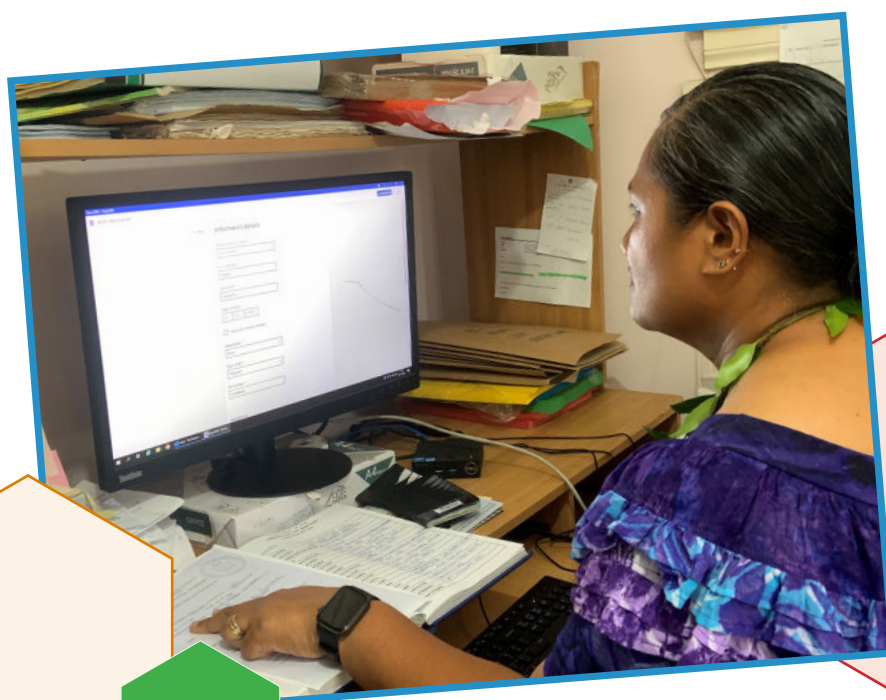


# INTEROPERABILITY AND DATA SHARING BETWEEN CIVIL REGISTRATION, HEALTH INFORMATION, STATISTICS AND ASSOCIATED SYSTEMS





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Pacific  
Community  

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Communauté  
du Pacifique

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# TABLE OF CONTENTS

<b>ABBREVIATIONS .....</b>	<b>IV</b>
<b>ACKNOWLEDGEMENTS.....</b>	<b>V</b>
<b>EXECUTIVE SUMMARY .....</b>	<b>1</b>
Data sharing opportunities .....	2
Challenges .....	2
Key factors to consider .....	2
<b>NAVIGATING DATA SHARING OF VITAL RECORDS IN THE PACIFIC .....</b>	<b>5</b>
Introduction .....	5
Methodology and approach .....	7
Digital data sharing capabilities across Pacific CRVS systems .....	7
Data-sharing needs and opportunities.....	10
Challenges in the digital transformation of data sharing for efficient civil registration.....	12
<b>TECHNICAL FOUNDATIONS AND STANDARDS FOR SEAMLESS DATA EXCHANGE.....</b>	<b>16</b>
Periodic data sharing .....	16
Real-time data sharing where timeliness is essential .....	19
Data standardisation formats for real-time data sharing.....	19
Application Programming Interfaces (APIs) .....	19
Some healthcare sector data standards .....	20
Message protocols .....	20
<b>CONCLUSIONS AND RECOMMENDATIONS .....</b>	<b>24</b>
<b>APPENDIX 1 – COUNTRY OVERVIEW.....</b>	<b>26</b>
American Samoa .....	26
Cook Islands.....	27
Fiji .....	28
Niue .....	29
Tokelau.....	30
Tonga .....	30
Solomon Islands .....	32
Samoa.....	33
Vanuatu .....	36
<b>APPENDIX 2 – CASE STUDY – TOWARDS UNIVERSAL CRVS DATA SHARING STANDARDS .....</b>	<b>38</b>
Advantages resulting from adhering to FHIR standard.....	39
<b>APPENDIX 3 – CHECKLIST FOR THE DECISION MAKING ON DATA SHARING .....</b>	<b>42</b>

