can support the economic viability and long-term sustainability of ICT4E interventions. Aligning ministerial planning is particularly important to ensure that ICT4E initiatives are supported by increased access to necessary resources, such as electricity, telecommunication, and ICT technical support.

Resource planning should consider the fact that many residents in the Pacific have limited disposable incomes, and may require subsidies to support their engagement in education and e-learning initiatives.



School children in Samoa walk on their way to school.

Aligning Stakeholder and Policies

ICT4E policies should be closely linked to national ICT policies and socioeconomic development plans. Achieving this parity is particularly important for equitable distribution of ICT4E resources across urban, rural, and remote communities. Equitable and efficient deployment of ICT4E resources requires close coordination between relevant stakeholders, and alignment of ministerial planning. For instance, providing access to utilities (such as power and telecommunication services) is not the core business of ministries of education. However, these resources are necessary to deliver ICT4E services. As such, there is a need to work closely with, and to leverage relevant line ministries to enhance ICT4E initiatives and outcomes.

Review of current ICT policy documents in the region indicates that many national ICT4E policies are not aligned with local circumstances and, as a result, are often too ambitious. In many Pacific countries, ICT4E policies were developed before broader national ICT policies and reforms to the telecommunication sector, creating misalignment between ICT4E policies and the broader ICT sector.

Currently, there are government and institutional networks that operate in parallel, which creates redundancies, increases costs, and thus risks the sustainability of interventions. Policy frameworks across the Pacific region, and at the national level, should be firmly based on long-term value analysis, and should be designed to leverage overlapping sector goals to achieve greater economies of scale.

Box 1: Fostering Collaboration Across the Pacific Community

Deepening collaboration at both the national and regional levels can reduce costs and improve the quality of information and communication technology for education (ICT4E) initiatives. At the same time, integrating government and private sector stakeholders beyond the education sector can further reduce costs and help produce mutual benefits, such as sharing information and communication technology (ICT) services.

At the national level, producing ICT policies and development strategies can help guide targeted investments and support ministries in coordinating responsibilities and sharing costs. Increasing ministerial dialogue also helps ensure that policy plans are aligned with on-the-ground developments across sectors. When preparing national ICT documents, policy makers should directly address ICT4E goals, in order to deliver optimal ICT benefits to the education sector.

At the regional level, there is a growing need for collaboration between national governments, education institutions, the private sector, and development partners. One option for increasing dialogue between relevant ICT and education stakeholders is to designate coordination responsibilities to a single agency, and for this agency to convene regular meetings and collate resources. Development partners can play a key role in initiating dialogue. However, successful collaboration to drive ICT4E benefits will require ongoing participation from a diverse range of stakeholders.

Source: Authors.

Students of the University of the South Pacific Solomon Islands study at the campus' computer laboratory (photo by the University of the South Pacific).



Expanding Policy Designs

Most ICT4E policies in Pacific countries focus on teaching ICT as a subject in primary and secondary schools, as opposed to using it as a tool to support teaching and learning. In light of the rapidly growing number of applications for ICT, and the expansion of the postsecondary education sector, any review of ICT4E policies in the region should consider applications to support postsecondary education. Considering the broadest possible scope of ICT4E applications is important to encourage sector-wide thinking and collaboration, which leverage greater economies of scale to improve resource efficiency.

Smaller Pacific countries should consider developing integrated national ICT policies with corresponding ICT4E sections to support collaboration across sectors. Larger Pacific countries may consider designing ICT policies within the national education sector, to leverage resources across different levels of the education sector. Various models of integrating ICT policies into education have proven successful, and provide lessons learned as more Pacific countries develop their own ICT4E policies (Box 1).

Economic Considerations

Although ICT equipment and services are getting less expensive in the Pacific, they are still not affordable to all people and institutions in the region. To ensure the sustainability of programs and initiatives, it is critical that project designs consider recurrent costs, in addition to front-end capital investments. Given the fragile and small economies of many Pacific countries—in which citizens often have limited disposable incomes—there is an ongoing need for government subsidies to support education. Three of the key ICT4E finance topics for policy makers, development partners, and education institutions to consider are (i) how to leverage greater economies of scale through collaboration, (ii) how best to provide subsidies without creating dependence, and (iii) how to ensure the financial sustainability of ICT4E initiatives, in light of up-front and recurrent costs.

Ensuring that ICT4E initiatives consider local contexts is essential for securing domestic buy-in. As such, programs and policies need to be aligned with financial, technological, and human resource availability. Adopting integrated policy and financing approaches that are aligned with national conditions can increase cost efficiency and leverage available domestic resources to support sustainability.

Since many schools in the Pacific are managed by community groups, there is an increasing trend of mobilizing community support through local fundraising, corporate social responsibility, and alumni networks, to drive e-learning initiatives, even in cases where public funds are not made available. Increasing collaboration between community groups and public sector stakeholders may be an effective way of strengthening domestic buy-in to initiate and sustain e-learning initiatives.

Box 2: Pooling Resources to Deliver Improved Education Outcomes

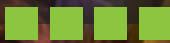
Solomon Islands has limited access to information and communication technology (ICT) resources. However, it has made considerable progress to leverage existing human and financial resources by developing a “whole of government ICT policy,” and a corresponding ICT Support Unit within its Ministry of Finance. Pooling resources has helped it reduce costs by leveraging greater economies of scale to provide domestic capacity. The Asian Development Bank is working with relevant stakeholders to ensure that national ICT developments are closely aligned with ongoing information and communication technology for education (ICT4E) initiatives.

Fiji enjoys relatively high access to telecommunication services, with 95% of its population receiving access to a mobile network. However, many families have limited disposable incomes. To subsidize the costs of ICT4E initiatives, the government has introduced a levy on all telecommunication providers, which is used to support ICT4E initiatives at the school level. Further, Fiji has committed 15% of its school grant budget to ICT4E interventions to drive national developments in ICT4E. These approaches illustrate methods of leveraging existing domestic resources to increase access to, and the quality of education.

