

Strategy for Fintech Applications in the Pacific Island Countries

*Prepared by an IMF staff team comprising Sonja Davidovic,
Elena Loukoianova, Cormac Sullivan, and Hervé Tourpe*

No. 19/14

Asia and Pacific Department

Strategy for Fintech Applications in the Pacific Island Countries

Sonja Davidovic, Elena Loukoianova, Cormac Sullivan, and Hervé Tourpe

Copyright ©2019 International Monetary Fund

Cataloging-in-Publication Data
IMF Library

Names: Davidovic, Sonja, author. | Loukoianova, Elena, author. | Sullivan, Cormac, author. | Tourpe, Herve, author. | International Monetary Fund. Asia and Pacific Department, issuing body. | International Monetary Fund, publisher.

Title: Strategy for fintech applications in the Pacific Island countries / Sonja Davidovic, Elena Loukoianova, Cormac Sullivan, and Herve Tourpe.

Other titles: International Monetary Fund. Asia and Pacific Department (Series).

Description: Washington, DC : International Monetary Fund, 2019. | At head of title: Asia and Pacific Department. | Departmental paper series. | Includes bibliographical references.

Identifiers: ISBN 9781498326735 (paper)

Subjects: LCSH: Financial services industry—Technological innovations—Islands of the Pacific. | Banks and banking—Technological innovations—Islands of the Pacific. | Financial services industry—Law and legislation—Islands of the Pacific.

Classification: LCC HG173.D38 2019

Abstract

The Bali Fintech Agenda highlights 12 principles for policymakers to consider when formulating their approaches to new financial technology (fintech). The agenda aims to harness the potential of fintech while managing associated risks. This paper looks at how some elements of the Bali Fintech Agenda could be used in Pacific island countries, which face significant financial-structural challenges. Notwithstanding these challenges, fintech solutions can complement existing efforts to promote financial inclusion, enhance financial sector development, and increase inclusive growth potential, thus reducing poverty. The paper outlines technologies and policy areas particularly relevant to the Pacific context and provides a potential action plan to help advance the policy agenda. We emphasize the feasibility of adopting fintech applications in the Pacific through a coordinated regional approach, anchored by appropriate regulation and infrastructure.

The Departmental Paper Series presents research by IMF staff on issues of broad regional or cross-country interest. The views expressed in this paper are those of the author(s) and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

Publication orders may be placed online, by fax, or through the mail:
International Monetary Fund, Publication Services
P.O. Box 92780, Washington, DC 20090, U.S.A.
Tel. (202) 623-7430 Fax: (202) 623-7201
E-mail: publications@imf.org
www.imfbookstore.org
www.elibrary.imf.org

Contents

Acknowledgments	v
Glossary	vii
Executive Summary	xi
1. Introduction	1
Setting the Stage	3
Prerequisites for Technology-Enabled Financial Inclusion	6
2. Fintech Solutions for the Pacific	17
Payments and Settlements.....	17
Cross-Border Payments and Remittances	20
Identity Verification Requirements.....	23
Credit Scoring and Information Sharing.....	25
3. Risks, Constraints, and Mitigation Strategy	29
Infrastructure Constraints	29
Cybersecurity Risks	30
Operational Risks.....	32
Market Risks	33
4. Conclusion	35
Appendix 1. Characteristics of Existing and Emerging Technologies	37
Appendix 2. Digital Identity Pilot Projects in Papua New Guinea	43
Appendix 3. Existing Pacific Island Country Efforts	45
Appendix 4. Pacific Island Countries’ Fintech Ecosystem Opportunity	47
References	49
Boxes	
Box 1. Innovative Approaches to Regional Regulation.....	14
Box 2. Action Plan.....	38

Figures

Figure 1. Pacific Islands: Overview of Financial Development 4

Figure 2. Pacific Islands and Comparators: Access to Technology 5

Figure 3. Key Regulatory Challenges in Promoting Fintech..... 10

Figure 4. Challenges to Financial Inclusion..... 13

Figure 5. Highlights from Global Findex 2017: Mobile Money and Financial
Inclusion 18

Figure 6. Pacific Islands: Remittances..... 21

Figure 7. Unregistered Population..... 23

Figure 8. Aadhar Authentication Process..... 24

Figure 9. Predictive Power and Availability of Data in Emerging Markets 25

Figure 10. Foreseeable Risks from Growth of Fintech..... 30

Figure 11. Learning Assessment: Regulatory Priorities vs. Knowledge..... 31

Figure 12. Number of Digital Loans Repaid at the Time of Survey 33

Tables

Table 1. Territories without Fiber Optic Internet 7

Acknowledgments

The authors are grateful to Kenneth Kang, Alison Stuart, and our colleagues who provided useful comments, guidance, and support. In particular, the authors would like to thank Nadine Schwarz, Jonathan Pampolina, Emmanuel Mathias (IMF Legal Department); Fabiana Melo, Tommaso Mancini Griffoli, Dirk Grolleman, John Kiff (IMF Monetary and Capital Markets Department); Vikram Haksar, Manasa Patnam, Patrick Gitton (IMF Strategy Policy and Review Department); Deniz Igan (IMF Research Department). The team is also grateful to Chau Nguyen (IMF Asia Pacific Department) for excellent research assistance. This Departmental Paper also responds to interest in the topic in the region. At the Pacific Islands Central Bank Governors' meeting, the Governors announced the Samoa Commitment to the Pacific Islands, which affirms the intention of the Pacific Islands, Australia, and New Zealand to leverage information technology to deepen and enhance the efficiency of financial systems, to best support economic development and financial inclusion. The specific strategic initiative agreed to at the November 2018 meeting is to lead the development of a regional know-your-customer facility and associated regionally linked payment and settlement arrangements (RBA 2018).

Glossary

AI/ML	<i>Artificial intelligence/machine learning.</i> AI is a broad concept of referring to a 50-year old domain of automation mimicking human intelligence. More recently, ML has emerged as a profoundly disruptive technology capable of being trained and then capable to adapt to new situations by itself when exposed to more data.
Algorithm	<i>Computer algorithm:</i> Algorithms are a series of logical steps written in any programming language that can be understood by a computer.
API	<i>Application programming interface:</i> Code that allows two distant software systems to communicate with each other, even between two very different technologies—for example, between a smartphone and a banking system. APIs can be private, requesting authentication, or public.
Big data	Describes the growing availability, from an increasing number of sources, of voluminous data, web content, documents, videos, and other forms of information. Big data is often used in combination with AI/ML to feed the computer learning process.
Biometrics	Refers to the use of people's unique physical characteristics (facial features, fingerprints, iris recognition), typically to authorize access to certain devices, such as a private facility door or a smartphone.
Cryptography	In computer science, refers to mathematical algorithms used to secure communication and storage of information in a manner accessible only to the intended individuals or systems.

DLT	<i>Distributed ledger technology:</i> A special distributed database in which data, such as transactions of assets or records and registries of fixed assets, can only be appended, but cannot be deleted or modified. Public DLT usually has no central control; private or permissioned DLT allows many levels of control. Blockchain is a popular example of a public DLT.
GSM	<i>Global system for mobile communications:</i> Often referred to as 2G is a telecommunications technology used by the second generation of cellular phones, widely used in most developing economies today. GSM phones often contrast with smartphones, which are more powerful and operate on faster networks known as 3G, 4G, and soon 5G.
MNO	<i>Mobile network operator:</i> Also known as a wireless service provider, a provider of <i>wireless communication</i> services that owns or controls all the elements necessary to sell and deliver voice and data services to mobile users.
NFC	<i>Near-field communication:</i> The technology allows devices (with an NFC chip) placed in immediate proximity to each other to exchange data. There are two types of NFC communication— one-way communication (a device reads and writes on an NFC chip) and two-way communication (two devices that can both read and write on an NFC chip).
Open data system	A technology platform that supports public data sharing, usually through an API. Data can be issued by private firms or government agencies.
Smart contract	An algorithm stored using distributed ledger technology instead a regular computer or server. Its distributed, unalterable nature is often seen as advantageous when intermediaries are not considered trustworthy or when coded contracts can be self-executed without intermediaries.
TCP/IP	<i>Transmission control protocol/internet protocol:</i> Key foundation protocols of the internet. TCP/IP is the language that enables data connectivity and end-to-end transmission between servers providing services to the internet and devices consuming information from the internet.
USSD	<i>Unstructured supplementary service data:</i> A messaging function in feature cellphones that enables a user to dial a number that starts with * and ends with #. By dialing certain numbers, mobile users can access basic services over low-bandwidth connections.

Executive Summary

The spread of innovative financial technologies (fintech) has been progressing rapidly over recent years, introducing opportunities for Pacific island countries. Fintech could potentially allow these countries to alleviate the impact of structural impediments and persistent challenges, such as geographic remoteness and dispersion, small scale, limited infrastructure, and fragile correspondent banking relationships. Fintech solutions can complement existing efforts to promote financial inclusion, enhance financial sector development, and increase inclusive growth potential, thereby reducing poverty.

The paper identifies four areas that can support Pacific island countries' efforts to expand financial inclusion, including innovative payment systems, identification requirements, credit sharing information, and risk assessment and management. For a sustainable and successful adoption of technology-enabled financial inclusion solutions, it is important to work toward achieving the necessary preconditions. These include a robust general and information technology infrastructure, an enabling market environment, and a sound regulatory framework. This paper provides a strategy and corresponding action plan that aims to help guide Pacific island country policymakers toward accomplishing the identified preconditions and advancing their policy agenda.

- Pacific island countries are well positioned to leapfrog into innovative technologies that can support countries' efforts to boost growth and expand financial inclusion. However, countries should consider costs and risks in selecting technologies that are feasible and commercially viable.
- Reliable electricity, internet, and cellular network coverage across countries is a necessary condition for adoption of new technological applications and solutions. Physical infrastructure may benefit from public-private partnerships to absorb the costs.

- Sustainable adoption requires policymakers to provide a favorable market and regulatory infrastructure. Policymakers should promote a level playing field and encourage collaboration among market participants, identify and close regulatory gaps, and enhance financial and digital literacy.
- A regional approach to fintech applications could help overcome capacity and scalability constraints, including an innovation hub or a sandbox, technological platforms, regional networks, and collaboration and knowledge sharing.
- Effective collaboration with development partners, including the IMF, provides opportunities to benefit from knowledge exchange and the experience of peers.

Potential benefits from fintech solutions suggest that they should be part of a national or regional financial inclusion strategy. This strategy should cover the entire population, bridging the digital divide, especially with respect to women, low-income households, and geographically remote communities. At the same time, countries should bear in mind the risks associated with fintech and evaluate new technologies with their development partners before implementation, to ensure their sustainable adoption.

1 Introduction

Innovative technologies introduce opportunities for Pacific island countries to support financial sector development and inclusion. The expansion of submarine fiber-optic cables and greater mobile network coverage improve the prospects for adopting fintech solutions to help resolve some macro-structural impediments in these countries, including the so-called tyranny of distance.¹ Digital technologies can also boost Pacific island countries' macroeconomic resilience and help achieve the United Nations 2030 Agenda for Sustainable Development, including the Sustainable Development Goals, by increasing access to finance and insurance for households and small businesses.

Innovative technologies offer a complementary approach to financial inclusion in Pacific island countries, if managed well. Lack of scale, limited infrastructure, geographic remoteness, and weakening correspondent banking relationships have been affecting economic growth, hampering sustainable development and increasing these countries' exposure to external shocks. These challenges undermine traditional approaches to business and finance, which rely on physical infrastructure and scale. In this way, fintech solutions can complement existing efforts to promote financial inclusion,² enhance financial development, and increase inclusive growth potential, thus reducing poverty.

The 2018 Bali Fintech Agenda (IMF and World Bank 2018) provides a useful framework for countries' consideration of high-level policy issues regarding harnessing the potential of fintech while managing associated risks. The agenda proposes 12 elements policymakers should consider. It is particularly

¹“Tyranny of distance” is a term used to highlight the structural challenges to economic development prevalent in the Pacific. Specifically, Pacific island economies are extremely isolated and, with their small populations, have limited scope to take advantage of economies of scale. See Becker (2012) for further details.

²Selected efforts include the drafting of financial inclusion strategies, financial education campaigns, the development of the Inclusive Insurance Innovation lab, and regional cooperation through the Pacific Financial Inclusion Programme.

relevant for Pacific island countries, given its emphasis on regional and international cooperation and its calls to

1. Embrace the promise of fintech with its far-reaching social and economic impact, particularly in low-income countries, small states, and for the underserved;
2. Enable new technologies to enhance financial services provision by facilitating foundational infrastructures, fostering their open and affordable access, and ensuring a favorable policy environment;
3. Foster fintech to promote financial inclusion and develop financial markets by overcoming challenges related to reach, customer information, and commercial viability, and by improving infrastructure;
4. Safeguard the integrity of financial systems by identifying, understanding, and mitigating the risks of criminal misuse of fintech, and by using technologies to strengthen compliance with anti-money laundering and combating the financing of terrorism (AML/CFT) measures;
5. Modernize legal frameworks to provide an enabling legal landscape with greater clarity and certainty regarding key legal aspects of fintech activities.

This paper aims to build knowledge among policymakers about using technology to improve access to finance. The objective is to provide policymakers with actionable ideas on leveraging fintech solutions to enhance financial inclusion and stem the weakening of correspondent banking relationships. The paper draws on elements of the Bali Fintech Agenda and uses fintech examples from less developed economies that might be feasible for the Pacific island country-specific context. The paper builds on the results of IMF research on financial inclusion (Loukoianova and others 2018) showing that small states are more likely to leapfrog³ into new technologies. It also responds to the Samoa Commitment for the Pacific Islands by providing background analysis and a potential action plan on how to best leverage information technology to support development and financial inclusion.⁴

Pacific island countries' small economies offer a good environment for exploring new technologies in a regional approach. Small economies may not face scalability limitations that can impede adoption of some fintech solutions in larger economies. However, without reliable mobile network and internet coverage, subject to frequent natural disasters, and faced with other capacity constraints, these economies could find it hard to adopt new technology. To overcome these challenges, Pacific island countries could benefit

³“Leapfrogging” refers to the adoption of the latest technology and bypassing one or more of its antecedents.