## **ABBREVIATIONS**

API	Application Programming Interface
BDM	Births, Deaths and Marriages
CRVS	Civil Registration and Vital Statistics
DXP	Data Exchange Platform
FHIR	Fast Healthcare Interoperability Resource
HIS	Health Information System
HL7	Health Level Seven International
ICT	Information and Communication Technology
NHIS	National Health Information System
OpenHIE	Open Health Information Exchange
PATIS	Patient Information System
PIMS	Patient Information Management System
SILAS	Share, Integrate, Link American Samoa

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**CIVIL & IDENTITY REGISTRY**

**Celebrating the 43<sup>rd</sup> Independence**

**Anniversary of Papua New Guinea**

**"For all you sons and daughters of this land"**



## EXECUTIVE SUMMARY

The registration of vital events such as births, deaths, marriages, and divorces hinges on extensive data sharing among various governmental and civil entities. Identity verification crucially depends on data exchange, allowing for real-time updates and the prevention of identity fraud. This process involves healthcare providers, vital records offices, public health agencies, funeral directors and court systems. These all need to coordinate in order to maintain accurate legal records and facilitate services like public health surveillance and civil document verification.

Interoperability is the ability of diverse systems to work together. Interoperability is key to data exchange. Interoperability involves compatible data formats, communication protocols, system interfaces, concepts, definitions, standards, classifications, and even standardised protocols for non-digital records. The digitisation of legacy paper-based records and the use of fully digitised-registration both require secure networks and application programming interfaces (APIs) for efficient data sharing.

The Pacific has seen significant efforts in digitising civil registration and legal identity systems. As well, there has been a demand for inter-country data sharing, especially in cases of movements and health initiatives across borders. Digital systems offer fast and cost-effective data sharing as well as challenges like data privacy, security concerns and the need for common standards.

Pacific civil registration and vital statistics (CRVS) systems exhibit varying levels of digital development, from initial digitisation efforts to moderately integrated systems, and some highly advanced digitised setups. Each country faces challenges in its journey towards an efficient, integrated civil registration and vital statistics system.

This report provides insight into the existing landscape for interoperability between government information and communications technology (ICT) systems across the Pacific by focusing on a detailed examination of the experiences of eight jurisdictions in the Pacific: American Samoa,<sup>1</sup> Cook Islands, Fiji, Niue, Samoa, Tokelau, Tonga and Vanuatu. New Zealand and the United States of America are considered in the context of cross-border digital data interoperability opportunities, while the Pacific Community (SPC) is considered as a possible participant in regional data sharing. The insights contained in this report can be applied to within country, between country, and regional data sharing.

Digital data-sharing capabilities across Pacific CRVS systems can be categorised into three main levels of digital development:

**Emerging digital systems with limited integration:** Countries in this category are in the early stages of digitising CRVS systems with limited integration into other government systems. Examples include:

- **American Samoa**, transitioning from manual to digital platforms like Familytrac on Share, Integrate, Link American Samoa (SILAS), yet to progress in integrating with other systems.
- **Cook Islands**, where the CRVS system is a mix of manual processes and a basic Microsoft Access database.
- **Niue**, implementing OpenCRVS for streamlined data processing but lacking integration with other government databases.
- **Tokelau**, marked by early-stage digitisation efforts with constrained infrastructure.
- **Tonga**, having a partially digitised civil registry with ongoing efforts to improve cross-linking and integration, particularly with the health sector.

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<sup>1</sup> American Samoa is a U.S. territory subject to federal regulations such as the reporting of vital statistics to the Centers for Disease Control and Prevention (CDC); for simplicity, it and similar entities are hereafter referred to as countries in this report.

**Digitised and moderately integrated systems:** These systems are more advanced, with a significant proportion of records digitised and some level of data sharing with other government systems.