Samoa has increased access to digital learning resources by encouraging students to bring their own devices to school. The “bring your own device” practice helps maximize the use of available digital learning resources, by allowing students to bring their mobile tablets and other devices to school to access learning tools. The practice is used in private schools in Samoa, and is an example of how existing resources can be leveraged to increase access to learning opportunities, in learning environments with limited access to financial resources.

Source: Authors, based on field and desk research.

Students from a remote school in Malaita Province, Solomon Islands pilot the use of mobile tablets loaded with e-learning resources.



Networks and Connectivity

Connectivity plays an important role in supporting teaching, learning, and research. Both online and offline connectivity (such as local area networks [LANs] and wide area networks [WANs]) can support distribution and use of e-learning materials, as well as distanced learning and other research functions across the sector.² ICT networks can provide private connections to support knowledge sharing, while telecommunication and internet connectivity can support local and international exchange of e-learning resources, respectively.³

Connectivity and telecommunication infrastructure varies widely between and within Pacific countries. As such, stakeholders need to carefully consider the different resources available at the national and institutional levels when designing and implementing ICT4E initiatives. Given the limited communication infrastructure in the region, stakeholders should seek to collaborate to reduce costs and increase access to communication resources, whenever possible.

² Please refer to pages 18–21 for a more detailed discussion of e-learning resources, and the role of connectivity in designing and implementing corresponding initiatives.

³ In this publication, the term “ICT network” refers to connections used to link electronic devices, for the purpose of sharing information.



Students of the University of the South Pacific Solomon Islands study at the campus' computer laboratory.


Telecommunication

Telecommunication sectors in Pacific countries are evolving rapidly, and changes are particularly evident in larger countries like Fiji and Samoa. Deregulation of the sector, and establishment of independent regulators in Fiji and Samoa, for example, have generated significant interest from the private sector, which has, in turn, stimulated competition. The influx of corresponding investments is gradually improving coverage, service quality, and pricing. However, telecommunication sectors in the region still require further technical and financial investments to become mature systems, with levels of service, coverage, and pricing that are comparable with international standards.

Information and Communication Technology Networks

Institutions that enjoy access to ICT networks benefit from increased opportunities to support research, teaching, and learning. However, many universities in the region have limited or no local access to ICT networks, even in cases where connections are technically feasible. A number of universities in the region are currently developing their own ICT networks. However, current efforts are costly and fragmented. Collating efforts nationally, or across the region, may provide options for reducing costs and increasing access to education resources.

Although access to information is typically considered a basic right, exclusive access to information resources can provide competitive advantages to individuals and organizations. As such, reaching agreements to distribute access to existing and planned ICT networks will require complex and high-level discussions. The Pacific Islands Forum Ministers of Education meeting and the USP Governing Council's meeting may be effective venues for initiating such discussions.



A high school student attends his class at Tupou High School in Nuku'alofa, Tonga.



Barriers to broader access to ICT networks include (i) high capital and recurrent costs associated with developing and maintaining university networks, particularly given the small size of postsecondary institutions in the Pacific; and (ii) lack of institutional arrangements to support shared access. The current distribution of access, paired with public financing for selected education institutions, has also raised questions surrounding the equity of financing and distribution of resources.

University of the South Pacific Satellite Communication Network

The University of the South Pacific (USP) was the first higher education institution in the region to establish its own satellite communication network (USPNet). The network connects USP's campuses across its 12 member countries, and benefits from exclusive access to Australia's Academic and Research Network.⁴

⁴ USP's 12 member countries are the Cook Islands, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, and Vanuatu.

USPNet started as a regional network to support USP in delivering education services to its member countries and campuses. In its first iteration, it supported USP's governance, administration, human resource management, financial services, teaching and learning, and research. However, in recent years, USPNet has expanded to serve more than its original educational services mandate.

USPNet now provides network services to support regional agencies in addressing issues pertaining to cyber security, climate change, and disaster management. Although USPNet provides access to regional organizations to support these functions, currently, it only shares access with a select few educational institutions.

Pacific education leaders frequently cite the goal of establishing a Pacific knowledge hub, and it is now technically feasible to do so.⁵ USP is seeking to create and host a knowledge hub for the Pacific; one possible method for accelerating this process is to review the structure of USPNet to open access for other postsecondary education providers.⁶ Doing so may prevent costly and unsustainable duplication of efforts to establish parallel ICT networks, and increase the number and quality of learning opportunities for students in the region.

Stakeholders in the region may explore the option of establishing USPNet as an independent entity, with an independent business and governance model. Doing so may permit greater focus on providing connectivity services for regional agencies. As a separate entity, USPNet could also consider options for expanding services to all postsecondary education institutions in the region. This arrangement may help USPNet access additional financing to support expanded functionality. Implementing these changes would require increasingly transparent governance and management structures to support better planning, expansion, and accountability of the network.

A comprehensive study of USPNet's utilization and service would help relevant stakeholders better understand network demands, and provide sound information on which to base further improvements to USPNet's technical capacity. In 2013, USP staff undertook an internal review of ICT services and infrastructure. Although the initiative was timely, it appears that the review was never fully completed, and that it would have benefited from more rigorous analytical work. Information provided through a more in-depth review may help stakeholders adjust applications to better target emerging and future demands on the ICT network, and could support future targeted investments to expand USPNet's services and network quality.⁷

⁵ Deputy Vice Chancellor, Professor Bythell's address to the Pacific Islands Universities Research Network, in July 2013 noted that USP had signed an agreement with 10 other Pacific universities to establish the network to help coordinate and support collaborative research, and to address policy issues. This is also noted in USP's Strategic Plan 2013–2018, which aims at greater engagement with the region and communities. The Strategic Plan specifically notes the goal to "provide and maintain leadership in Pacific academic and research networks." Activities toward realizing these commitments are ongoing.

⁶ USP. 2013. *University of the South Pacific: Strategic Plan 2013–2018*. Suva.

⁷ USP. 2013. Internal Review of ICT Services and Infrastructure at USP. Unpublished.

A student of the University of the South Pacific studies at the campus' computer laboratory (photo by the University of the South Pacific).