⁴The Samoa Commitment intends to leverage information technology to support economic development and financial inclusion in the region (RBA 2018).

from regional approaches to deploying fintech to foster financial inclusion and development. Digital platforms can accelerate adoption of a regional know-your-customer facility and regionally linked payment and settlement arrangements as outlined under the Samoa Commitment (RBA 2018). A regional regulatory sandbox and innovation hub could help policymakers and regulators maximize a technology's benefits while mitigating potential risks. Policymakers would also be better equipped to assess the viability of digital financial products and services.

The paper proceeds as follows. It first sets the stage by describing the current state of financial development and the level of access to technology in Pacific island countries. It then focuses on identifying the necessary prerequisites for technology-enabled financial inclusion, including technological and general infrastructure requirements, and the regulatory and market environment. Third, the paper outlines a strategy for promoting fintech solutions in Pacific island countries in four areas—payment systems, identification requirements, credit sharing information, and risk assessment and management. The paper concludes with key takeaways and policy recommendations.

Setting the Stage

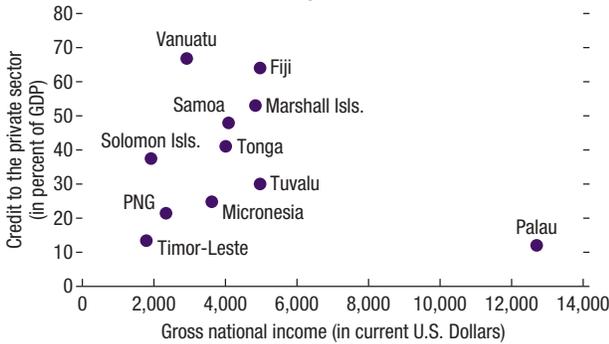
Pacific island country characteristics constrain the promotion of financial inclusion and development, limiting economic growth. The main obstacles to deepening these countries' financial inclusion are geographic remoteness, low financial and technological literacy, and limited digital infrastructure. Expanding the formal financial sector would not only help bring in large segments of the unbanked population but would also substantially add to growth and reduce inequality and poverty—since financial development is at the low end of the curve (Figure 1, panel 2). These findings are supported by a wide range of literature on financial inclusion.⁵

Financial development and inclusion in the region vary across countries with different income levels. There is room for some countries to move toward the regional frontier. For example, Fiji, the Marshall Islands, and Tuvalu show different financial development outcomes despite their similar income levels. This suggests that policy decisions, rather than income, play a significant role in determining the overall effectiveness of the financial system. The level of financial inclusion varies across the region but is lower than in countries with similar income levels in other regions, in part reflecting the structural challenges faced by Pacific island countries.

⁵This includes IMF (2015), Loukoianova and others (2018), and Jahan and others (2019).

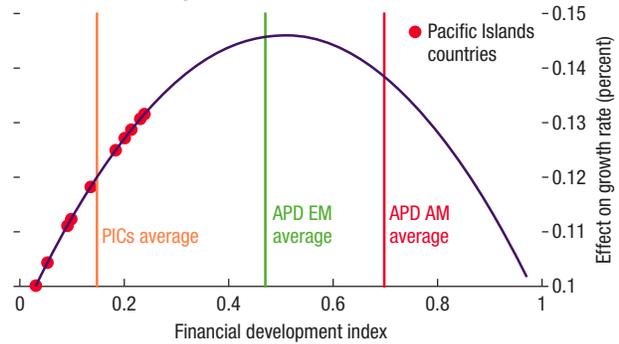
Figure 1. Pacific Islands: Overview of Financial Development

1. Economic and Financial Development in Pacific Islands



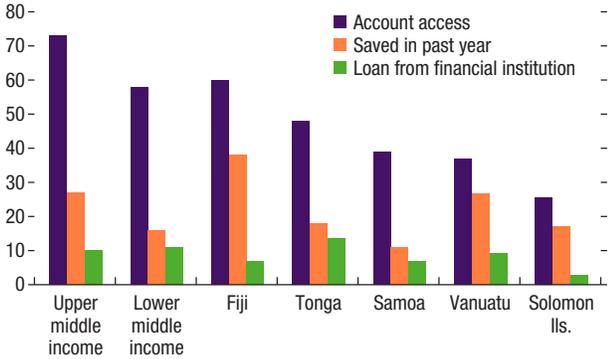
Sources: World Development Indicators; IFS; and national authorities.

2. Financial Development Effect on Growth



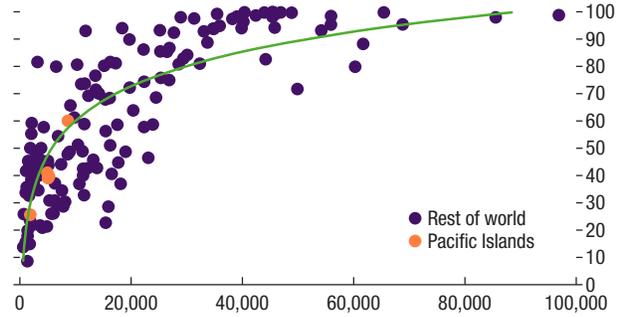
Source: IMF staff estimates, based on the methodology in SDN/15/08 (Table A1), and Čihák and others (2012).

3. Financial Inclusion in the Pacific (In percent of population)



Sources: PIRI Demand Side Surveys; and Global Findex.

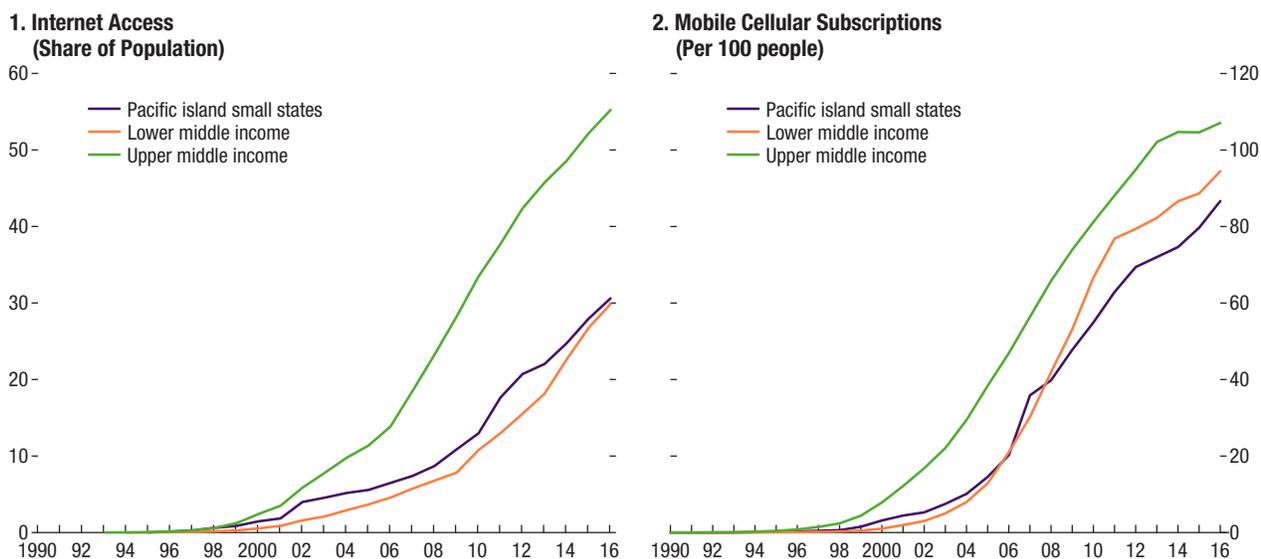
4. Access to Account by Income Level, 2017 (In U.S. dollars and percent of population)



Sources: World Bank Global Findex; Pacific Financial Inclusion Programme surveys; IMF's *World Economic Outlook*; and IMF staff calculations.

Pacific island countries have several common characteristics, which are salient when considering how to address weaknesses in the financial sector. The structure of the financial system is typically dominated by a small number of banks, all countries in the region need to improve financial inclusion, and access to technology is low (but growing fast). Low digital and financial literacy in the Pacific hamper financial inclusion on the demand side and may respond well to both technological and nontechnological solutions.

Access to technology in the Pacific has been rising rapidly, though from a low base. The level of access to technology in the Pacific is broadly comparable to that of lower-middle-income economies; however, it is still below what would be expected based on their income level. In 2016, there were approximately 75 mobile phone subscriptions for every 100 people, and 30 percent of the population on average had access to the internet. Internet access differs across

Figure 2. Pacific Islands and Comparators: Access to Technology

Sources: World Bank, World Development Indicators; and International Telecommunications Union.

Pacific island countries. In 2016, 50 percent of the population in Fiji and Tonga had internet access, while in Papua New Guinea only 9.6 percent did.

Despite slow progress, the Pacific is on the cusp of a connectivity revolution (Figure 2). First, the region has shown significant growth in internet access for several years, often because of submarine cable installation. In Samoa, for example, the share of the population with internet access increased from 7 to 29 percent during 2010–16. Second, there has been an ongoing drive in the region (facilitated by Asian Development Bank and World Bank financing) to move from satellite to cable internet connections.⁶ In 2014, 8 out of the 10 countries without cable internet access were in the Pacific. All but one of these countries are expected to establish a connection by 2020. Developing these connections constitutes a large investment, indicating the high priority Pacific island countries and donors place on technological development. For example, in Palau the cost of the cable project represents over 8 percent of GDP. These two factors should facilitate the move from basic mobile phones to more versatile smartphones.

Growing access to technology in the Pacific can enhance the efficiency of financial systems. This would be consistent with a bigger role for mobile network operators in the retail payment system. Since the mobile network operator business model does not require the physical presence of bank branches

⁶Roughly 99 percent of global internet traffic goes through undersea fiber-optic cables, referred to as the internet’s “backbone” because of their speed, lower cost, and greater reliability than satellite technologies.

and ATMs, it is better suited for high-volume and low-cost transactions (GSMA 2011a). The complementary nature of mobile banking would allow mobile network operators to help banks serve a market they might otherwise have exited (Sy and others 2019). On the other hand, mobile operators would benefit from the established financial infrastructure, lending channels, and market intelligence of the banking sector. Collaboration between mobile network operators and banks could catalyze knowledge sharing and technology-induced efficiency gains that would help overcome capacity constraints, improve regulatory compliance, and safeguard asset quality.

Prerequisites for Technology-Enabled Financial Inclusion

Sustainable technological adoption requires adequate infrastructure, a sound regulatory and market environment, and effective collaboration among stakeholders. The assessment of conditions for technology-enabled financial inclusion should begin with an understanding of the infrastructure required.

Technological and General Infrastructure Requirements

The technical feasibility and commercial viability of different technologies depend on country circumstances and preferences. Some technologies are affordable and relatively easy to use; others are costly or technically complex (Annex 1). The maturity, scalability, and performance of the technologies in the country-specific context also matter.

The conditions for a dependable, modern, and scalable technology platform begin with continuous and reliable access to electricity. In some developing economies and remote areas, more people have mobile phones than access to electricity (CNET 2016). To ensure a continuous power supply in off-the-grid areas, companies are deploying devices that can be charged with solar power. Advances in science, such as combining the functions of solar energy conversion and storage, introduce more efficient, compact, and cost-effective solar energy usage (Li and others 2018). With a view to developing economies' needs, companies designed affordable portable solar-panel-enabled payment devices that even allow trading of excess electricity with peers and mobile charging kiosks.⁷

The completion of the submarine fiber-optic cables will facilitate technology-enabled financial inclusion (Table 1). Pacific island countries have invested heavily in a modern information technology infrastructure (Appendix 3). Higher-generation broadband 3G and even 4G connectivity have

⁷The cost of 20 kiosks runs about US\$30,000 (Schiller 2013).

Table 1. Territories without Fiber Optic Internet

Pacific	Rest of the World
Timor-L'Este (under discussion)	Eritrea
Solomon Islands (2019:Q4)	Western Sahara
Kiribati (end-2019)	Saint Helena (2020)
Cook Islands (2019)	Falkland Islands
Nauru (end-2019)	Ascension Island
Tuvalu (2022)	Antarctica
Norfolk Island	Cocos Islands
Niue (2019)	South Georgia & Sandwich Islands
Tokelau (2020)	
Pitcairn Islands	

Sources: Telegeography and National Authorities.

been developing rapidly in Kiribati, the Solomon Islands, Tuvalu, and Vanuatu.⁸ Other Pacific island countries should continue to leverage 2G-based services, such as unstructured supplementary service data (USSD)–enabled payment applications while investing in broadband connectivity.

Development partners and public-private partnerships could help expand connectivity given Pacific island countries' limited fiscal space. For example, a World Bank grant will finance an innovative public-private partnership between the government-run entity Tuvalu Telecoms Corporation and an international telecommunications operator to develop the nation's internet network (WBG 2019). At the same time, the rapidly decreasing costs and growing bandwidth of satellite (ITU 2017) will remain important for remote areas without a viable business case for cable (Brewer 2018) and as a contingency in case of cable-related outages. For example, the cable outage in Tonga in January 2019 left the country without internet for at least three days before satellite connections were established. Policymakers should balance investments in cable and satellite according to the need for greater bandwidth in high-density areas and the reliability of satellite in remote areas or as backup in case of outages (George 2018).

More mobile subscriptions will enable access to internet services, reduce the cost per user, and facilitate financial inclusion efforts. The subscriber penetration rate in Pacific island countries grew from 17 to 40 percent during 2008–14 (GSMA 2015). But the region remains among the least connected in the world in terms of mobile subscriptions. Only modest growth is expected in the next few years due to difficulties reaching outer islands and concerns about affordability. The spread of mobile connectivity varies across the region. Fiji and Samoa have a penetration rate of more than 65 percent, while Micronesia and Kiribati are still below 17 percent. Consequently, the infrastructure conditions must be assessed at a country, rather than regional,

⁸The recently formed Amalgamated Telecom Holdings Kiribati Limited announced that it would be conducting the first phase of its improvements in Kiribati with 3G and 4G network upgrades.

level. However, coordination should remain regional to ensure scalability and commercial viability.

Faster connectivity provided by higher network bandwidth would accelerate the adoption of more sophisticated fintech applications. More advanced, smartphone-enabled fintech applications use a large volume of data and require fast connectivity through higher-bandwidth 3G, 4G, or 5G networks. In many Pacific island countries, however, older and lower-capacity 2G connectivity predominates.