- **Samoa's** evolving CRVS system involves the Births, Deaths and Marriages (BDM) office digitising records since 1993. Many historical records remain physical. A pilot process is in place for digital birth notifications from the health information system directly to CRVS and national identification (ID) servers.
- **Solomon Islands** is using the Promadis platform for CRVS. Promadis facilitates data exchange but full integration with government systems is not yet in place.
- **Vanuatu's** RegisterViz platform exemplifies substantial digital capabilities with enhanced interoperability, however, its integration throughout all government sectors is currently underway.

**Highly integrated and digitised systems:** This category includes systems with extensive electronic data sharing across various government departments. A notable example is:

- **Fiji's** CRVS system, the Data Exchange Platform (DXP), is an electronic vital events registration platform for efficient data sharing. It is part of an ongoing effort to standardise processes and reduce reliance on manual systems.

## Data sharing opportunities

Civil registration authorities rely on data sharing for the registration of vital events like births, deaths, marriages and divorces. Data exchange is essential for statistics, social services, passports and identity, and election offices. Not all scenarios require real-time data sharing but regular data exchange is required.


Health facilities provide birth and death notifications and courts contribute documents for adoptions, marriages, and divorces. This process traditionally involved physical document transfer but digital systems now enable direct, efficient information exchange. Key areas for data sharing in Pacific CRVS practices include health system integration, digital identity system updating, immigration verification, social welfare provision, voter registration, taxation, personal data verification to facilitate banking or insurance processing, land rights enabling and fraud prevention.

## Challenges

The adoption of digital systems for data sharing in Pacific CRVS systems is challenged by several factors. Limited interoperability within health ICT systems impedes the electronic transfer of crucial data, such as birth and death notifications. Outdated digital civil registration platforms in certain instances operate on vendor-proprietary database designs limiting external access to stored records and its migration to different database platforms. An urban-rural digital divide, which in the Pacific includes a main island – outer islands digital divide, further restricts data sharing, with many rural areas and outer islands still dependent on manual processes. Insufficient funding and a lack of skilled staff hinder the development and maintenance of advanced digital systems. Outdated legal frameworks and policies not adapted to the digital era obstruct the adoption of modern data-sharing solutions. Issues with data accuracy and a lack of inter-agency collaboration result in inconsistent records and inefficient processes. Additionally, cultural hesitancy and mistrust to the government handling of personal data create resistance to digital data sharing initiatives. Addressing these diverse challenges is essential for the effective implementation and utilisation of digital data sharing in CRVS systems.

## Key factors to consider

Digital technologies have enabled near real-time sharing of vital events data, but establishing nationwide digital data exchange systems requires significant investment. This is especially true for instant sharing of birth and death notifications, which necessitates all hospitals being computerised and continuously connected to



the central civil registration system. However, the necessity of real-time data sharing varies, and in certain cases such as monthly statistical updates or quarterly voter roll updates, periodic batch data transfers might be more appropriate and cost-effective.

The decision to implement real-time digital data sharing largely depends on a country's population size and the frequency of vital events. In smaller Pacific countries with fewer events to register per month, the investment in real-time data sharing might not be justified due to low utilisation. In contrast, populous countries with higher event frequencies could find this investment more reasonable due to the regular usage of the system.

In some cases, alternative solutions like remote software in health facilities or electronic PDF forms with QR codes for data transfer can avoid the costs of real-time integration. A hybrid system, combining real-time data sharing in high-volume hospitals with batched transfers in low-volume facilities, might be optimal in many countries, balancing efficiency and cost.

In smaller Pacific nations, simple extensions of the main civil registration platform into health facilities might be more advantageous and cost-effective than real-time integration. For high-volume data sharing situations, real-time data exchange between different ICT systems remains optimal, necessitating standardised data formats and APIs for efficient interoperability. Health-related data standards like Fast Healthcare Interoperability Resources (FHIR), Open Health Information Exchange (OpenHIE), and Health Level Seven International (HL7) – elaborated in detail in the section on technical foundations and standards enhance this capability, facilitating seamless data sharing between health systems and civil registration authorities.