Sector and Institution Management

Information and communication technology (ICT) governance tools, such as education management information system (EMIS) and enterprise resource planning (ERP) software, are designed to assist ministries and institutions to plan, manage, and monitor their resources more effectively. EMIS platforms support sector governance, and ERP platforms deliver management functions for postsecondary institutions. Each system can assist stakeholders to compile and analyze relevant data and, in turn, support resource allocation and decision-making.

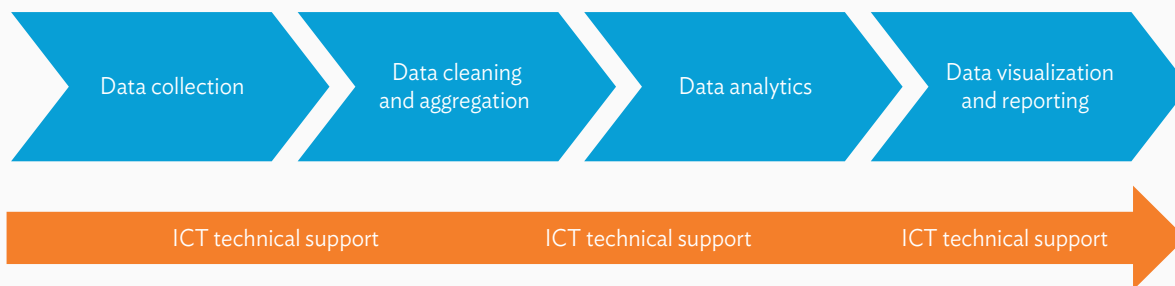
Development partners have supported most Pacific island countries to implement EMIS platforms to enhance governance and management capacities. USP has implemented an ERP system, and other universities in the region—including the Fiji National University and the Solomon Islands National University—are in the process of procuring ERP platforms. To realize the full range of benefits associated with sector and enterprise management software, stakeholders need to carefully plan rollout (from procurement to ongoing management), and to ensure that data collection and analysis target an appropriate range of inputs to support decision-making at all levels.

Education Management Information System

The expansion of education sectors across the Pacific underscores the need to develop and operate robust EMIS platforms to support informed decision-making in increasingly complex data environments. Comprehensive EMIS platforms can support (i) student examination and assessment, (ii) minimum service standards for school environments, (iii) asset registries, (iv) teacher and non-teacher personnel supply and demand management, (v) teacher training, and (vi) financial management. Effective use of EMIS platforms can produce a comprehensive understanding of education sector performance, and help target resource allocations and capacity development support.

Although some Pacific governments have operated EMIS platforms for as much as a decade, no country in the region appears to make full use of its platform. EMIS development and use has several key stages: (i) data collection, (ii) data aggregation and setting up databases, (iii) data analytics and data visualization, and (iv) reporting (Figure 1). However, most Pacific countries with EMIS platforms have not progressed beyond the first two stages, and primarily use their systems to collect demographic data and report on sector indicators. This focus overlooks a number of applications and, therefore forfeits potential benefits. Ensuring robust and effective use of EMIS platforms requires ongoing technical support, local buy-in, and data inputs that are both relevant and accurate.

Figure 1: Stages of EMIS Platform Development Indicating Continued ICT Technical Support



EMIS = education management information system, ICT = information and communication technology.

Source: Authors.

In 2012, the Australian Department of Foreign Affairs and Trade (DFAT) undertook a rapid assessment of EMIS interventions across the Pacific. The study provides one of the few evaluation reports to date, and notes the following key gaps: (i) varying quality and timeliness of EMIS data, (ii) insufficient technical support for the use and maintenance of database software, (iii) challenges in implementing and optimizing EMIS platforms at different levels of the education sector, (iv) limited data analysis capacity at the local level, and (v) limited local demand for data.⁸ Perception barriers also appear to affect the adoption and use of EMIS platforms.

⁸ DFAT. 2012. Pacific Education Management Information Systems—Rapid Review. Unpublished.

Although there are ongoing activities to optimize EMIS applications and use across the Pacific, site visits conducted in 2017 confirm that the gaps identified in 2012 continue to be relevant. DFAT has committed to increase long-term financial support for EMIS programs in the region, through the Secretariat of the Pacific Community (SPC) and the Education Quality and Assessment Programme. Overcoming key technical and resource constraints, as well as strengthening capacity in target areas, can help increase the use and value of EMIS platforms in the Pacific and, in turn, support more efficient administration across the sector.

Addressing barriers. EMIS platforms are not typically used to their full potential. In many cases, they are used to report on international development indicators, but not to capture and respond to local management needs for data. Ministries of education often perceive EMIS to be a top-down approach that requires them to report on Sustainable Development Goals (SDGs) and regional indicators, as opposed to being a bottom-up tool to facilitate planning and management across the sector—this perception can limit local buy-in. Lack of domestic ownership, in turn, limits the sustained use of EMIS platforms beyond the initial setup process.

Building domestic capacity in system operation and management may be one way of encouraging more robust use of EMIS platforms, changing perceptions, and encouraging sustained use. Capacity development should highlight ways in which stakeholders can leverage EMIS platforms to simplify onerous data analysis, and support more efficient and effective development of the education sector.

Technical resources and capacity. Sustainable use of EMIS platforms requires ongoing capacity to maintain ICT hardware and software, in parallel with all stages of implementation. However, stakeholders often underestimate the need to provide ongoing technical support and corresponding financing. It is critical that decision makers (i) consider local technical and human resources availability, (ii) identify ways of providing ongoing technical support, and (iii) allocate resources to cover associated capital and recurrent costs. ICT technical support needs can either be met by in-house capacity or by outsourcing services with service agreements. The specific arrangement for providing ICT support will vary by country, and should be considered in the design and implementation of any EMIS or ICT4E initiative.⁹

In addition to technical support, successful management of EMIS platforms requires capacities in undertaking routine trend analysis and producing education sector performance reports. Although national institutions—including universities, bureaus of statistics, and central planning departments—may currently be capable of providing capacity building to enhance analytical capacity, little has been done to leverage these resources to build relevant capacities within ministries of education in the Pacific.