Higher-network bandwidth would allow Pacific island countries to explore the benefits of technologies beyond payment systems. Governments could harness technology to improve tax collection, government transfers, trade financing, and land registries (Gupta and others 2017). The banking sector could leverage biometric technology to comply with identification requirements and big data to build out their clients' credit information and assess their creditworthiness. Households and businesses would obtain enhanced access to finance based on a convenient biometric identity system. They would be able to conduct financial transactions through blockchain-enabled mobile wallets on their smartphones.

Despite its scalability and usability constraints, lower-bandwidth 2G connectivity can still be transformative for the unbanked. Although access to broadband internet might remain either unavailable or unaffordable for the foreseeable future for the poorest regions in Pacific island countries, this should not be considered an obstacle to financial inclusion. Financial digital services in emerging market economies using mobile and even blockchain technology paired with biometrics have been developed under similar poor-connectivity conditions. For example, IDbox uses a private blockchain, which operates on a 2G network (Appendix 2). Private blockchain networks are more amenable to adoption in Pacific island countries than in larger economies due to their small size and distributed geography.

A Favorable Regulatory and Market Environment

Successful adoption of technological solutions relies on a sound regulatory and market environment and level playing field. International experience has shown that successful fintech projects in developing economies progressed in an enabling regulatory environment supported by clearly defined roles and close collaboration among economic agents—telecommunications companies, banks, financial supervisors, and international development partners.⁹

⁹See for example Loukoianova and others (2018) and Jahan and others (2019) for background on the experience in Asia-Pacific economies and Sy and others (2019) in the context of African economies.

Strategic Framework

Financial inclusion strategies in Pacific island countries can be reinforced through country-specific digital strategies. The digital strategy could provide the blueprint for the adoption of fintech-enabled payment solutions and should reference required legislation and regulations for consumer and data privacy protection, AML/CFT, and bankruptcy. The strategy would provide an operating framework for banks, telecommunications companies, and mobile network operators. It would also identify the main beneficiaries of fintech solutions, such as small businesses and citizens in remote areas.

Regulatory Framework

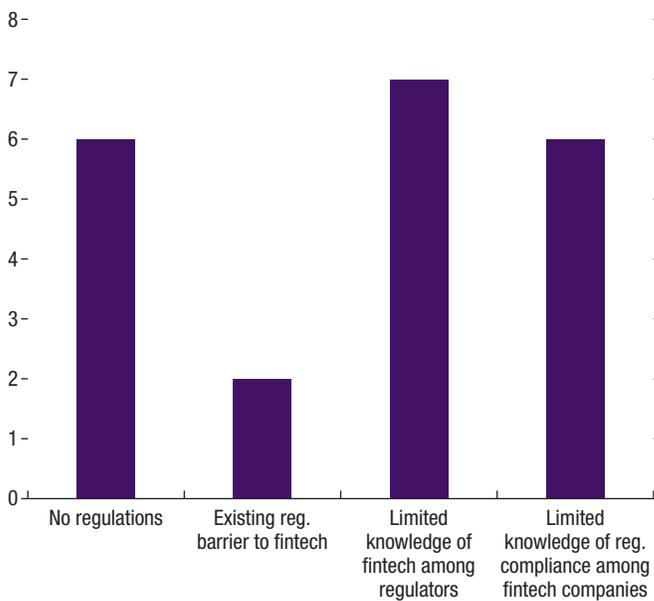
The quality of regulation and supervision of the financial sector varies across the Pacific. For example, Tuvalu has large gaps in financial institutions' regulation and relevant supervisory mechanisms. In contrast, the Cook Islands' supervisory framework was deemed to have achieved substantial results in its 2018 assessment according to the Financial Action Task Force standards. The absence or weakness of legal standards and supervisory functions might discourage some Pacific island countries from adopting fintech applications since an adequate legal framework is necessary to promote their sustainable adoption.

Flexible approaches to regulation and supervision would balance the need to ensure rigorous standards with the existing large regional disparities in legal frameworks. Regulatory and industry sandboxes, innovation hubs (see Box 1), or special flexible legislation would establish a controlled environment for market participants and regulators alike to engage in live, time-bound knowledge exchange or testing of innovation under a regulator's oversight. They could encourage the regional harmonization of regulatory standards, spur Pacific island countries to further develop their legal frameworks, and encourage leapfrogging into new technologies. For example, the Central Bank of Kenya and the Communications Authority of Kenya adopted a "test-and-learn" approach that combined a sound regulatory environment with the ability of innovators and entrepreneurs to introduce new and diversify existing financial products (Gupta and others 2017).

In Pacific island countries, priority should go to building the right skills and knowledge of fintech to better inform regulators (Figure 3).¹⁰ Knowledge exchange through innovation hubs and regulatory sandboxes and coordination of supervision efforts among regional and international standard-setting bodies and supervisors, especially regarding cross-border financial operations,

¹⁰PIRI (2018a).

Figure 3. Key Regulatory Challenges in Promoting Fintech
(N = 7)



Source: PIRI 2018 survey results.

can help close this knowledge gap (BIS 2018). The Association of Financial Supervisors of Pacific Countries (AFSPC) could drive this capacity building and knowledge exchange initiative for national supervisors. Developing collaboration models, training curricula, and exchange programs between countries of the AFSPC, and participating in the Global Financial Innovation Network (GFIN 2019) could help build and transfer knowledge. The AFSPC could also serve as a single counterparty for international banks to discuss regional correspondent banking relationship issues and explore the potential of technology to address them.

A regional regulatory approach could facilitate knowledge sharing and strengthen Pacific island countries' integration into the global financial system. The AFSPC could take the lead role in promoting regional solutions to fintech regulations, while a regional regulatory program could be modeled after other regional initiatives, such as the East African Securities Regulators (Mbaka 2018) and the Association of Southeast Asian Nations (ABAC 2018). The regional regulatory approach should promote transparency and greater interoperability in cross-border payments and harmonize regional policy developments and approaches to cross-border data transfers and payments systems.¹¹ It should also ensure that risks, including financial integrity risks, are adequately mitigated.

Market Environment

Policies and laws should foster the right incentive structures, guarantee universal access to information technology and general infrastructure, and promote collaboration models. On the supply side, close cooperation between line ministries and government agencies can ensure that competition

¹¹A notable example of agencies that could be tapped in support of this regional approach is the World Bank's Pacific Payments Remittances and Securities Settlement Initiative (PAPRI), a major regional initiative to support payment system modernization, including through integration across the region.

policies enable an even playing field and healthy competition and address potential risks of market concentration and abuse by market participants. The authorities could consider incentivizing joint investment structures to foster collaboration models between both entrants and incumbents in digital financial services. Safaricom's investment in mobile networks helped the government achieve the last mile in the expansion of network coverage and scaled-up operations, which aligned with M-Pesa's and the Kenyan government's goal to expand mobile payments. Trust legislation offers opportunities for collaboration between banks and mobile network operators. In Kenya, it allowed these operators to make transfer payments through the banking system, which helped banks see mobile network operators as partners rather than competitors.

Incentivizing consumers will drive the demand for fintech applications. To ensure the success of fintech applications, policymakers could join with the private sector to provide an adequate incentive structure and work with targeted groups to convey the benefits of digital financial services. Monetary incentives for active users and participating stores and businesses could provide incentives on the demand side (Licandro 2018).

Developing robust and interoperable payment systems and platforms for technological research could foster collaboration and spur innovation among market participants.

- Identity and payment systems built on a platform using open standards that have system-designed controls and privacy protection could build trust in technological solutions (IMF 2018). The platform could be developed to include the regional know-your-customer facility supported by Australia and New Zealand (RBA 2018).
- Separately, technological platforms can be used to help define research priorities and action plans for fintech-enabled financial inclusion at the national and regional levels, drawing on a variety of participants ranging from the industry to civil societies. Development partners or public-private partnerships could secure the capital investment to establish the regional platform. A fee-based structure would help Pacific island countries bring together key regional stakeholders, mobilize ongoing funding, and influence the development and deployment of technological breakthroughs in fintech.
- By design, technological platforms are interoperable, which increases efficiency, reduces barriers to entry, and generates the critical mass necessary for the development and exploitation of new technologies, which supports competition.

Payment systems enabled by mobile networks and money transfer operators can play a critical role in the provision of digital financial services. Finan-

cial institutions in developing economies focus their efforts on providing a low volume of high-value financial products and services. The constrained lending capacity of commercial banks in Pacific island countries because of a lack of collateral and limited lending opportunities may have reinforced this model. The business model of mobile network payment platforms, on the other hand, appears to be better suited to handle a high volume of low-value financial transactions (GSMA 2011). Mobile network operators can respond directly to the needs of people excluded from the formal financial sector. Money transfer operators could serve as payment kiosks or branches for mobile network operators. Digital financial service providers such as mobile network operators or other technology companies can also help build trust in digital financial services and catalyze an expanded role for the banking sector in the region. The most successful payment systems—M-Pesa, for example—have a complementary and highly collaborative relationship with traditional financial institutions, such as the relationship between commercial and microfinance banks and the telecom company Safaricom (Gupta and others 2017).

The banking sector should develop effective governance structures, establish information technology and other risk management procedures, and adapt its business model. As mobile network operators and other telecommunications companies enter the payment system, banks should adjust their due diligence approach and risk management strategies so that they can identify, manage, and monitor risks associated with fintech solutions. Third-party risk for services outsourced to telecommunications and mobile operators should be eased by means of contracts, service agreements, and audit rights. Outsourced services should be held to the same control standards as internal operations (BIS 2018).

Digital and Financial Literacy

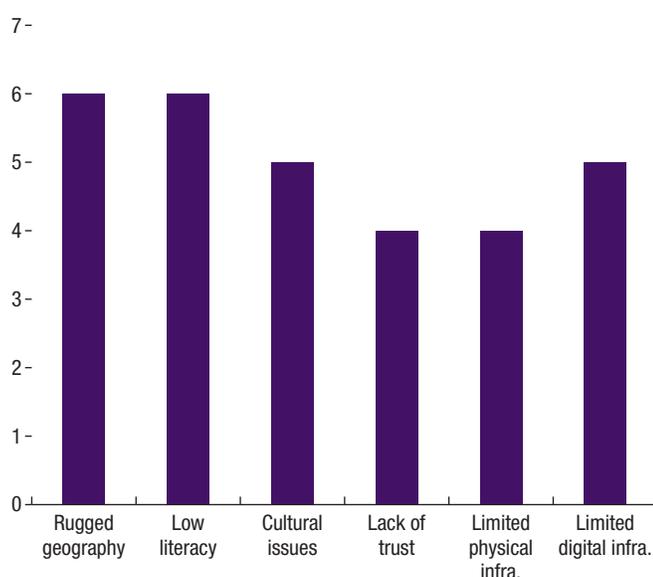
Promoting digital and financial literacy of households would increase trust in technological solutions and build financial resilience. Pacific regulators have identified low literacy and lack of trust as the main challenges to financial inclusion (Figure 4).¹² Thus, promoting financial and digital literacy should be a core element of a national or regional financial inclusion strategy for it to be effective. This could be done through public-private partnerships. For example, in Kenya, Safaricom's agent network played an instrumental role in helping consumers resolve their questions and teaching customers how to use mobile money services (GSMA 2011a). India set up the National Digital

¹²PIRI (2018).

Literacy Scheme, which brings together the public and the private sector to raise digital literacy awareness. The program aims to improve people's digital literacy skills and drive the inclusion of rural communities in the global digital economy (NDLM 2016). The Solomon Islands is planning to integrate basic financial and digital education into the core school curriculum (PFIP 2016). The Australia and New Zealand Banking Group deployed MoneyMinded, a flexible online education program that supports adults in building knowledge and skills on money management.

To ensure that the benefits of fintech are shared equitably, the authorities should assess the coverage of its adoption across public services. Affordability may be a major obstacle to households accessing the internet (A4AI 2018). Country authorities could explore subsidizing internet access for low-income households or setting up internet hubs. An employment strategy could include vocational training and start-up funding options for local software and application development. At the regional level, Pacific island countries might promote start-ups through an incubator approach in collaboration with universities in Australia and New Zealand that host students from the Pacific island countries and with the University of the South Pacific. Bilateral and multilateral development partners can support Pacific island countries through seed money and employment and study exchange programs. A well-designed public policy approach supported by development partners would help build trust in technology, develop a new tech-savvy generation, and lay the foundations for a stronger, more competitive, and technology-driven economy.

Figure 4. Challenges to Financial Inclusion
(N = 7)



Source: PIRI 2018 survey results.

Box 1. Innovative Approaches to Regional Regulation

With the advent of fintech, regulators have adopted innovative approaches to regulation. Regulatory sandboxes and innovation hubs and offices have emerged as two preferred models to address regulatory questions related to fintech applications (UNSGSA and CCAF 2019).

Innovation Hubs and Offices

Innovation hubs and offices offer a dedicated point of contact and support to digital financial service providers for fintech-related issues. They offer support to firms in identifying opportunities for growth and innovation and provide nonbinding guidance on the conformity of innovative financial products, services, and business models with licensing and registration requirements and supervisory expectations (ESAs 2018). They can facilitate cooperation between regulators and innovators, enhance knowledge of technology-enabled financial inclusion, and reduce regulatory uncertainty (UNSGSA and CCAF 2019).

The establishment of innovation offices is relatively easy but requires staff technical capacity and early engagement with innovators. It is important to engage the innovation community early in the process in a coordinated approach across government agencies. Pacific island countries would need to secure executive support for the sandbox, build staff technical competency, and define eligibility criteria for participants that are aligned with the office's strategic objectives. These are the key ingredients for the success of an innovation hub (UNSGSA and CCAF 2019). Partnering with universities and Samoan students in Australia and New Zealand could support these efforts.

Regulatory Sandboxes

A regulatory sandbox is a voluntary regulatory program in which digital financial service providers can simulate and test their innovative financial products, services, and business models in a controlled environment. Sandboxes enable regulators to address potential risks of new technologies without stifling innovation (IMF 2017). Participants could develop cost-efficient market-ready products and participate in shaping new legislation. Regulators would be able to stay on top of technological innovations and identify regulatory gaps in a controlled setting.

Establishing sandboxes is resource intensive while not necessarily contributing to advancing financial services. Determining the eligibility criteria, designing a solid exit strategy, and simplifying administrative procedures can be complex, and ongoing maintenance of the sandbox can be costly. Regulatory sandboxes are voluntary, so they need interested digital financial service providers (UNCDF 2018). Early lessons learned show that the costs could outweigh the benefits: most regulatory questions raised in

Box 1. Innovative Approaches to Regional Regulation (continued)

sandboxes could effectively be resolved without a live testing environment (UNSGSA and CCAF 2019).