The trend in government ICT systems is towards national data interoperability frameworks, streamlining data sharing across various systems. These frameworks offer unified integration services and open standards, exemplified by Fiji's DXP and Tonga's Interoperability Framework (yet to be implemented). This approach facilitates efficient data sharing, particularly between healthcare systems and civil registries, while reducing the need for custom solutions and ensuring data quality and security. Other Pacific nations like American Samoa, Vanuatu, and Solomon Islands are exploring similar models to enhance data sharing and use across public agencies.

It should be noted, that even in scenarios where immediate data sharing isn't necessary, it's important for the data-providing agency to collaborate closely with recipients to accurately determine data requirements and formatting. This collaboration focuses on exchanging files containing valid, useful information that can be seamlessly integrated by the recipients. Defining specific data needs is crucial, including determining the types of data required (such as names, IDs, dates), ensuring data quality (completeness, accuracy, validity) and setting the frequency and schedule of data transfers. This careful identification of requirements upfront ensures that the right information is shared effectively, meeting user needs while minimising privacy risks.

The move to standardised data exchange in CRVS systems is essential for efficient and accurate data management within the Pacific region and internationally. A notable challenge is the absence of international standards for storing information in civil registration records, as this is typically governed by national regulations. Each authority sets its own standards, which impacts the interoperability and consistency of data across jurisdictions.

# NAVIGATING DATA SHARING OF VITAL RECORDS IN THE PACIFIC

## Introduction

The effective registration of vital life events such as births, deaths, marriages, and divorces requires extensive data sharing between various governmental and civil entities. When a child is born, healthcare providers must notify vital records offices to register the birth while also reporting health statistics to public health agencies. The child's birth certificate can then be used to verify identity and eligibility for various services. Similarly, when a death occurs, healthcare providers, funeral directors and vital records offices all need notification in order to process death certificates and update records. Marriages and divorces that are validated through the court system must also be shared with vital records to keep all government documentation up to date. Data sharing allows streamlined registration of vital events and maintains accurate legal records across multiple stakeholders. This coordination is essential for functions ranging from public health surveillance to civil document verification.

Effective identity verification frequently relies on data sharing between vital records and other governmental entities. When applying for benefits, licences or other services, residents often need to provide birth certificates or other vital records to validate their legal name, date of birth, and other personal details. Ongoing data exchange allows real-time updates when records are amended, keeping identity documentation accurate. Data sharing also assists in detecting and preventing identity fraud across agencies.

The key to effective data exchange between agencies is interoperability. Interoperability refers to the ability of diverse systems and organisations to work together through compatible data formats, communication protocols and system interfaces. For vital-records data, interoperability depends on consistent data standards for representing names, dates, locations, and other details in a common way across different databases and paper filing systems. For non-digital records, interoperability relies on standardised protocols for requesting, copying, and transferring physical documents between agencies. Institutional interoperability is also critical, ensuring cooperative organisational structures, legal agreements, and governance policies that make data sharing permissible and productive.

Digital technologies enable data sharing between electronic systems. However, interoperability is also crucial for non-digital records accessed manually by employees across different agencies. It also requires technical interconnectivity through secure networks and APIs that allow authorised cross-system data queries and transfers between digital systems.

The interoperability of ICT systems for health, CRVS, identity management, and social services authorities is fundamental in ensuring universal registration of vital events and the sharing of legal identity data across various government platforms. This interoperability enables more efficient and robust governance, improved service delivery, and enhanced public accountability. Interoperability is not just about technology; it is the confluence of data standards, policies, coordination, procedures, and technology that allows for the seamless exchange, integration, and cooperation between different systems. It allows diverse entities to work together towards a unified goal - an efficient, effective and inclusive registration of vital events and the sharing of data for use across government agencies. The digitalisation of registration services and digital data exchange can deliver faster and cost-effective data sharing when different ICT systems are digitally interconnected.