Appropriate methods for meeting data analysis needs will also vary by country. Larger Pacific countries may be able to do analytical work internally, though they may require capacity development support to do so. Smaller Pacific countries, by contrast, may require external assistance that can be provided remotely.

⁹ Different countries in the Pacific have adopted a wide range of practices to provide ICT support, in line with their varying resource availability and governance structures. For example: (i) Fiji houses an ICT support unit within its Ministry of Education; (ii) Solomon Islands leverages a “whole of government approach” to provide ICT services to all ministries, through a centralized government unit in the Ministry of Finance; and (iii) Kiribati outsources specific services.

Discussions have begun on the possibility of using the Statistics for Development Division of SPC to host a regional EMIS analytic support facility. However, this option may fail to cater to the unique needs of each Pacific country, and since SPC is partially financed by development partners, this option may not be financially sustainable.

Scope and quality of data. The quality and relevance of input data underpin the ability of EMIS platforms to support effective decision-making. Establishing acceptable lag-times and margins of error can help secure a high quality of data, while limiting unnecessary resource expenditures to achieve costly “last-mile” accuracy. Focusing too many resources on increasing data accuracy can slow overall progress toward EMIS platform implementation. The process of setting acceptable margins of error is particularly important in the Pacific context, where geographic dispersion, and limited electricity and communication resources complicate timely and accurate data collection.

Box 3: Refining Input Data to Support Management

Fiji and Samoa are in the process of integrating human resource management, finance, and student assessment data into their respective education management information system (EMIS) databases. Doing so can significantly improve their systems over time. Review of EMIS platforms in Fiji, Samoa, and Solomon Islands indicates the need to review conceptual designs, particularly with respect to the scope of data fields that are included in each system.

Fiji. Review of Systems Approach for Better Education Results reports on EMIS, and verification during site visits indicate that Fiji has the most advanced EMIS system in the region. Fiji’s EMIS has good demographic data at the school level, and the government is in the process of merging other databases. However, even Fiji’s EMIS would benefit from further improvements. Some actions that can be taken to strengthen the system include (i) integrating postsecondary information into the system, (ii) merging existing databases, and (iii) refining data fields to indicate which teachers teach which subject (to reduce teacher mismatch).^a It should be noted that Fiji’s EMIS platform has benefited from long-term, on-site technical advisors that have helped build both the system and local capacity.

Samoa. Samoa’s EMIS has disparate databases for teachers, students, assets, and assessments. The teacher database contains only basic information, such as the number of teachers and their qualifications, but does not include teaching subject data. There have been several attempts to merge teacher, student, and assessment databases, but a collated database has not yet been created. Issuing student identification numbers or student enrollment numbers can be an effective mechanism for monitoring student enrollment and transfers to track students and avoid duplications when calculating per capita funding. Samoa has made considerable progress to improve student administration and examination practices and, in 2015, the government successfully introduced a student enrollment numbers system that covers all existing and new students.

^a The term “teacher mismatch” refers to cases where a teacher’s academic qualification does not correspond to the subject he or she teaches.

Sources: World Bank. 2015. *Samoa Education Management Information Systems: SABER Country Report 2015. Systems Approach for Better Education Results*. Washington, DC; Namrata Saraogi, Diana Katharina Mayrhofer, and Abdul-Hamid Husein. 2017. *Fiji Education Management Information Systems: SABER Country Report 2017*. Washington, DC: World Bank; and World Bank. 2015. *Systems Approach for Better Education Results (SABER)*. Washington, DC.

Strengthening labor markets with education data. EMIS has the potential to strengthen governance and management of education institutions across the Pacific. However, limited use of EMIS in the postsecondary subsector, and lack of coordination between stakeholders, is currently limiting potential benefits. Demand for postsecondary education in the Pacific has increased, leading to growth in the number of public and private service providers, and to increased student participation rates. In Fiji, for example, there are now 140 postsecondary education providers offering postgraduate programs—these range from trade training schools to institutions. Samoa and Solomon Islands are also experiencing growth in the number of universities, theological colleges, and technical and vocational education and training (TVET) providers.

At present, most postsecondary education data in the Pacific is collected and retained by postsecondary institutions, and specific data is shared in an ad hoc manner, only when ministries of education request it. The lack of a systematic approach to monitoring the performance of the postsecondary subsector generates mismatches between labor market demand and supply.¹⁰ Collecting data that tracks students as they transition from the school system into postsecondary education, and eventually into the workforce, can enable more effective workforce planning.

EMIS platforms can support alignment of available programs with labor market demand, help benchmark and improve the quality and relevance of postsecondary education services, and strengthen labor market outcomes. This sort of planning, however, can only be achieved with the support of robust EMIS platforms that integrate primary, secondary, and postsecondary education data. Currently, most EMIS investments in Pacific island countries target the school subsector, which limits sector-wide analysis and leads to missed opportunities in potential labor force enhancement.

The Fiji National High Education Commission has expressed interest in receiving assistance to include postsecondary education data and other knowledge management information into its EMIS.¹¹ One reason for doing so is to improve system sustainability by consolidating existing resources.¹² Fiji has started to include TVET data into its system, but has begun collecting the information in an ad hoc manner and, as a result, does not yet have the full range of postsecondary data available. Developing a conceptual model to collate information from the postsecondary subsector can support tracking and management across the education sector.

¹⁰ Kenn Chua and Natalie Chun. 2016. In Search of a Better Match: Qualification Mismatches in Developing Asia. *ADB Economics Working Paper Series*. No. 476, February. Manila.

¹¹ Conversation with the Director of Fiji Higher Education Commission, 28 January 2017.

¹² J. Sarvi and H. Pillay. 2015. *Integrated Information and Communication Technology Strategies for Competitive Higher Education in Asia and the Pacific*. Manila: Asian Development Bank.

Box 4: Enterprise Resource Planning at the University of the South Pacific

The University of the South Pacific (USP) currently uses the Ellucian Banner software to support student administration, and human resource and finance functions. USP has developed a range of additional applications for specific purposes, including a leave management system and an online portal for student administrative services. Each application is linked to the Ellucian Banner database. USP has made periodic modifications to add new capabilities and, while modifications have extended functionality, the ad hoc approach used to develop these modifications may have contributed to the reduced interoperability of the current system. As a result, USP's current enterprise resource planning platform may lack some of the administrative and management features that support efficiency in more developed platforms.