A feasibility assessment that focuses on capacity and strategic objectives would help Pacific island countries determine an adequate regulatory approach. The results of the feasibility study, including an actionable timeline and cost-benefit analysis, would help guide Pacific island countries in their fintech regulatory journey and distill associated resource implications. These countries could link their regulatory programs to a distinct financial inclusion objective set out in their financial inclusion strategies. This approach allows for better measurement and monitoring of regulatory program performance (UNCDF 2018). One such goal might be fintech applications that serve populations in outer islands or remote areas.

High-level institutional support is needed for any innovative regulatory program. To ensure the success of an innovative approach to regulation, it is advisable that Pacific island countries secure high-level institutional support from central bank governors; for instance, in the form of a designated full-time, cross-functional team from different government and regulatory agencies across the countries. In addition to leading the feasibility assessment, this group could encourage the growth of fintech associations and regional networks by organizing fintech challenges and competitions in partnership with development agencies, private sector participants, and universities in Australia and New Zealand.

Payments and Settlements

The Pacific region has the potential to improve the provision of payments and settlements. At present, the region has deficiencies in its cash-dominated payment infrastructure that can be alleviated through the adoption of improved financial technology. The provision of digital retail, interbank, and international payments would reduce transaction costs for households, businesses, and the government, particularly the substantial costs associated with traveling between islands to physically make payments. Evidence from other regions shows that new payment technology and infrastructure can spread rapidly¹ in developing economies and provide efficiency benefits.²

Currently, the Pacific relies on cash for most retail transactions, which can be costly and inefficient. Cash in circulation is slightly higher than the world average at 80 percent of GDP. Whereas globally cash has been falling as a share of the money supply, in Pacific island countries it has remained constant at this level since the early 2000s. This heavy reliance on cash payments is supported by survey-based data indicating that most people in the Pacific use cash for most transactions (PIRI 2017), followed by the use of paper checks for larger transactions. In a region where the population is often dispersed across different islands, the use of face-to-face cash transactions and checks is a substantial impediment to commerce. For government transfers and salaries, as well as for tax payments, there is typically a need to travel to the capital, which can be costly, time-consuming, and inefficient.

¹For example, in Kenya, Cambodia, and Bangladesh the number of registered mobile money accounts grew by an average of more than 140 percent each year between 2012 and 2017 (IMF Financial Access Survey 2018).

²Fintech providers are often able to offer lower-cost services (Sy and others 2019) and faster processing (Capgemini and BNP Paribas 2018).

Figure 5. Highlights from Global Findex 2017: Mobile Money and Financial Inclusion

Two-thirds of the 1.7 billion unbanked adults in 2017 have a mobile phone.



Mobile money has played a major role in advancing financial inclusion, the mobile phone is arguably the most powerful instrument of development in history.



Source: World Bank, Global Findex (2017).

There are several technological models that could improve the efficiency of payment systems, provided effective AML/CFT and consumer protection measures are implemented to mitigate risks. These include mobile money, mobile payments, modernizations of interbank settlement systems, regional solutions, and blockchain applications for international remittances. These models should be designed to withstand risks, including those related to financial integrity and fraud.

Mobile Money

Mobile money can improve payment system efficiency (Figure 5).

Mobile money monetizes the value of prepaid phone credit, allowing it to be transferred from user to user instantly, driven by relatively simple technology. It relies on the identification and security provided by SIM card technology, as well as the near ubiquity of cell phone access, and it is not subject to geographic constraints. Mobile money took off quickly in several emerging market and developing economies—notably, in Asia and east Africa. These systems can then be used to move up the chain of financial complexity, with M-Pesa in Kenya now offering loans and insurance through their mobile money platform.

Mobile money can be extended beyond payments to offer virtual savings accounts and short-term credit. The M-Pesa technological platform was initially designed for transfers, payments, and settlement. At the second stage, the platform was used for virtual microsavings accounts with virtual banking services. The savings product M-Shwari allowed users eventually to transfer money from their M-Pesa wallet to their savings account (Gupta and others 2017). M-Shwari operates a tiered risk-based know-your-customer system with simplified multiple identity-verification mechanisms. These mechanisms use identity information stored by Safaricom for M-Pesa and the official government registry of individual databases (GSMA 2013). The participating digital financial service providers used the collected savings and transaction data from M-Pesa and M-Shwari to evaluate creditworthiness and price short-term credit to extend microloans to their users (GSMA 2013). In the

last stage, the platform was fully enabled to process cross-border and international remittances.

Several mobile money companies are now operating in the Pacific, seeking to replicate the rapid growth in other regions. In Fiji, the technology has grown very rapidly—with nearly 1.2 million mobile money transactions reported in 2017, representing 0.8 percent of GDP, with average year-over-year growth in the number of transactions exceeding 150 percent between 2014 and 2017. The value of transactions is higher in some countries in the region; for example, in Tonga and Samoa the total value transacted reached 2.8 and 1.1 percent of GDP, respectively.

Mobile Payments

Unlike mobile money, mobile payments use bank accounts to complete transfers and payments. This has been particularly prominent in China. This approach combines smartphone technology with access to conventional bank accounts. It uses the secure identification provided by SIM cards to allow users to make uniquely identifiable payments, typically by scanning a QR code with their phone. It is appealing to users; phones replace much of the hardware, making it less costly for merchants to integrate their operations with the technology. As long as merchants can get access to a unique code, they can accept payments digitally. A variant of this model is seen through online money transfer services such as Paypal, which create a platform for initiating financial transfers. Previously, these types of transfers had to take place in person at a bank branch.

Interbank Payments

Mobile money and payment developments highlight the need to modernize the traditional interbank payment system, which is facing increasing competition from fintech companies. Unless the interbank payment system responds adequately to this competition the financial system could move outside traditional banking institutions—for example, through adoption of disintermediated mobile money solutions. This would deprive banks of an important source of income and customers.

The payment infrastructure system for interbank settlements in the Pacific typically uses correspondent banks (Alwazir and others 2017). However, some check settlement services are organized by the central bank and are often conducted manually, which means that moving to an electronic system

can increase efficiency significantly.³ If there are formal payment systems, they operate at the national rather than regional level (for example, FIJI-CLEAR in Fiji and KATS in Papua New Guinea).

Developing a regionally integrated payment system would generate important synergies. First, digitizing clearing arrangements would reduce transaction times, benefiting consumers and firms. Second, minimizing the need to settle payments through correspondent banks can lower financial institutions' costs of doing business and reduce the potential risks of weakening correspondent banking relationships. Third, a common protocol for electronic transfers will make it easier to integrate innovations with common systems across the region. Finally, this integration can be used to drive process improvements—for example, with respect to AML/CFT requirements—by setting common standards across the region, which would facilitate international remittances.

An integrated payment system could lead to a low-cost, efficient real-time gross settlement system for the region. The World Bank's Pacific Payments, Remittances and Securities Settlement Initiative (PAPRI) aims to develop such a system, using a multifunctional payment utility that can act as both an automated transfer system and a central securities depository. It would be rolled out to four Pacific island countries—Samoa, the Solomon Islands, Tonga, and Vanuatu—and is under development. This effort highlights the potential for a well-designed system to facilitate real-time gross settlement across the region. The potential for this project to improve financial system efficiency and regional trade has been cited as beneficial for both financial sector development (IMF 2015) and regional trade (UNCTAD 2018). Developing the capacity for real-time gross settlement is an opportunity to improve the existing fintech infrastructure through the design and building of systems that facilitate regional integration and could complement other fintech developments.⁴ However, the project highlights impediments to a regional approach, such as the need for payment system legislation in all participating jurisdictions.

Cross-Border Payments and Remittances

International remittances are a particular class of cross-border payments (Figure 6). They are a major source of income in the Pacific, averaging about 10 percent of GDP, which reflects the region's high emigration rates and seasonal employment programs. For countries such as Tonga and Samoa, which

³PNG introduced an electronic check clearing system in 2014 (KATS). Prior to this all checks were physically transferred to the capital for processing in the clearing room. The introduction of the electronic system reduced the time taken to clear checks from up to seven days to four.

⁴See for example the discussion in Mnohohitnei and others (2019).

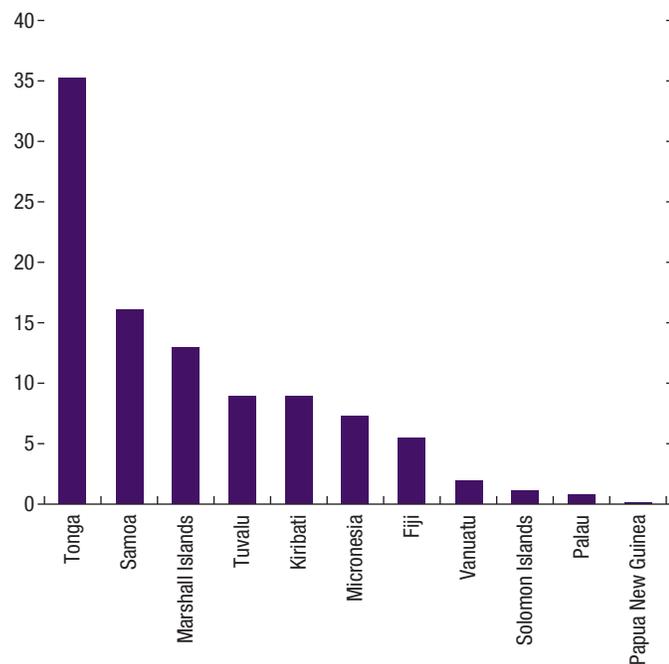
receive more than 30 and 15 percent of GDP in remittances, respectively, these international remittances are critical. Reducing the transaction costs associated with these payments could generate large benefits.

There is a perception that the cost of remittances is high in the Pacific in part because AML/CFT compliance is expensive and transactions are small. AML/CFT measures oblige the sending bank and any

correspondent bank party to the transfer to be able to verify the identity of the intended recipient, monitor suspicious financial transactions, and provide regular reporting. Smaller money transfer operators cannot absorb the higher compliance cost and are forced to pass it on to their customers or go out of business. Verifying identity can be difficult in the Pacific since formal identification is not always available, and bank accounts are often used by several people. In addition, Pacific countries' AML/CFT legal frameworks can be deficient, financial intelligence units' analysis capacity is often underdeveloped, and AML/CFT supervisory frameworks still have frequent significant gaps. As a result, correspondent banks charge more for payments to the region or withdraw from the remittance business.

Fintech has the potential to reduce the cost of remittances. For example, greater use of digital identification can improve and facilitate customers' identity. Greater digitalization more broadly can facilitate record keeping and data management, as well as verification and tracking of payments. Technology can also improve detecting and reporting of suspicious financial transactions and statements. Finally, distributed ledger technology has the potential to

Figure 6. Pacific Islands: Remittances
(In percent of GDP)



Source: World Bank Remittance database (2018).

“disintermediate” the payment process, which would lower costs related to traditional intermediaries.

The elimination of intermediaries allows for cost- and time-efficient payment settlements and simplifies person-to-person, person-to-business, and government transactions. In a permissioned blockchain environment, the financial supervisory or regulatory authority participates in the network with full oversight and auditing capabilities of financial transactions recorded on the ledger. For example, using a blockchain-based payment system, the company Circle launched an international person-to-person application service for cross-border payments without commission or foreign exchange surcharges (Neville and Allaire 2017). Other digital service providers, such as Abra and Coins.ph, in the Philippines, provide their customers with a secure digital crypto-asset wallet. Customers can exchange their crypto-assets for cash paid to a local service provider and pay no deposit or exchange transaction fees (Fuster and Ramadorai 2018). The Bill and Melinda Gates Foundation launched an open-source mobile payment platform, Mojaloop, for financial organizations, regulators, and digital financial service providers to promote mobile payments in developing economies for the unbanked (Alexandre 2018).

The distributed architecture of the blockchain could allow for cost-effective and near-real-time settlement of payments in remote areas and outer islands. The technology presents many opportunities, but it is still in the early stage of development, and policymakers should weigh technological benefits against new types of associated cyber risk. They should also ensure that, despite the absence of traditional, regulated intermediaries, the risks to financial integrity are adequately mitigated.

Identity Verification Requirements

Technology-enabled identity validation can support Pacific island countries' efforts to improve financial inclusion (Figure 7). AML/CFT requirements call, among other things, for adequate identification of the customer and beneficiary, which can be challenging. Lacking proper identity documentation, more than a billion citizens in low-income countries have trouble accessing vital services, including financial services. In Pacific island countries, about 20 percent of the population is unregistered (WBG 2017a). When they are adequately designed and supported by domestic legislation, digital IDs can facilitate the identification of customers and, as a result, increase financial inclusion. Electronic identity verification would enable governments to build a national digital identity that banks and digital financial service providers could build into their financial products and applications, ensuring compliance with identification requirements.

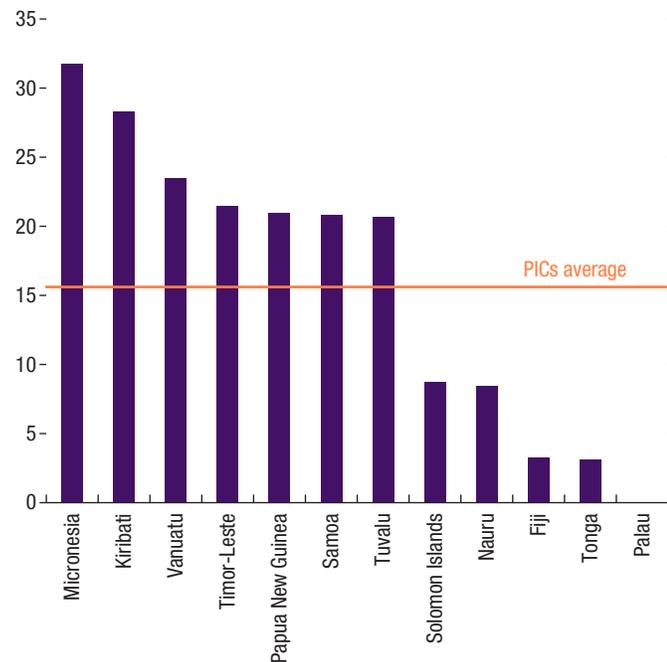
Subject to an early cost-benefit analysis, a regional know-your-customer utility that is well designed and robust could be established with donor support. The World Bank has developed guiding principles for digital identification systems that maximize the benefits of identification systems and mitigate associated risks (WBG 2016). The principles focus on inclusion of all citizens; a robust, secure, and accurate identification system; and a sound governance framework defining

accountability, oversight, and regulation. The experience with the Singapore know-your-customer utility calls for an early cost-benefit assessment of such initiatives (ABS 2018). The development of a regional know-your-customer facility in the Pacific with support from Australia and New Zealand could benefit from these design principles.