The importance of digital data exchange in achieving sustainable development gains further momentum with Digital Public Infrastructure (DPI).<sup>2</sup> This global collaboration brings together governments, tech companies, multilateral organisations, and civil society to empower 100 developing countries by 2030 with secure,

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2 <https://www.itu.int/initiatives/sdgdigital/digital-public-infrastructure/>

inclusive, and impactful DPI solutions. From healthcare and education to finance and digital identity, this initiative recognises that seamless data exchange across sectors, underpinned by responsible safeguards and public-private partnerships, holds the key to bridging the digital divide and building a more equitable future for all.

The integration of ICT systems face challenges:

- Data privacy and security concerns
- Barriers in the legal frameworks
- Lack of willingness to collaborate across agencies
- Lack of common standards
- Complex system architectures

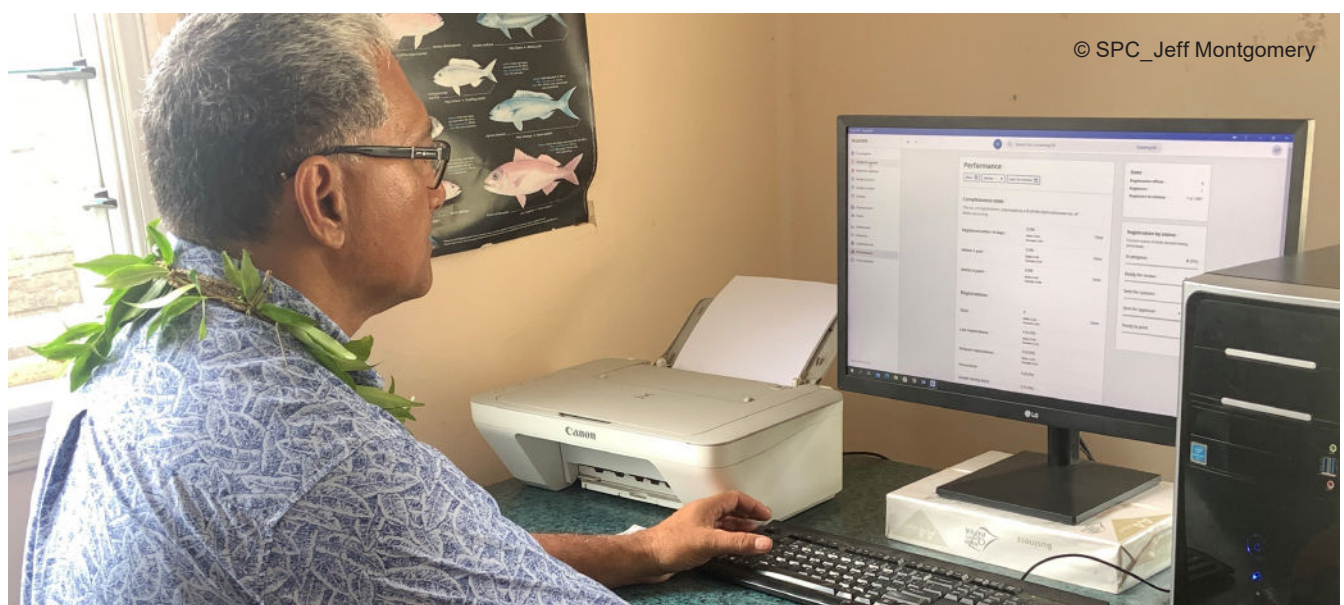
In the Pacific, several countries have committed substantial resources towards digitising their civil registration and legal identity systems over the past few years. Other countries are either currently in the process of digitisation or harbour ambitions to transition towards electronic CRVS (e-CRVS) systems.