Source: Authors, based on interviews and desk research.

Enterprise Resource Planning Platforms

ERP platforms support well-informed institutional governance and resource allocation and, as such, can improve the quality of education for students and the financial performance of institutions. ERP platforms can help decision makers provide course offerings that are more relevant to student and labor force demands, and ensure the proper distribution of human and financial resources to improve education outcomes.

Options to reduce cost and improve service. Given the small size of most postsecondary institutions in the Pacific, a regional approach may be appropriate to leverage greater economies of scale for procurement and ICT technical support. From a commercial perspective, servicing small individual institutions with multiple information technology (IT) platforms limits the ability of vendors to provide the best support services at affordable costs. Domestic technical support is often not available, and importing services from overseas can be costly. This highlights the potential value of developing regional backend support for these ERP platforms—doing so is only possible through a regional approach.

Considerations for selecting the appropriate platform. ERP systems are costly to set up and, in many cases, even more costly to modify. Due to the fact that ERP platforms cannot be readily changed, careful selection of an appropriate platform is essential. Planning should consider: (i) financial value analysis; (ii) the range of services a given system can provide; (iii) flexibility of the system's architecture to add new services; and (iv) provision of product support, following procurement. Since USP has ample experience using ICT enterprise software in the context of small island economies, it may be able to share valuable lessons learned, and to provide leadership to support other higher education institutions in establishing their own ERP platforms.



Students at the University of the South Pacific Solomon Islands study at the campus' computer laboratory (photo by the University of the South Pacific).

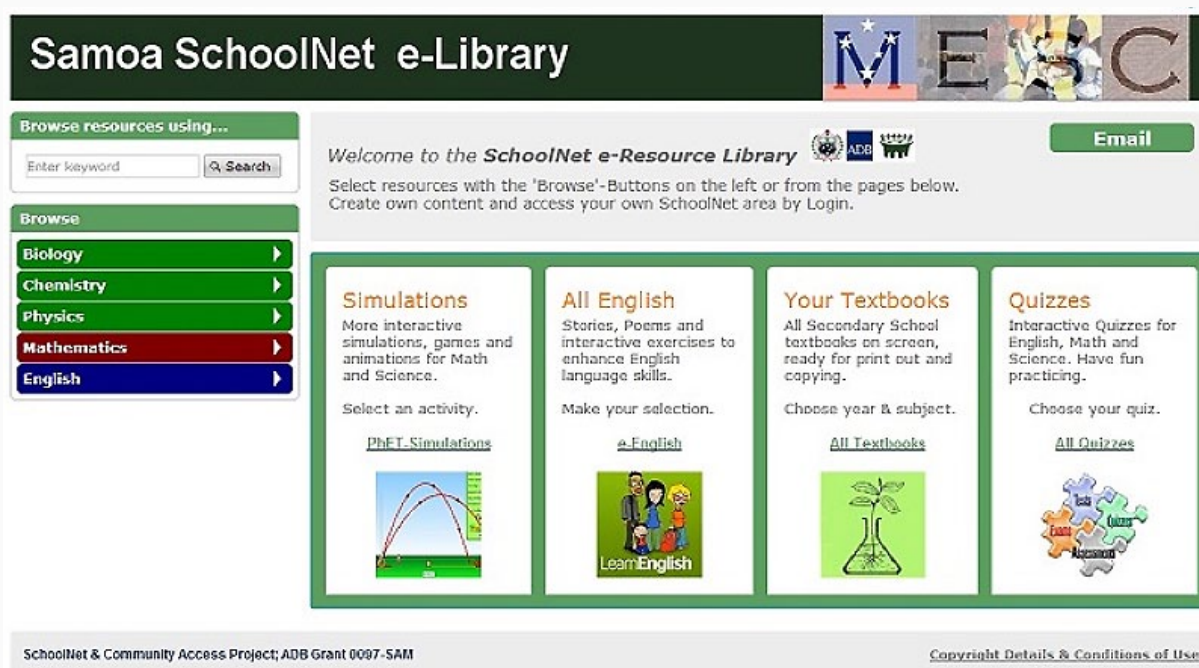


Applications of Information and Communication Technology for Teaching and Learning

Information and communication technology for education (ICT4E) has the potential to improve learning outcomes by modernizing classroom practices. The term e-learning covers a wide range of electronic educational applications and processes, including computer-based learning, virtual classrooms, and digital collaboration. E-learning resources, in turn, are defined as any entity, digital or non-digital, that may be used and reused for learning, education, or training. Some examples of e-learning resources include collections of content items, simulations, and interactive materials. An e-learning repository is a collection of e-learning resources, systematically collated and indexed for a curriculum. Devices, such as desktop computers and mobile tablets, can be used to support distribution and use of e-learning resources and repositories, even in learning environments with limited or no connectivity.

E-learning initiatives and resources can significantly improve teaching and learning outcomes across the education sector, by supporting visualization of complex concepts, repeated practice to develop mastery, and interactivity and self-directed learning. Despite the wide range of potential benefits, however, the majority of e-learning initiatives in the Pacific have taken place on a pilot scale, and e-learning resources have not been developed systematically. As stakeholders begin scaling ICT4E and e-learning initiatives, they should consider (i) the need for technical and financial investments to develop high-quality e-learning resources, (ii) the need to design projects that can be expanded alongside national ICT developments, and (iii) potential application of devices to support e-learning.

Figure 2: ADB-Financed Samoa SchoolNet e-Library



Source: Samoa SchoolNet e-Library.

Developing Effective E-learning Resources

High-quality e-learning resources provide better learning opportunities for students. However, developing appropriate resources requires specialized skills, equipment, and software—which are often in short supply in the Pacific—as well as a high volume of contributors, and close collaboration between them. To develop resources that are specialized for the Pacific context, there is a need to establish an entity (or group of organizations) responsible for (i) aggregating; (ii) customizing, verifying for quality and appropriateness; (iii) indexing materials for curricula; and (iv) uploading them to repositories. Given the specialized nature of these tasks, a systemic approach, perhaps at the regional level, is needed to leverage economies of scales to develop and collate materials that target demand areas in the education sector.