Identification and authentication systems can use simple credential technologies such as biometrics alone or in combination with other technologies.

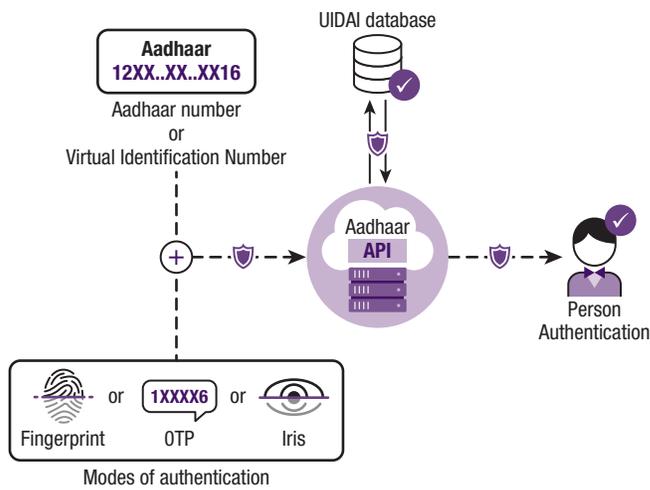
- Aadhaar IDs in India rely on encrypted databases and biometric verification—through fingerprints and iris scans—and are now used by about 1.2 billion people (Figure 8). The card is also used for access to government services, purchases of cell phones, and access to financial services, including bank accounts.
- Papua New Guinea has experimented with blockchain technology and cell phones to develop a low-cost biometric system. The Bank of Papua New Guinea looked at using the high penetration of SMS-capable phones in the country to improve identification using blockchain-technology-enabled identity solution through IDbox. The Box is a low-cost solar-powered

Figure 7. Unregistered Population
(In percent of country population)



Source: World Bank, Global ID4D Dataset (2018).

Figure 8. Aadhar Authentication Process



Source: Aadhar API.
 Note: OTP: one-time password and UIDAI: Unique Identification Authority of India.

device that records and encrypts personal identification based on fingerprints and mobile phone numbers. However, given scalability concerns related to the IDbox, Papua New Guinea has moved on to exploring an enhanced digital identity solution using Near Field Communication technology to capture and store identity data (Appendix 2).

- Samoa’s biometric identity data will be integrated into a decentralized platform with a native biometric identity system and payment solution with a multicurrency wallet. Partner remittance institutions, such as money transfer operators and financial institutions, will be able

to ascertain their customers’ identity electronically through mobile and web-based applications and carry out transactions with them. The platform is expected to enhance customer due diligence and financial institutions’ capacity to monitor and detect suspicious financial transactions.

Know-your-customer utilities can be decentralized through the distributed nature of blockchain technology, allowing easy access to customer credit information. Current identification systems can be inefficient for both customers and financial institutions. They require submission of different forms to each bank, paper-based documents, and a long due diligence process. Various pilots are therefore exploring the benefits of blockchain to facilitate the process. For example, CordaKYC is a blockchain-based decentralized know-your-customer utility pilot project aiming to introduce a more direct customer-bank approach. The goal is to provide more transparency and more operational efficiency to banks and customers and to align with customer data protection regulatory requirements (Rutter 2018). Whether centralized or decentralized, a robust know-your-customer utility would pave the way for more sophisticated credit scoring and information sharing models. Although they can facilitate implementation of some AML/CFT requirements, decentralized know-your-customer facilities do not eliminate the banks’ and other financial service providers’ need to ensure that they adequately and effectively implement their AML/CFT obligations.

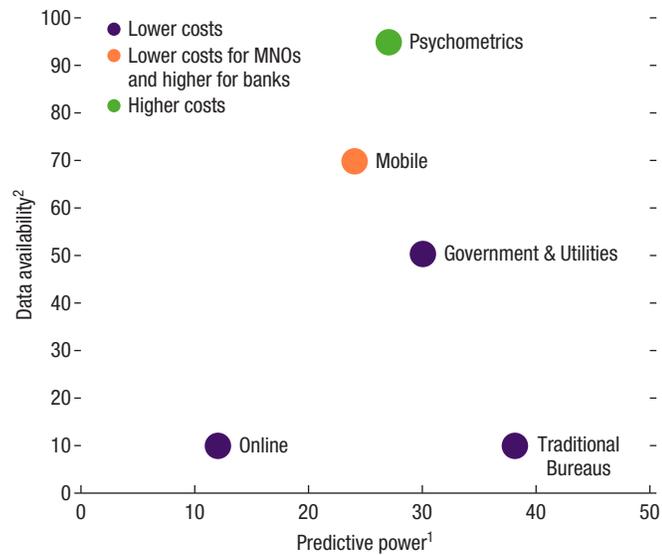
Credit Scoring and Information Sharing

Scarce or incomplete information about creditworthiness in Pacific island countries need to be addressed to improve access to finance. In most Pacific island countries, credit registries are either absent or underdeveloped. Data on the total number of adults covered by public or private credit registries and bureaus in Pacific island countries

is unavailable (WBG 2018). The absence of high-quality credit information about borrowers obstructs banks' due diligence and lending decisions, increasing their exposure to nonperforming loans and lowering profit and lending capacity. As a result, Pacific island country lending has relied on government guaranteed loan programs that essentially transfer credit risk from the financial institutions to the government—adding contingent liabilities to the fiscal accounts. Guarantee funds tend to underprice risk, which encourages credit risk and discourages improvement in lenders' credit assessment and risk management skills (Dirou and Holden 2016). Expanding access to credit requires an innovative approach, with better credit information collection and sharing.

Technological solutions enable the collection of existing and alternative data that can be integrated into the credit modeling process (Figure 9). When traditional credit information is scarce, alternative data sources can be used for assessing creditworthiness—such as mobile phone and utility payment records, tax and corporate registries, mobile money payment history, and criminal records—and can be consolidated and built into the banks' credit models. There are also credit models that tap into consumers' online activities or behavior from social media or digital commerce sites, so called “digital footprints.” Psychometric data collected through questionnaires that ask

Figure 9. Predictive Power and Availability of Data in Emerging Markets



Source: EFL (2015).

¹Out of sample GINI Coefficient with comparable model & sample.

²Hit rate on sample of low-income applicants in emerging market economies.

about individuals' ability and willingness to repay can also be used to assess credit risk (EFL 2015). Digital footprint data should be used with great caution: an unanticipated bias of artificial intelligence algorithms used to process and analyze the data can hurt certain user groups (Fuster 2017). For any of the solutions, it is essential that consumers have control over their data. To safeguard privacy, consumer data, should be shared only with explicit consent and for an intended purpose.

Digital financial service providers in emerging market and developing economies have been leveraging alternative data sources to assess creditworthiness. *Konfio*, an online lending platform for small businesses in Latin America, uses big data analytics from electronic invoice records and tax filings for rapid credit assessment. This provides affordable financing for financially underserved microenterprises (Konfio 2018). *Capital Float*, in India, uses social media activities and government data from Aadhaar records to extend collateral-free business loans to small and medium enterprises (Capital Float 2018). In several countries, Tala establishes identity and assesses credit risk based on a wide range of data and data signals from their borrowers' phones. These data include basic biographical information, the borrowers' social network size, merchant activities, and their habits and activities (Tala 2018).

Using cryptography-enabled blockchain technology, some digital financial service providers build consumer data protection into their products and services. Blockchain technology is used to ensure data privacy, as encrypted data built into the blockchain is very difficult to alter or delete. Private blockchains give users the ability to control access to and share their data. MicroMoney collects about 10,000 customer big data parameters through mobile phones in several Association of Southeast Asian Nation countries to establish a potential borrower's credit score. Based on the credit score, a digital financial profile is generated, encrypted, and stored in the MicroMoney Blockchain Credit Bureau. Once potential borrowers agree to share their data with financial institutions, financial information is available for them to access and interpret via simple integration with a secure application programming interface (API) (Croth 2017). The encryption mechanisms and secure APIs offer built-in data protection.

Fintech solutions for credit scoring and sharing can provide the building blocks for a regional approach to credit bureaus or registry. Data collected from a range of alternative sources could be used to develop financial profiles in Pacific island country credit registry functions to support financial stability and credit market efficiency. Financial service providers draw on credit reporting systems to screen borrowers and monitor the risk profile of existing loan portfolios. Credit regulators could have full or partial access to the credit information to enhance their understanding of interconnected credit risks

faced by systemically important borrowers and financial institutions, and to carry out their oversight functions.

Regional bureau regulators should allow data collection and sharing while protecting consumers against data breaches, misuse, and fraud. Governments should stimulate the digitization of consumer data both by public agencies and other service providers. When appropriate, data should be shared securely with banks and licensed nonbank financial service providers. In the European Union, the Revised Payment Service Directive (PSD2) requires financial institutions to release customer data to authorized third parties. This type of information sharing is intended to facilitate equitable access to creditworthiness and credit scoring information among digital financial service providers. The General Data Protection Regulation (GDPR) ensures that data is shared with careful consideration for privacy and confidentiality.

Risks, Constraints, and Mitigation Strategy

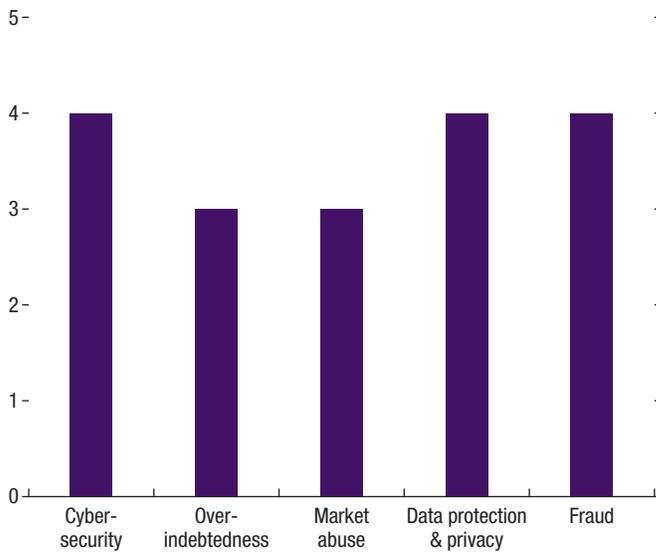
The implementation of fintech products and services will face risks and constraints that need to be factored into the implementation and risk mitigation strategy. Certain risks and constraints, such as limited infrastructure, are inherent to the country-specific context. Other risks, such as cybersecurity risk, are exogenous in nature and can affect any country. Policymakers should conduct a comprehensive assessment of risks by type and nature to decide how to absorb, control, or mitigate them. The risk assessment forms the foundation of a risk mitigation strategy, which will help guide policymakers in determining appropriate action items.

Infrastructure Constraints

Uneven and underdeveloped general and information technology infrastructure might hinder the development of technology-enabled solutions. Reliable electricity underpins all technological solutions, even those that use less advanced features and devices, such as feature phones running on 2G cellular networks. In Pacific island countries, continuous access to electricity can be difficult in remote areas and the outer islands. Cellular network and internet connectivity can also be challenging due to these countries' rugged geography. Existing or new infrastructure is subject to damage and destruction by natural disasters that occur frequently in the Pacific region.

Capital investment is needed to ensure reliable infrastructure. Most Pacific island countries have successfully secured financing for undersea fiber-optic cables. This is necessary for reliable countrywide cellular network coverage. To improve coverage in remote areas where cabling is not financially viable, Pacific island countries should consider increasingly affordable satellite coverage. Backup satellite facilities can also help avoid disruption of critical services in cases of cable outages. To decide which infrastructure to choose,

Figure 10. Foreseeable Risks from Growth of Fintech
(N = 7)



Source: PIRI 2018 survey results.

policymakers should define strategies to clarify local goals (availability, quality, pricing, and so on) and adopt metrics to measure progress.¹ Diversifying the sources of energy to include solar, tidal, and wind, Pacific island countries could ensure continuous electricity supply. This would also promote energy self-sustainability and efficiency and would help countries meet climate change mitigation targets. Pacific island countries could also consider technology solutions that do not need power or internet, such as IDbox or the Digital Access Rights tool (Appendix 2).

Cybersecurity Risks

Cybersecurity is one of the main risks to adopting fintech solutions (Figure 10). Regulators in Pacific island countries have identified cybersecurity, data protection and privacy, and fraud as the most critical risks from fintech. Cybersecurity risks cannot be completely removed but can and should be controlled. Cyber risks emanating from exchanging data using API technology, whether built on a cloud infrastructure or not, can be alleviated through the adoption of strong cyber policy controls and auditing practices (PwC 2017).

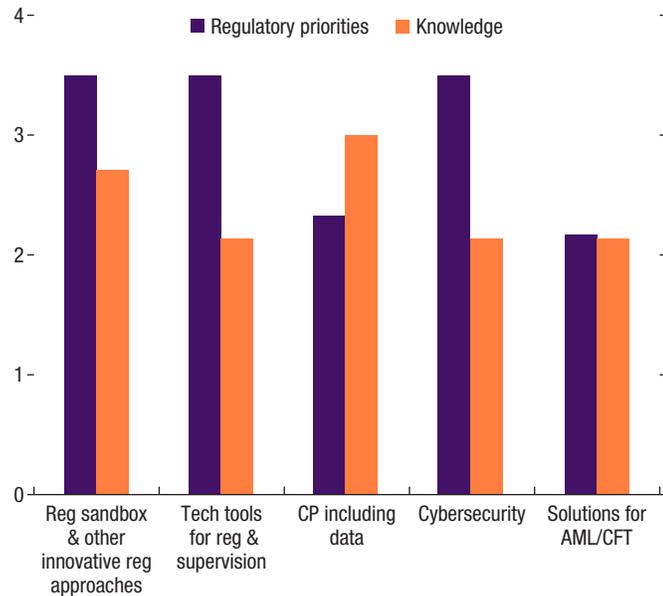
Working with a cloud provider has many advantages but must be accompanied with a strategy governing data exchange, storage, and protection (Figure 11). The disintermediated and nearly immutable nature of the blockchain offers more resilience than centralized technologies; however, hackers have been able to break into third-party applications and exploit smart contracts built into the blockchain (Orcutt 2018). Digitization of identity exposes sensitive, personal data to possible breaches and misuse. The security of biometric data remains work in progress, since it can be intercepted without their owners’ consent or knowledge.