To date, development of e-resources in the Pacific has depended on disparate initiatives, such as teacher-led innovations. Initiatives have concentrated on school education and, in the context of higher education, they have focused on studying ICT as a subject, rather than as a tool to support teaching and learning across the curriculum. Despite the high demand for skills in the region, existing TVET programs have not yet used much ICT in developing and supplying e-learning resources. Increasing the application of ICT to support TVET, particularly through distance learning, may provide options for making existing courses more cost-efficient and widely available.

A number of barriers continue to slow the development and use of high-quality e-learning resources to support teaching and learning across the region. Current barriers include (i) ubiquity of online resources, which conflates the role and function of ICT-enhanced teaching and learning modalities;¹³ (ii) lack of capacity to design and implement repositories, which limits the potential of these resources to support education; (iii) lack of resources to build the capacity of teachers to design, implement, and use e-learning resources; and (iv) limited development of open education resource policies in the region, which impedes the use of existing open education resource and leads to duplication of efforts.

Developing and supplying high-quality and appropriate e-learning resources in the Pacific will require more systemic approaches to developing e-learning resources, compiling them into repositories, and distributing them to stakeholders across all education subsectors. A higher degree of collaboration, between national institutions and regional stakeholders, is essential to driving innovation in the sector and to providing improved teaching and learning resources for students across the region.

E-learning and Connectivity

Connectivity is often mistaken for internet connectivity and, although access to the internet is desirable, it is not a prerequisite for the success of e-learning initiatives. E-learning resources can be made available offline, on tablets, and other devices, distributed by LANs and WANs, exchanged through ICT networks, and accessed on the internet. Given the varying levels of telecommunication infrastructure and internet connectivity in each Pacific country, e-learning programs in the region need to consider local contexts and the availability of ICT resources. It is also important that programs be designed in such a way that they can be expanded alongside domestic ICT developments (Box 5).

Given the distribution of many Pacific communities across remote islands, ICT4E program designs need to consider ways of balancing equitable deployment of resources with effective program design. For example, in accordance with diffusion theory, it may be most effective to start e-learning initiatives in urban centers (where connectivity and resources are often more available), and to gradually expand them to last-mile sites. However, this approach may raise concerns of equity for remote communities, or populations on

¹³ H. Beetham and R. Sharpe. 2013. *Rethinking Pedagogy for a Digital Age: Designing for 21st Century Learning*. Routledge.

Box 5: The Samoa SchoolNet and Community Access Project

The Samoa SchoolNet project was designed to assist the government to achieve more equitable and effective information and communication technology (ICT)-enhanced education system, and to promote lifelong learning. Its intended outcome was to enhance learning outcomes for secondary students and improve knowledge-sharing through ICT.

The project was implemented in three phases, which were aligned with developments in Samoa's telecommunication infrastructure. During the first phase, e-learning resources were provided at the school level, using local area networks. Activities were gradually scaled up to a national wide area network during the second phase—connecting all secondary schools and the Ministry of Education, Sport and Culture. During the third phase, the network was connected to the internet through a single gateway at the Ministry of Education, Sport and Culture.

The gateway allows students of the University of the South Pacific or the National University of Samoa to connect to their respective university platforms online, from home or from internet cafes, provided that they are teachers or teacher trainees. This arrangement was initially used only for teachers participating in the SchoolNet program, but has since been expanded to support teachers wishing to upgrade their teacher certificates to bachelor's degrees through the teacher upgrade program at the National University of Samoa. Since Samoa has wireless broadband capability, the network also enables video conferencing between the two main islands, which supports a range of stakeholders, including several ministries.

The project provides a good example of responsive bottom-up design, because it was cognizant of the evolving nature of the national ICT sector in Samoa, and because it adopted an industry standard ICT system that could be progressively expanded and upgraded. The Samoa SchoolNet project also illustrates how collaboration among different ministries and stakeholder groups can deliver additional benefits by expanding available resources.

Source: Asian Development Bank. 2007. *Report and Recommendation of the President to the Board of Directors: Proposed Asian Development Fund Grant to the Independent State of Samoa for the SchoolNet and Community Access Project*. Manila.

outer islands and in rural areas. Conversely, although piloting new interventions in last-mile site has merit and helps ensure equity, failed or unsustainable pilots can undermine the benefits of ICT4E, and reduce the confidence of governments to invest in future initiatives. As such, each program should consider methods of balancing equity and efficacy issues during program design. There is a continued need to develop an evidence-based understanding of e-learning, and how best to implement it in the Pacific context.

One option is the bottom-up approach of working from school LANs, locally hosting approved e-learning resources, progressing to WANs, and then to internet-based systems (pending availability). Existing barriers are primarily logistical and attitudinal—the lack of an evidenced-based understanding of e-learning resources has undermined efforts to develop and scale successful initiatives.

Information and Communication Technology Equipment and Devices

Devices provide access to e-learning resources. Most postsecondary institutions in the region have at least one computer lab for teaching and learning, and will need to develop associated plans for progressive software and hardware upgrades. This is particularly important as technologies become more energy efficient, and are updated with new instructional features. Incremental updates can help ensure cost efficiency and maximize learning outcomes.

As devices become less expensive and more widespread, policy makers and institutions are considering new methods for providing equipment. Perhaps the most critical questions concerning devices in ICT4E interventions are how devices should be used, and, in cases where they are provided by schools and education institutions, how use arrangements should be structured.

Accessing equipment. To date, ICT4E equipment for initiatives in the Pacific has often been obtained through aid projects, diaspora groups, local and overseas business networks, philanthropy, and government provisions. However, private ownership and access to equipment have increased due to innovations in technology and decreasing technology costs. As a result, education institutions and governments are shifting away from public procurement models, in favor of “bring-your-own-device” approach. Under these arrangements, education providers assign minimum technical specification requirements for devices, and students procure them from local ICT vendors.