¹There are no international metrics for developing economies, Kelly and Rossotto (2012).

Regulators and institutions in Pacific island countries could be at a disadvantage in coping with the growing risks of cyber threats. The gap between regulatory priorities and knowledge is highest for cybersecurity and technological tools for regulation and supervision. This knowledge gap could translate into weaker capacity to confront attacks and fraud, increasing Pacific island economies' exposure to cybersecurity risks.

Figure 11. Learning Assessment: Regulatory Priorities vs. Knowledge

(Average score, with 1 being least and 5 being highest)



Source: PIRI 2018 survey results.

Controlling cybersecurity risk requires a multifaceted approach that addresses financial product design, regulatory and market infrastructure considerations, and capacity building. Policymakers should require all digital financial service providers to offer system-designed transparency, controls, and data governance and protection mechanisms in their financial products. Building regulatory requirements and strong AML/CFT measures into the digital financial product is an important first step in protecting consumers from misuse and fraud and could reduce the cost of compliance monitoring. Developing technology-neutral, interconnected, and interoperable systems or platforms under regulatory oversight increases transparency, collaboration, and resilience. Policymakers should seek to build the necessary resources and capacity to effectively implement international AML/CFT standards and monitor digital financial service providers for money laundering and terrorism financing risks.

Regional approaches are needed to ensure that regulators and supervisors in Pacific island countries can adopt strong controls and overcome resource and skill constraints. The Association of Financial Supervisors of Pacific Countries

could play a role in bringing together those with the requisite skill sets and in seeking development partner assistance where there are gaps. Private sector participants could benefit from the knowledge transfer associated with technology platforms and innovative regulatory programs and could adopt developing fintech applications with built-in AML/CFT requirements (Beened 2018). Pacific island countries should engage with Australia and New Zealand to support the development of an open, free, and secure internet to drive economic growth, protect security, and promote stability (RNZ 2018).

Operational Risks

Fintech solutions for financial inclusion might be exposed to operational disruptions and challenges. Power outages following natural disasters would interrupt data sharing services necessary for fintech applications. This could potentially disrupt the functioning of the technological platform and the entire technological ecosystem. The lack of interoperability between different applications would hamper their effectiveness and adoption. Creating a technological platform would ensure interoperability between applications but increases the risk of a single point of failure. The skills and competencies needed to develop, maintain, and train algorithmic models or develop and maintain code for fintech applications may be lacking in Pacific island countries. Unanticipated biases might occur in using machine learning techniques that could adversely affect segments of the population.

Interoperable technological platforms, open-source software code, and capacity building efforts are critical to sustainable adoption of fintech applications. To ensure business continuity and fast recovery in case of operational disruptions, policymakers should adopt standards that require digital financial service providers to provide backup systems, incident response plans, and regular operational failure plans (IMF 2018). Alternative power sources, such as backup generators, should be in place to prevent disruption from electricity outages. Building fintech applications on a single technological platform preempts the risk of limited interoperability and provides supervisors more oversight and transparency. Although open-source software code requires maintenance, configuration, and ongoing support, it is free of charge, is supported by a community of developers, and prevents dependence on one vendor (Zivtech 2018). In cases, when digital financial service providers outsource part of their services to third parties, they should be required to have contractually binding third-party liability clauses set up. Working with larger data sets under the guidance of skilled public or private sector partners, including universities, could help reduce algorithmic bias.²

²Machine learning bias, also known as algorithm bias or artificial intelligence bias, is a phenomenon that occurs when an algorithm produces results that are systematically prejudiced due to erroneous assumptions in the machine learning process.

Market Risks

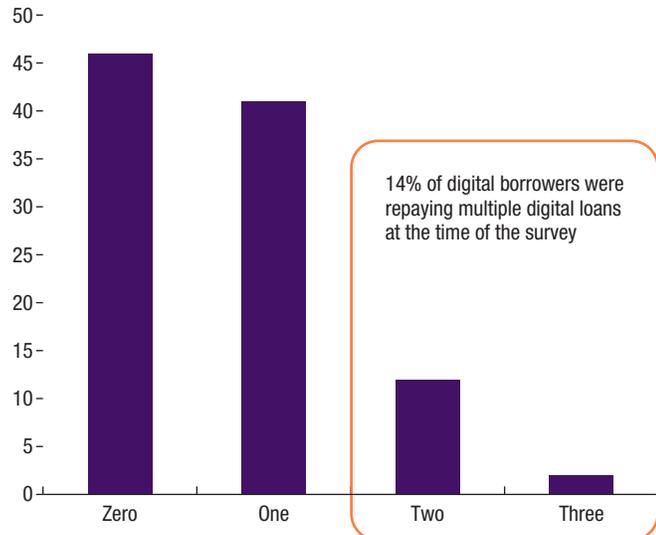
The main market risks are related to unequal access to infrastructure (Figure 12). Preferential or unequal access distorts competition among market participants. It inhibits innovation and raises barriers to entry for new digital financial service providers. There is also a risk of market concentration, with large industry players and proprietary software edging out

smaller digital financial service providers. The cost of entry and maintenance due to Pacific island countries' rugged geography might discourage new market entrants. On the demand side, poor financial and digital literacy and lack of trust in technological solutions could discourage adoption. Greater availability of digital loans could lead to overindebtedness, especially among borrowers with limited financial literacy (Totolo 2018). Overindebted individuals might be blacklisted by credit registries, which would effectively bar their access to credit.

Open and competitive markets with appropriate collaboration models and incentive structures are necessary for successful technological adoption. The policy framework should be designed to promote competition, innovation, and consumer choice and guarantee a level playing field for all market participants in the digital financial payment system. Policies should be guided by principles of standardization, interoperability, and equal access to key infrastructure (IMF 2018). Encouraging collaboration between established financial institutions and new market entrants can spur development of complementary business models and of interoperable technological solution, as is evident in the case of M-Pesa. Lowering entry barriers might offset the elevated cost related to maintenance and production inputs.

Figure 12. Number of Digital Loans Repaid at the Time of Survey

(In percent of all digital borrowers)



Source: FSD-Kenya.

Given their small size, Pacific island countries are well positioned to leapfrog into innovative technologies that support financial inclusion and growth. However, country authorities should be careful in selecting technologies that are feasible and commercially viable in their countries and mitigate associated risks. Well-designed, effective, and legally sound mobile and technology-driven projects offer opportunities for social experimentation and a bottom-up approach to technological solutions.

Fintech can boost countries' efforts in promoting financial inclusion. The use of fintech should be an integral part of national financial inclusion strategies (Loukoianova and others 2018). The public and private sector should work together to enhance technological and financial literacy for everyone and pave the way for adoption of more advanced technological solutions. In addition, early technological adoption can support countries' efforts in creating opportunities for education, employment, and small business development.

- *Mobile money solutions and digital payment systems* promote transparency and cost and time efficiency and improve oversight in the financial sector. Fintech applications can reduce costs, improve the efficiency and security of transactions, and complement traditional banking instruments and intermediation channels. This would reduce reliance on physical bank branches and ATMs and the use of cash as a means of payment.
- For *identification requirements*, new technologies such as digital IDs could facilitate the identification process, enhance due diligence in the loan approval process, and reduce reliance on paper documentation. Digital identities offer citizens a low-cost alternative to validate their identity, which, if supported by countries' legal framework, can unlock access not only to payment systems but also to vital government services.

- For *credit and information sharing*, technological solutions could support the collection and sharing of consumer financial information and behavior and underpin the development of credit bureaus and registries. Data on consumer behavior and payment history from financial institutions and alternative sources, including social media and mobile phones, can be consolidated into a single database and used for credit modeling purposes. Digital financial profiles can be built based on this data.

Technological adoption requires policymakers to provide the appropriate supporting physical and regulatory infrastructure, but this is a demanding task.

- *Physical infrastructure could benefit from public-private partnerships.* Countries should continue investing in undersea fiber-optic cables to enable 4G and 5G cellular networks. Other physical infrastructure could be developed jointly by the private sector, the authorities, and donor partners to reap the most benefits from existing and emerging financial sector fintech solutions at the lowest cost. Countries could also focus on technological solutions that operate under existing infrastructure conditions.
- *A regional approach to fintech applications for financial inclusion and regulatory frameworks is essential to overcome capacity and scalability constraints.* Regional initiatives such as innovation hubs, regulatory sandboxes, and technological platforms would avoid duplication and harmonize policy and regulatory standards. At the same time, they enable a two-way knowledge exchange between regulators and digital financial service providers. This would set the stage for the regional know-your-customer utility introduced at the 2018 South Pacific Central Bank Governors' Meeting. These initiatives would also allow policymakers to build a market environment attractive to incumbent and new market participants.

The authorities should also support regional approaches to social innovation and grass-roots experimentation, targeting solutions designed to reach remote areas. This might boost employment and vocational training opportunities. Regional incubators, capacity building with universities and donor partners, and support for local start-ups will help further the adoption of technologies for financial inclusion. Affordable access to technological solutions and enhanced digital and financial literacy will promote adoption on the demand side. Including financial and digital literacy in the financial inclusion strategy and in the national school curriculum is central to building trust in the technology. Pairing with private sector stakeholders and development partners can help showcase the benefits and value of the technological solutions.

Effective collaboration with development partners, including international financial institutions, provides opportunities to benefit from knowledge exchange and the experience of peers. The IMF is positioning itself to provide

targeted technical assistance, capacity building, and training on emerging fintech issues. Furthermore, the IMF can provide analytical support on fintech through coverage during Article IV consultations, where relevant to the macroeconomy. The wider network of donors, including the World Bank, Asian Development Bank, and bilateral development partners, have substantial and growing expertise on fintech issues and can support Pacific island countries' efforts to develop effective fintech policies and regulations. They may also have the capacity to facilitate the implementation of specific fintech projects, where appropriate.

Box 2. Action Plan

Near-Term Steps

- Conduct a feasibility study for the establishment of a regional regulatory sandbox and/or innovation hub.
- Facilitate creation of robust interoperable technological platforms for banks, mobile network operators, and other institutions.
- Establish a full-time, cross-functional team from different government and regulatory agencies across Pacific island countries to monitor and evaluate initiatives implemented through the regulatory sandbox and/or innovation hub.
- Create a supervisory and oversight framework that balances the risks and efficiency of fintech solutions.
- Build networks and collaboration models with regional and international development partners, standard-setting bodies, and supervisors.
- Develop legislation to ensure competition and a level playing field for all market participants.
- Devise a financial and digital literacy strategy to stimulate adoption of fintech applications and promote start-ups and incubators.

Medium-Term Goals

- Ensure reliable electricity, internet, and cellular network coverage across the country.
- Focus on simple and affordable retail payment software applications.
- Establish a favorable market environment and incentive structures for all market participants.
- Promote education and build capacity through partnerships with regional universities, associations, research institutions, and development partners.

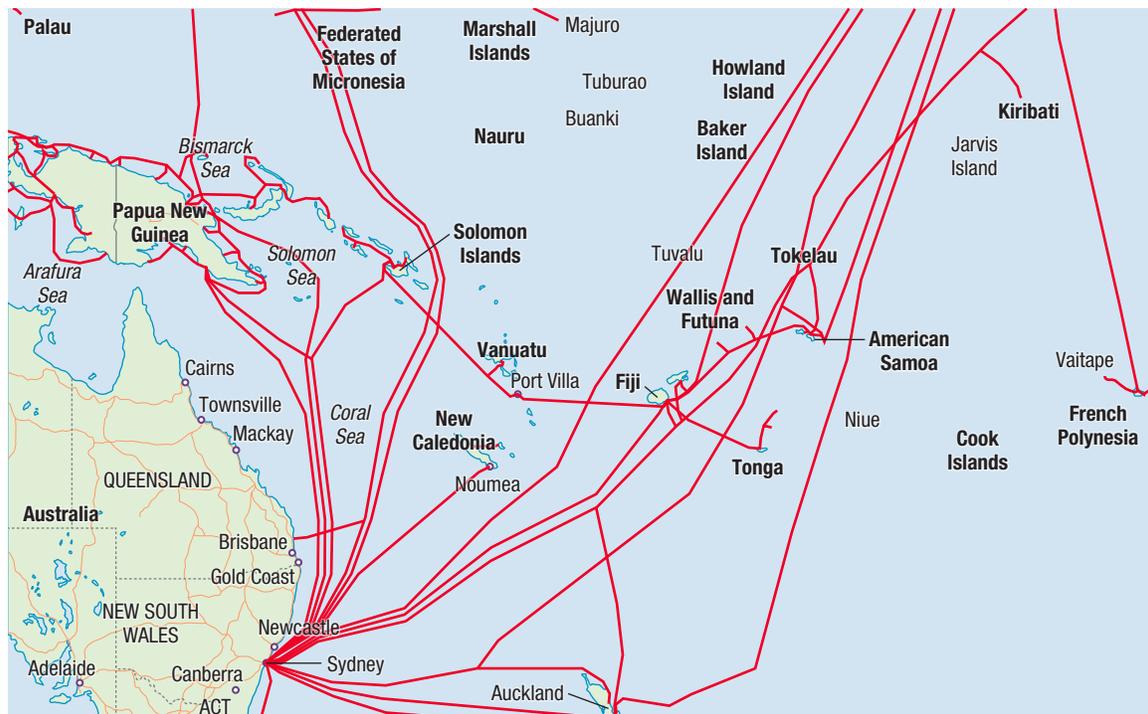
Appendix 1. Characteristics of Existing and Emerging Technologies

Taking stock of existing and emerging technologies allows the identification of technological solutions most amenable to adoption by Pacific island countries. Many developing economies have embraced mobile technologies to foster financial inclusion in the past decade, often leapfrogging into more advanced technologies despite constraints such as device affordability and connectivity challenges. Although latecomers can benefit from these experiences, new opportunities have emerged, including distributed ledger technology (DLT). There are also many traditional technological solutions that are equally viable to tackle financial inclusion challenges. Effective adoption of any technological solution relies on a good understanding of the distinct types of available technologies, their characteristics, and the infrastructure requirements for their adoption.

Improved internet coverage and affordable mobile access have increased the availability of online services for the financially excluded population in developing economies. Kenya and other developing economies with infrastructure and macro-structural constraints like those of Pacific island countries already provide basic access to financial services such as mobile payments and micro-lending using well-established technologies. In many instances, payments can be processed using feature phones.¹

The backbone of Pacific island countries' connectivity is a combination of submarine cables, satellites, and landline networks (Appendix Figure 1.1). Developing economies have for the most part leapfrogged to mobile connectivity, bypassing landline infrastructure, which is particularly costly in hard-to-reach and remote areas. Submarine cables are critical to improve the islands' connectivity, as everything from data to voice requires these lines.

Appendix Figure 1.1. Submarine Cables in the Pacific by 2020



Source: Telegeography.

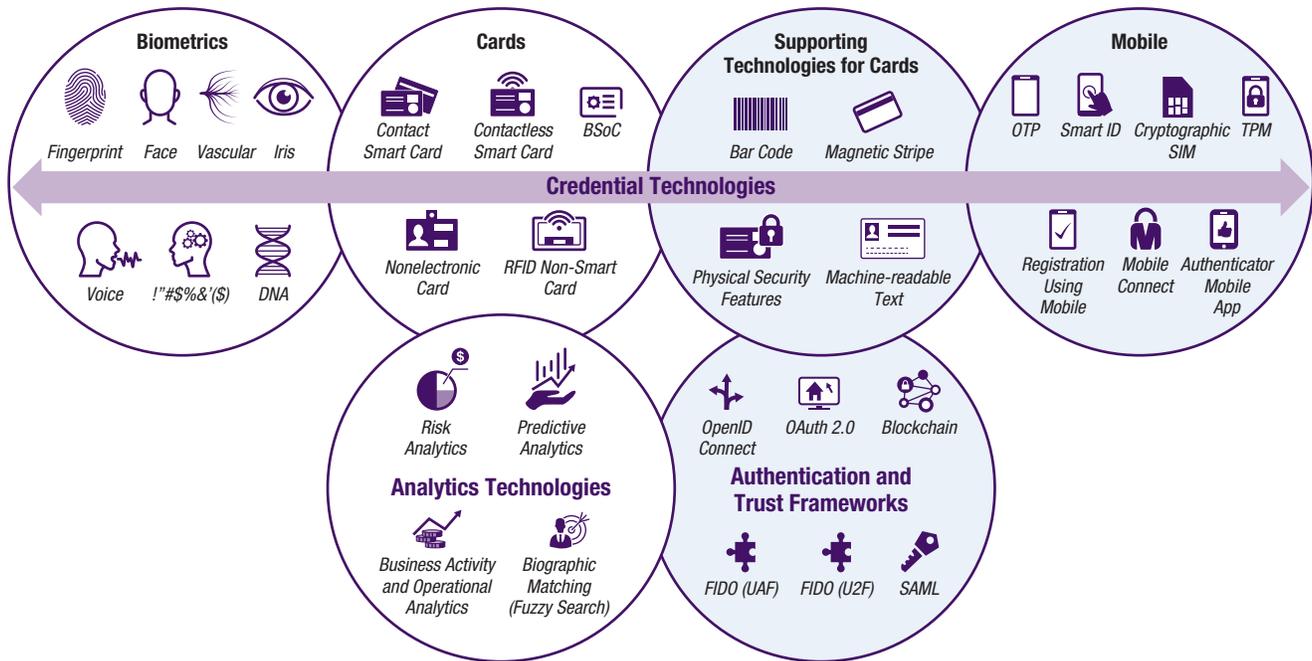
Even a modern internet service, such as the cloud architecture, relies on submarine communication cables.¹

Feature phones running on lower 2G bandwidth cellular networks are expected to represent over 50 percent of connections in Pacific island countries in 2020 (GSMA 2015). Despite their lower capability and other limitations, these phones have proved useful in countries with lower-generation cellular networks' slower connections. The nearly three-decade-old unstructured supplementary service data (USSD) technology has reemerged as a critical enabler for mobile services, including payment systems in developing economies. Most mobile payment and other financial mobile services, even M-Pesa in Kenya, are using USSD to take advantage of low-cost devices and poor connections.²

¹Satellite coverage, while slower and often expensive, remains critical to reach the most remote and least-populated islands, especially for disaster relief and emergency communications. TV services, which can play a key role in technology and financial literacy, are usually provided by satellite.

²Other examples of mobile services accessible today on low-bandwidth, low-cost phones include Facebook, Wikipedia, and utilities and payment registration.

Appendix Figure 1.2. Identification and Authentication Technologies



Source: World Bank Group (2018).

More powerful mobile devices—smartphones—provide faster access to the newer generations of cellular networks, such as 3G and 4G connections.³ The higher connectivity enables more advanced mobile services, particularly for payments. Smartphones can host mobile wallet applications that store payment card or bank information on the phone and replace the need for cash or credit cards to settle person-to-person or in-store payments. The new generation smartphones are equipped with Bluetooth and near-field communication (NFC) technology, which allows two devices in physical proximity to exchange data, including payment data.⁴ NFC is not immune to security risks such as data interceptions, eavesdropping, and data modification attacks.

A secure and private digital identity can be established with the use of credential and analytics technologies or trust and authentication frameworks (Appendix Figure 1.2). To ensure access to payment systems based on an established identity, commercial applications use credential technologies, specifically biometric technology. The technology uses physical or behavioral traits intrinsic to every individual, including fingerprints and typing patterns,

³5G technology is expected to be available in 2019 in developed economies.

⁴NFC-enabled payment applications include Apple Pay, Android Pay, Samsung Pay, Visa payWave, and MasterCard PayPass.

to establish their identity. Biometric identification requires a device to record the biometric factor, such as a fingerprint, software to convert it to a data point in digital format, and a secure database to store the data set. The technology is secure and convenient: no passwords, security tokens, or documentation are required to prove identity. Because of their visibility, biometric data can easily be intercepted and captured without owners' consent or knowledge. Unlike passwords, however, in cases when personal biometric data are compromised, they cannot be changed. Multiple authentication mechanisms are often used to mitigate this risk.

Traditional technologies are being augmented with more innovative fintech solutions. In the case of M-Shwari in Kenya, the paperless banking service offered through M-Pesa, artificial intelligence (AI) assesses creditworthiness based on M-Pesa clients' past financial behavior. AI and machine learning (ML) solutions typically require a large amount of high-quality representative data samples. The data must be machine readable and stored in the appropriate data format. Finally, the development, maintenance, and training of AI/ML systems require distinct skills, such as in computer coding and data science.

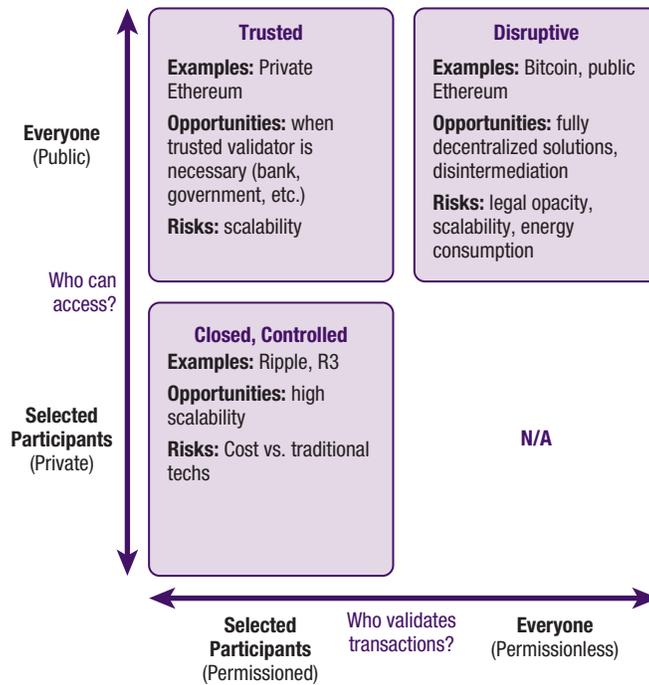
The interoperability of distinct systems can be ensured through technological solutions, but increasing interconnectedness presents new risks. For two financial products—such as M-Pesa and M-Shwari—to interoperate seamlessly, a software architecture called application programming interface (API) is necessary. APIs allow service providers such as governments, banks, financial institutions, and mobile network operators either to share data with other systems⁵ or make their service programmatically accessible over online connections such as USSD or the Internet equivalent, called TCP/IP (transmission control protocol/Internet protocol). APIs constitute an essential building block of fintech products and their interoperability. However, policymakers should carefully monitor and guard against APIs' intrinsic risks: they are particularly susceptible to cyberattacks such as data breaches, unauthorized service access, and complete system shutdowns through denial of service attacks.⁶ Mitigating such risks is expensive, as it requires skilled personnel and costly firewalls that must be continuously maintained and upgraded to outsmart attackers. Services relying on interoperable systems become dependent on the weakest link—a sizable risk in countries with unreliable electrical grids or exposed to natural disasters.

Moving mobile services to a cloud architecture is a popular risk mitigation strategy. Cloud architectures are designed and staffed to cope with the risks

⁵For example, Payment Services Directive 2 (PSD2) in Europe.

⁶Denial of service attacks are designed to overload APIs with a massive number of requests until the service stops responding.

Appendix Figure 1.3. Distributed Ledger Technology Serving Different Purposes



Source: IMF staff.

related to API cyberattacks.⁷ Cloud-based systems are appealing because of their low up-front investment cost, more efficient resource utilization, and reliability. Although they alleviate certain cybersecurity risks inherent to on-premise data centers, cloud solutions introduce new challenges for digital financial service providers. Designing a cloud-based system can be complex, and transferring control over the data in the cloud to the third-party provider presents its own challenges.

Distributed ledger technology offers advantages, including a reduced need for interoperability among system participants, enhanced resilience to cyberattacks, and the capability for cost-effective applications (Appendix Figure 1.3). Distributed ledgers use cryptography to record transactions of financial assets such as remittances and to track records of fixed assets such as land. Data are stored, shared, and synchronized among network participants. Participants can be various entities, institutions, people across the world, and business functions that mathematically validate new data entered and the integrity of the entire ledger since inception. Whereas any network participant can gain

⁷Popular cloud services include Amazon Web Service, Microsoft Azure, and Google Cloud.

access to a public DLT network, only designated participants can join a private or permissioned DLT.⁸ Due to its core element of disintermediation, in which trust is distributed among network participants, no central authority is necessary to ensure the integrity of the database in public DLTs. In most cases, government-led DLT initiatives will use a permissioned (public or private) DLT to maintain some level of control. The distributed nature of DLT makes the system resilient to attacks or outages.

One of the best-known public implementations of DLT is the *blockchain*, which lies at the core of many innovative fintech initiatives. Blockchain describes the unique format of a computerized ledger, in which valid transactions are organized in blocks. The blocks are cryptographically linked to one another in a chronological chain. Only new blocks can be added to the chain, and once a block is added it cannot be changed or deleted. Transactions are broadcast in real time across the network of participants, which eliminates the need for reconciliation or intermediation. This can reduce settlement time, lower back-office costs, and secure data transmission (Casey and others 2018). Although promising, the technology is still in its infancy and faces challenges related to scalability, high energy consumption (in the case of permissionless blockchain networks), and maturity.

⁸The most popular public blockchain networks are the Bitcoin and Ethereum blockchain.

Appendix 2. Digital Identity Pilot Projects in Papua New Guinea

Papua New Guinea faces serious general and information technology infrastructure constraints, with large segments of the population excluded from the financial sector. Papua New Guinea is the second largest island in the world, with a population of about 8 million people, 72 percent of whom live in rural or remote areas (APEC 2018). Citizens in remote areas lack access to identification, which obstructs their access to finance. As a result, 65 percent of the total population does not have a bank account. Moreover, 80 percent of the total population lives off the electrical grid (APEC 2018). Although very few people have smartphones, more than 75 percent of the population uses SMS-capable phones.

The Bank of Papua New Guinea (BPNG) received support from development partners and private companies to find technological solutions to expand financial inclusion. One such solution was IDbox—a low-cost device with biometric-technology-enabled identification which runs on a private blockchain and relied on phones with SMS capability. The device included solar panels, which allow it to operate in areas with no electricity. Identity is set up once using biometric fingertip identification. The biometric information is cryptographically encoded and stored on the device's ID card and linked to an individual's SMS-capable phone. These types of phones run on low-bandwidth networks such as 2G. The established identity can be used for domestic or cross-border payments, voting, validating vaccine and medical history, and trading excess electricity units stored in the device.

The BPNG used the pilot project to inform regulation and gather lessons learned. The IDbox pilot project allowed the BPNG to observe international fintech trends, acquire knowledge about the benefits and pitfalls, and provide thought leadership in the fintech area. While the concept and design of the IDbox offered a viable solution in two field trials, scalability and transaction capacity speeds proved unacceptable. Also, the reliance on a single individual

for development and maintenance proved to be a key risk that could not be sufficiently mitigated.

Papua New Guinea is now exploring alternative solutions using the Near Field Communication (NFC). Given the mixed results of the IDbox project, the ADB supported Papua New Guinea to develop the Digital Access Rights tool. The tool works on any Android-powered platform and can operate in both online and offline modes, gathering basic KYC data, capturing photo ID and potentially biometric security features. The captured data is wirelessly transferred to a plastic card using NFC technology. Individuals in the field can use the card as soon as their identity data has been uploaded to a centralized database to access bank or government services. A working prototype of the tool has already been successfully piloted in the field with further product development and trials expected through the end of 2019.

Appendix 3. Existing Pacific Island Country Efforts

Supporting Infrastructure and Legal Frameworks

Cables

2000: Southern Cross (Fiji)

2009: PIPE (Papua New Guinea)

2010: Hantru (Micronesia, Marshall Islands)

2013: Tonga Cable (Tonga, Fiji)

2017: SEA-US (Palau, Micronesia)

2018: Tui Samoa (Samoa, Fiji)

2019: Coral Sea Submarine System (Solomon Islands, PNG)

2019: ICN2 (Solomon Islands, Vanuatu)

2020: Manatua (Cook Islands, Samoa, French Polynesia, Niue)

2020: Southern Cross Next (Fiji, Tokelau, Kiribati, Samoa)

Payment Systems Modernization Legislation

- Papua New Guinea (National Payments System Act 2013)
- Samoa (National Payments Act 2014)
- Fiji (Interchange Network (Payments) Act 2017)
- Vanuatu (Payments System Act 2018, planned)

Selected Applications

Mobile Money and Remittances: Mobile money companies are operating in several Pacific jurisdictions, including Samoa, the Solomon Islands, Tonga, and others. In addition, multiple mobile money operators have partnered with fintech companies specializing in remittances. This facilitates transfers from sites of the Pacific diaspora.