In some Pacific countries, however, residents cannot afford devices, or there are few or no technology vendors.¹⁴ In these cases, some level of government or institutional support may be necessary to provide devices. Although limited access should not deter those who currently have devices from engaging in e-learning, ICT4E policies should be designed inclusively to support a gradual increase in e-learning participation in both urban centers (where ICT devices are more often available) and rural areas.

In cases where the public sector or education institutions are considering procuring devices, stakeholders should consider the following questions: (i) do the students own the devices, or are they owned by government or schools, and leased to students; (ii) what is the rationale for distributing devices (i.e., are these equity-based policies to help only poor children, or will initiatives provide devices for all students); and (iii) who is responsible for providing maintenance support? If the objective is to overcome financial barriers and support all students to own devices individually, stakeholders in the region should consider alternatives to directly procuring devices.

¹⁴ Outer islands in Solomon Islands, Vanuatu, and smaller countries like Tuvalu are examples of areas where there are limited or no ICT vendors.

One option is for institutions to provide financial rebates to encourage students and teachers to purchase their own devices. This method would hold owners responsible for maintaining, monitoring uploads, and ensuring the security of the devices, which may be more cost-efficient than procuring them directly. Individual ownership also helps manage the risk of inappropriate or illegal use of publicly owned devices.¹⁵

Managing device quality to avoid e-waste. ICT programs should be considered long-term investments, and thus require strategic planning. Procurement of devices should be based on sound input from IT experts, as well as on input from key users, including education experts. It is also important to mitigate downstream risks, such as e-waste.

Although purchasing cheap devices, or accepting low-cost or free devices from international organizations can quickly increase access, it is important for stakeholders to assess device quality to avoid e-waste. Outdated devices and low-quality products become obsolete quickly, and generate e-waste. Therefore, it is important for governments to develop policies regarding the age of devices brought into the country, and for procurement methods to consider quality as well as cost.

The Secretariat for Pacific Regional Environment Programs has developed e-waste management guidelines, which may help policy makers develop appropriate e-waste policies at the national level. With respect to the quality and cost of devices, although industry-standard devices are often more expensive, large orders can be used to negotiate prices, and government tax exemptions on IT purchase related to education can support cost competition.

¹⁵ In cases where devices owned by the school or a third party are misused, the “duty of care” responsibility can fall on the owner. To avoid this, devices can be locked to restrict access, and constant monitoring of internet traffic may be a necessary component of the “duty of care” responsibility. Some countries adopt ICT at the school level, and consult parents on internet safety and responsibility. This arrangement helps distribute responsibility for the student’s safety between parents and educators.



Ministry of Education and Human Resource Development staff get training on the use of Kio Kit tablets.

Human Resources

Lack of human resources and training opportunities remain one of the key barriers to the success of ICT4E initiatives in the region. Implementing sustainable ICT4E interventions requires qualified human resources at all levels, including policy makers, curriculum and content designers, ICT system administrators, technical support personnel, district supervisors, teacher educators, school leaders, and teachers. As such, professional development and training should be key dimensions of any ICT4E initiative.

While many Pacific countries have adopted ICT in teaching and learning in their schools and postsecondary education institutions, teacher training and staff development programs in the region have not been responsive to evolving demand. E-learning initiatives are more likely to be successful if teachers and lecturers are trained to apply e-learning resources in their classroom practices. However, most ICT investments in the Pacific, to date, have been used for infrastructure and equipment. Ongoing development of ICT4E initiatives in the Pacific will require complementary training and human resource development to ensure quality and sustainability of results. In cases where local labor markets cannot meet skill demands, stakeholders need to consider options for outsourcing skills or building local capacity.

Meeting Specialized Technical Skill Demand

The high international demand for ICT experts, and local demand from the private sector make it difficult for the public sector to recruit and retain qualified ICT staff in the Pacific. Therefore, ensuring access to high-quality ICT services requires creative approaches, such as outsourcing and pooling resources. Stakeholders need to undertake cost-benefit analysis at the national level to determine the best options for securing necessary ICT personnel, and for building local capacity, where possible.

The most relevant options for securing human resources to support ICT4E initiatives in the Pacific include (i) outsourcing experts on a case-by-case basis, (ii) pooling resources across ministries to establish localized ICT support units, and (iii) building in-house capacity. Since identifying appropriate human resources will be an ongoing challenge in the region, it is essential that stakeholders continue to share best practices and lessons learned during implementation.

Information and Communication Technology Human Resources and Training in Schools and Universities

Education leaders need strong managerial skills to motivate staff and students, and to mobilize the local support required for ICT-enabled teaching and learning programs to succeed. Teachers and professors are pivotal for transforming teaching and learning practices and engaging students in ICT learning environments. However, current training programs do not typically include e-learning competencies and, thus, teachers are not trained to use e-learning resources in their classroom practices.

Preservice teacher training programs in the region provide limited to no ICT exposure. Only computer studies teachers are required to study ICT in their preservice programs. Currently, most ICT training for teachers is provided through short, in-service programs. Although school administrative staff (such as principals) are expected to submit EMIS data electronically, they only receive project-led, short-term training. There is an urgent need to review and modernize staff development programs in the education sector to include ICT competencies. Training programs should also build the capacity of teachers and other education sector stakeholders to maintain ICT system. Doing so can increase the sustainability of e-learning investments. Although some work has been done to increase the sustainability of ICT4E initiatives through training and human resource campaigns, further developments are needed to produce results. Staff development programs for university staff in the Pacific are limited, and there is typically no e-learning instructional design support to assist academic staff in adopting e-learning into their teaching models. Establishing robust training for education leaders, teachers, and university faculty is essential for advancing ICT4E in the Pacific.

Secondary students of Samoa Safata College avail e-learning resources.



Recommendations

Information and communication technology for education (ICT4E) initiatives can increase access to, and improve the quality of learning opportunities in the Pacific. Many of the pilot projects and initiatives supported by development partners, governments, and school communities in recent years provide useful lessons to improve future ICT investments. However, lack of capacity to map and respond to key education sector needs has hindered large-scale uptake of ICT4E in the region. Key issues for stakeholders to consider include (i) the appropriateness of different ICT systems and existing technical solutions, (ii) implementation processes for ICT in education projects, and (iii) human resource development.

A more collaborative and systemic approach is needed to help accelerate the uptake of ICT4E. Achieving intended outcomes requires that ICT4E initiatives be carefully planned, well-coordinated, based on empirical evidence, and that they adopt a long-term vision. Reforms should be supported by evidence from international research, and lessons from both global and local ICT4E development programs. In undertaking reforms, Pacific education leaders and institutions should take a long-term view of ICT4E investments, and seek to develop a more collaborative environment for developing and sustaining ICT4E initiatives.

Advancing Information and Communication Technology for Education Initiatives in the Pacific

- i. **Conduct upstream analytical work and feasibility studies.** Design and implementation of ICT interventions need to be well-informed. Rigorous upstream analytical work and feasibility studies are critical to inform strategies and assess risks in ICT4E programs. Research should consider (a) the political economy of education in the Pacific, (b) ICT technical and conceptual challenges, (c) human resource availability and training issues, and (d) specific national objectives for advancing ICT4E.
- ii. **Review national information and communication technology for education policies.** In the last 5 years, there have been significant changes in both the telecommunication and education sectors in the Pacific. Systemic review of changing circumstances in Pacific island countries is needed, to align ICT4E policies and strategies with changing national circumstances. The review should consider (a) availability of power, telecommunication services, and other resources at the national level; (b) methods by which ICT policies can pool and leverage resources across ministries to support education; (c) adopting sector-wide ICT policies (covering schools, TVET, and higher education) to reduce duplication of efforts and resources; and (d) leveraging contemporary research and innovations to advance ICT4E initiatives.
- iii. **Improve support for education management information systems.** There is a need to review current EMIS practices to extend their use to cover the full education sector, and to ensure that EMIS platforms capture all necessary data to analyze sector performance. EMIS architecture and software should be simple, cross compatible with local private or public sector institutions, and have the capacity to be expanded as necessary. Capacity building for relevant stakeholders should focus on data analysis and generating reports for planning purposes (using available data), as opposed to focusing on improving data quality.
- iv. **Strengthen adoption and use of information and communication technology for management applications in postsecondary institutions.** ICT can improve governance and management of education institutions. Upgrading USP's ERP can support its governance, human and e-learning resource development, financial management, data collection and analysis, and performance review. Lessons learned while upgrading USP's ICT platforms should be disseminated to support other universities in establishing successful ERP platforms.
- v. **Consider a regional approach to developing e-learning resources.** Given the central role of high-quality e-learning resources, it may be effective to establish an e-learning resource development and curatorial center, with appropriate human resources and technical facilities. The center could develop, collect, and coordinate the interchange of e-resources between Pacific countries. The center should be organized regionally to leverage economies of scale, and support national e-learning resource repositories.
- vi. **Develop and integrate information and communication technology competencies for preservice and in-service teachers, and other education personnel.** Stakeholders in the Pacific need more robust ICT training opportunities. Programs should include ICT competencies for preservice and in-service

teachers, principals, and education officers, and should cover areas including data collection, analysis, and use. As a regional leader in education, USP may be an effective institution to lead efforts in designing corresponding teacher courses. Designing and implementing successful training initiatives will require comprehensive review of the training needs of teachers, principals, and education personnel at the preservice stage, as well as ongoing professional development programs.

- vii. **Review arrangements to improve efficiency and equity of information and communication technology networks.** Review current arrangements between USPNet and Australia's Academic and Research Network, and explore ways to open access for other postsecondary service providers in the region. Establishing USPNet as an independent entity may be one option for increasing the number of postsecondary institutions that can access it, while enabling it to serve additional functions, beyond its current educational mandate. Allowing other postsecondary institutions to access these services can improve education outcomes for all students in the region, avoid duplication of efforts and large associated costs, and improve equitable provision of educational resources and services.
- viii. **Adopt a sector approach for developing an information and communication technology for education network.** Given the small size of the education sector in each Pacific country, there should be consideration for developing a national education ICT network that can be shared by the whole sector. In small economies, a consolidated network can be more efficient and sustainable, and some Pacific countries have already established some form of government ICT network. There is a need to strengthen and expand these networks to increase the provision of ICT4E services. An integrated approach to national ICT networks presents the most cost-effective option for Pacific countries to develop their ICT networks.

Further Considerations

Over the past decade, governments, development partners, and other education stakeholders have implemented a large number of ICT4E pilot initiatives. Although unique circumstances in each country lead to varying results and lessons learned, the following themes have emerged as recurring international lessons, and should therefore be considered in parallel to the recommendations provided above.

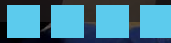
International Lessons Learned from Information and Communication Technology for Education Pilots

- i. ICT4E can form an integral part of education sector policy to support governance and learning.
- ii. Successful initiatives require serious political commitment and resourcing, and should be implemented in phases.
- iii. Design considerations need to consider total cost of ownership, and should factor in capital and operational expenditures, projected costs of technical support, and the availability of local suppliers and human resources.

- iv. ICT4E initiatives should form a core part of the curriculum, as opposed to being used simply as supplements.
- v. Collaboration across institutions, sectors, and countries can help leverage greater economies of scale—doing so is essential for maximizing the value of investments and realizing a full range of ICT4E benefits.
- vi. E-learning resources play an important role in improving learning outcomes, and require collaboration, as well as adequate human, technical, and financial resources to develop. As such, production of e-learning resources should not be left to teachers alone.
- vii. ICT4E should be integrated into teacher training at multiple levels, including both preservice and in-service teacher training. ICT4E should be included in teacher competency frameworks.



Secondary students of Samoa Safata College avail e-learning resources.



ICT for Better Education in the Pacific

ADB's developing member countries in the Pacific are gaining increased access to information and communication technology (ICT). At the same time, they are deepening collaboration across sectors, institutions, and communities. If planned and managed properly, developments in ICT can drive progress in education sectors across the region. This publication examines key opportunities for harnessing ICT to improve education outcomes and build the region's most valuable resource—its human capital.

About the Asian Development Bank

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to a large share of the world's poor. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

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