E-Wallets: Several mobile network operators and banks are competing with their own e-wallet platforms in Fiji, Papua New Guinea, Samoa, and the Solomon Islands.

Fintech for utility bills: Customers are buying prepaid electricity top-ups through Vodafone's M-Paisa mobile wallet in Fiji, and remote customers in Papua New Guinea use pay-as-you-go meters that can be topped up the same way for solar power.

Mobile Insurance: Mobile micro insurance offered in Papua New Guinea by BIMA uses the Digicel platform and is underwritten by Capital Life Insurance Company.

Digital Identity: IDbox, a Papua New Guinea pilot program developed in partnership with the central bank was piloted to facilitate improved identification and compliance. Papua New Guinea also piloted the Digital Access Rights tool to provide access to a variety of services that require a unique identity as the basis of engagement using the Near Field Communication technology and encrypted identity cards.

Appendix 4. Pacific Island Countries' Fintech Ecosystem Opportunity

See following page for Appendix Table 4.1.

Appendix Table 4.1. Pacific Island Countries' Fintech Ecosystem Opportunity

Actors		Constraints		Conditions for success	
Supply:	Government	Cost of remoteness	Innovation incubation, regulatory sandboxes Effective collaboration between banks, MTOs, MNOs Regional public/private sector coordination	Build Resilient Enabling Infrastructure: Continue to improve internet access Implement interoperability of payment, platforms, included via MNOs and other non-banks Enable safe innovation hubs	Relevant Initiatives TechFin: Alipay MNOs: M-Pesa, Wing (Cambodia), bKash (Bangladesh) Interbank: Stellar, Ripple Crypto: Abra, Coins.ph Mobile: WeChat, Alipay, WorldRemit
	Financial services providers (incl. non-banks)	Lack of regulatory framework			
	Tech firms	Lack of incentives			
	Merchants	Lack of digital services			
Demand:	 Financially under and unserved Storing funds, buying, paying bills, sending/receiving funds, borrowing, saving, insuring assets and risks	Affordability	Regional collab public/private sector/development partners Customer confidence. Trust in digital platforms	Promote Technological Adoption: Improve financial, digital literacy Facilitate simple, affordable retail payments systems Foster participation of merchants, retailers, etc..	KYC Requirements: PNG ID Box using fingerprint and blockchain Biometrics: Aadhaar, e-KTP DLT: uPort, Celo, OneName Other: e-Estonia Aadhaar Pay, BHIM BanQu, CordaKYC
		Financial literacy			
		Digital literacy			
		Credit history			
		Identity verification			
Enablers:	Mobile applications	Technical, and entrepreneurship skills	Develop fintech talent Competitive cost, regional public/private sector coordination Access to financially relevant data across enablers Reliable electric grid and telecommunications in rural areas	Share Knowledge and Collaborate: Establish regional networks for collaboration between supply and enablers Build capacity through training	Credit Scoring, Information Sharing Konfio, Capital Float, Tala lending Tiixa, Ant Financial MicroMoney, Bloom, Pave blockchain Europe: PSD2, MIFID2, GDPR
	Mobile devices	Commercial viability, cost/benefit			
	MNOs services	Unclear regulation			
	MNOs infrastructure	Interoperability			
	DFS systems	Cost of remoteness			
	Infrastructure (incl. electric grid)				
Capital (VC, IFIs...)					

Source: IMF staff.

References

- Aadhaar API. 2018. Authentication.
- Alexandre, A. 2018. “Gates Foundation to Partner with Ripple and Coil to Support ‘Pro-Poor’ Payment Systems.” *Cointelegraph*, October 18.
- Alliance for Affordable Internet (A4AI). 2018. *2018 Affordability Report*. Washington, DC.
- Alwazir, J., F. Jamaludin, D. Lee, N. Sheridan, and P. Tumbarello. 2017. “Challenges in Corresponding Banking in the Small States of the Pacific.” IMF Working Paper 17/90, International Monetary Fund, Washington, DC.
- Asia-Pacific Economic Cooperation (APEC). 2018. “Going Digital: Bilum and Blockchain in Papua New Guinea.” Press Release, March 6.
- Asia-Pacific Economic Cooperation Business Advisory Council (ABAC). 2018. *Structural Reform and Digital Infrastructure*. Companion Report to the 2018 AEPR: Structural Reform and Infrastructure, Washington, DC.
- Association of Banks in Singapore (ABS). 2018. “Industry Banking KYC Utility Project After-Action Report—Knowledge Sharing.” Singapore.
- Australia Securities & Investments Commission (ASIC). 2018. *Regulatory Sandbox*. Sydney.
- Bank for International Settlements (BIS). 2018. “Sound Practices: Implications of Fintech Developments for Banks and Bank Supervision.” Basel Committee on Banking Supervision, Basel.
- Becker C. 2012. “Small Island States in the Pacific: The Tyranny of Distance.” IMF Working Paper No. 12/223, International Monetary Fund, Washington, DC.

- Beened, W. 2018. "Everest, and 1000 Alternatives, Announce New Partnership to Accelerate Blockchain Innovation." *BlockchainNews*, October 11
- Brewer, J. 2018. "Satellite still a necessity for many Pacific Islands", APNIC, September 18.
- Callum, H. 2018. "Our Journey." Presentation to the International Monetary Fund, Washington, DC, October 6, 2018.
- Capgemini and BNP Paribas. 2018. *World Payments Report*. Paris.
- Capital Float. 2018. Capital Float website.
- Casey, M., J. Crane, G. Gensler, S. Johnson, and N. Nerula. 2018. "The Impact of Blockchain Technology on Finance: A Catalyst for Change." Geneva Reports on the World Economy 21, International Center for Monetary and Banking Studies, Geneva.
- Cheng, R. 2016. "By 2020, more people will own a phone than have electricity", CNET, February 3.
- Croth, M. 2017. "MicroMoney Launches the New Tool for Credit Scoring Based on Big Data and Neural Networks." *Geek Crunch*, September 29.
- CryptoCompare. 2018. *Crypto-Asset Taxonomy Report*. October.
- Dirou, P., and P. Holden. 2016. "Credit Can Increase Without Government Guarantees." Op-ed. Pacific Private Sector Development Initiative, December 15.
- Entrepreneurial Finance Lab (EFL). 2015. "Alternative Credit Scoring in Emerging Markets." Singapore.
- European Supervisory Authorities (ESAs). 2019. *Joint Report on Fintech: Regulatory Sandboxes and Innovation Hubs*.
- Fuster, G.-P., and W. Ramadorai. 2017. "Abra Rolls Out Support for 20 Cryptocurrencies and 50 Fiat Currencies." Finextra, March 15.
- George, A. 2018. "How Satellite Internet Could Provide Disaster-Proof Coverage." *Popular Mechanics* (March).
- Glazer, Kip. 2016. "Game-Based or Playful Learning, Not Gamification for All Things." *Literacy Daily*, April 27.
- Global Financial Innovation Network (GFIN). 2019. Website.
- Global System for Mobile Communications Association Intelligence (GSMA). 2011a. *Mobile Money for the Unbanked, Mapping and Effectively Structuring Operator-Bank Relationships to Offer Mobile Money for the Unbanked*. London.

- . 2011b. *Mobile Money for the Unbanked, Building, Incentivising and Managing a Network of Mobile Money Agents: A Handbook for Mobile Network Operators*. London.
- . 2013. *Tiered Risk-Based KYC: M-Shwari Successful Customer Due Diligence*. London.
- . 2015. *The Mobile Economy, Pacific Islands*. London.
- Gupta S., M. Keen, A. Shah, and G. Verdier. 2017. *Digital Revolutions in Public Finance*. Washington, DC: International Monetary Fund.
- Holmes, C. 2018. “Closing Keynote from Bank of Papua New Guinea.” Presentation at Blockchain Week 2018, London, January 24.
- IDBox. 2017. Website.
- International Business Machines (IBM). 2018. *IBM Blockchain World Wire*.
- International Monetary Fund (IMF). 2015. “Financial Inclusion: Can It Meet Multiple Macroeconomic Goals?” IMF Staff Discussion Note 15/17, International Monetary Fund, Washington, DC.
- . 2017. “Fintech and Financial Services: Initial Considerations.” IMF Staff Discussion Note 17/05, International Monetary Fund, Washington, DC.
- . 2018. “The Bali Fintech Agenda: A Blueprint for Successfully Harnessing Fintech’s Opportunities.” Press Release No. 18/388, October 11.
- . 2018, Financial Access Survey, September 28.
- International Telecommunication Union (ITU). 2017. “Satellite and Submarine International Connectivity in the Pacific.” Presentation at ITU / PITA Workshop, Suva, Fiji, August 2.
- Jahan, S., J. De, F. Jamaludin, P. Sodsriwiboon, and C. Sullivan. 2019. “The Financial Inclusion Landscape in the Asia-Pacific Region: A Dozen Key Findings.” Working Paper No. 19/79, International Monetary Fund, Washington, DC.
- Kelly, T., and C. M. Rossotto. 2012. *Broadband strategies handbook (Vol. 2): Overview*, World Bank, Washington, DC.
- Kevindra, D. A., and C. Lim. 2011. “Design and Implementation of e-KTP (Indonesian Electronic Identity Card) Key Management System.” International Conference on Advanced Computer Science and Information Systems, Jakarta, December 17–18.
- Konfio. 2018. Website.
- Leo, B., J. Kalow, and T. Moss. 2018. “What Can We Learn about Energy Access and Demand from Mobile-Phone Industry?” Center for Global

- Development Policy Paper No. 120, Center for Global Development, Washington, DC.
- Li, W., H. Fu, Y. Zhao, J. He, and S. Jin. 2018. "14.1% Efficient Monolithically Integrated Solar Flow Battery." *Chem* 4 (11): 2644–57.
- Licandro, G., 2018, Uruguayan e-Peso in the Context of Financial Inclusion, Banco Central del Uruguay, November 16.
- Loukoianova, E., and others. 2018. "Financial Inclusion in Asia-Pacific." IMF Departmental Paper No. 18/17, International Monetary Fund, Washington, DC.
- Mbaka, C. 2018. "EASRA to Employ Fintech Regulatory Sandboxes and Adopt Regional Framework." *TechMoran*, August 1.
- Mnohohitnei, I.; Scorer, S.; Shingala K.; Thew O. 2019. "Embracing the Promise of Fintech." Bank of England Quarterly Bulletin, 2019 Q1.
- National Digital Literacy Mission (NDLM). 2016. Website. Noida, India.
- Neville, S., and J. Allaire. 2017. "Free Cross Border Payments, European Growth, Product Features and New Services." *Circle* blog, June 14.
- Orcutt, M. 2018. "How Secure Is Blockchain Really?" *MIT Technology Review* 2 (3).
- Pacific Financial Inclusion Program (PFIP). 2016. *Solomon Islands National Inclusion Strategy 2016–2020.*, Suva, Fiji.
- Pacific Regional Initiative (PIRI). 2018a. "Presentation on Survey Results." Presentation at the 8th meeting of the Experts Groups on Financial Inclusion Policy (EGFIP) for the Pacific Islands Regional Initiative, Apia, Samoa, June 5.
- . 2018b. "Presentation on 2016 Demand Side Survey." 4th Pacific Islands Regional Initiatives High-Level Forum, Apia, Samoa, June 6.
- Perrigo, B. 2018. "India Has Been Collecting Eye Scans and Fingerprint Records From Every Citizen. Here's What to Know." *Time*, September 28.
- PricewaterhouseCoopers (PwC). 2017. "Understanding IT's Impact on Business Risk in the Technology Sector." London.
- Radio New Zealand (RNZ). 2018. "Australia and New Zealand Announce Joint Pacific Cyber Security Plan." November 19.
- Reserve Bank of Australia (RBA). 2018. "Samoa Commitment for the Pacific Islands." Media Release, November 29.
- Rutter, K. 2018. "If at First You Don't Succeed, Try a Decentralized KYC Platform: Will Blockchain Technology Give Corporate KYC a Second Chance?" *R3 Reports*, R3, New York.

- Schiller, B. 2013. "A Solar-Powered Charging Station For Countries With Lots Of Phones And Little Juice." *Fast Company*, October 1.
- Speider, U. 2018. "Satellite Still a Necessity for Many Pacific Islands." Asia-Pacific Network Information Centre blog, September 18.
- Submarine Cable Map. 2019. Website.
- Sy, A. N., and others. 2019. "FinTech in Sub-Saharan African Countries: A Game Changer?" IMF Departmental Paper No. 19/04, International Monetary Fund, Washington, DC.
- Tala. 2018. Website.
- Totolo, E. 2018. "Kenya's Digital Credit Revolution 5 Years On." FSD-Kenya blog, April 3.
- United Nations Capital Development Fund (UNCDF). 2018. "What Can We Learn from Sierra Leone's New Regulatory Sandbox?" Blog, May 16.
- United Nations Conference on Trade and Development (UNCTAD). 2018. Technology and Innovation Report: Harnessing Frontier Technologies for Sustainable Development, Geneva.
- United Nations Secretary-General's Special Advocate for Inclusive Finance for Development (UNSGSA) FinTech Working Group and Cambridge Centre for Alternative Finance (CCAF). (2019). *Early Lessons on Regulatory Innovations to Enable Inclusive FinTech: Innovation Offices, Regulatory Sandboxes, and RegTech*. New York and Cambridge, UK: Office of the UNSGSA and CCAF.
- . 2018. "Briefing on Regulatory Sandboxes." New York.
- World Bank Group (WBG). 2016. Identification For Development (ID4D) Global Dataset, Washington, DC.
- . 2004–18. World Bank Doing Business Dataset. Washington, DC.
- . 2017a. *Principles on Identification for Sustainable Development: Toward the Digital Age*. Washington, DC.
- . 2017b. Global Findex Database. Washington, DC.
- . 2019. *Affordable, Faster Connectivity for Tuvalu*. Washington, DC.
- Zivtech. 2018. "The Benefits of Open Source Software." Blog, February 8.