The need to share civil registration data between countries in the Pacific region has surfaced, resulting from the Pacific migration patterns, particularly in cases where individuals are born in one country, move to another and eventually die there. Some nations also find the need to exchange information about births and deaths in the context of trans-border initiatives or where a secondary country (for example, New Zealand or the USA) are responsible for issuing identity documents like passports. The potential also exists for CRVS data to be shared regionally for statistical analysis or disaster recovery efforts.

This report was developed with the aim to provide insight into the existing landscape for interoperability between government ICT systems across eight countries in the Pacific: American Samoa, Cook Islands, Fiji, Niue, Samoa, Tokelau, Tonga and Vanuatu. New Zealand and the USA were considered in the context of cross-border digital data interoperability opportunities.

This report is structured into key sections:

- Introduction framing the importance of system integration
- Overview of the landscape of digital data sharing abilities across the Pacific
- Examination of common data exchange challenges
- Interoperability opportunities identified by officials
- Technical components required
- Conclusions and suggestions for the way forward
- Detailed country profiles



## Methodology and approach

Digital public services typically comprise four layers of interoperability:<sup>3</sup>

- **Legal** interoperability refers to the ability of different legal systems and their respective frameworks to work together effectively. This concept is particularly relevant in the context of cross-border data sharing where diverse legal systems often interact.
- **Organisational** interoperability refers to aligning business processes, responsibilities and expectations between institutions. This requires documenting and integrating workflows and information exchanges.
- **Semantic** interoperability ensures the precise meaning of exchanged data is preserved and understood by all parties: shared vocabularies and data schemes and data formats.
- **Technical** interoperability enables system and service linkage through interface specifications, data integration protocols, and communication standards.

The focus of this report is on the technical and semantic aspects of data sharing. It aims to provide an overview of concrete, practical solutions for enhancing the exchange of data across various digital platforms and systems.

The technical and semantic aspects require that the legal and organisational layers have been achieved. This means that legal frameworks are already in place to allow for effective data sharing within a country or between countries; and that there is an alignment in business processes, responsibilities and expectations between institutions.

The data-gathering process spanned 1 August to 30 October 2023. It was an interactive and collaborative process comprising:

- An in-depth questionnaire evaluating interoperability of civil registration, vital statistics and identity management systems. This questionnaire was shared with ICT experts in each country to collect precise, detailed, context-specific data about existing operational methodologies, potential enhancements, hurdles towards interoperability, and current systems in use.
- Online consultations offering additional insights, feedback and clarity to the responses.
- A three-day workshop conducted in Auckland, New Zealand in October 2023 with representatives from participating countries, resulting a summary report<sup>4</sup>.

The main goal of the data collection and analysis was to thoroughly evaluate the potential for different countries' CRVS systems to work together effectively. This involved looking closely at how data is stored, shared, and managed in these systems, including the tools and methods used for connecting different systems, organising data and security and what common standards are in use and the potential use of APIs, acting like bridges that allow different software systems to communicate with each other.

At the country level, the aim was to map out each nation's rules for system cooperation, provide examples of existing connected government systems and explore how these could be expanded to improve the CRVS systems.

## Digital data sharing capabilities across Pacific CRVS systems

The digitisation and integration of CRVS systems varies across Pacific countries and can be categorised into three broad levels of digital development:

1. Emerging digital systems with limited integration,

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3 New European Interoperability Framework: Promoting seamless services and data flows for European public administrations, [https://ec.europa.eu/isa2/sites/default/files/eif\\_brochure\\_final.pdf](https://ec.europa.eu/isa2/sites/default/files/eif_brochure_final.pdf)

4 <https://purl.org/spc/digilib/doc/edyz5>

2. Digitised and moderately integrated systems, and
3. Highly integrated and digitalised systems.

This categorisation gives insight into the progress different countries have made in digitising what were previously manual, paper-based processes. At one end are countries in the early stages of CRVS digitisation with minimal data sharing between platforms. At the other end are robust national databases with advanced interoperability enabling seamless information exchange across sectors.

The following analysis provides an overview of individual Pacific countries and where they currently stand on this digital transformation pathway. It gives an overview of shared challenges, opportunities and next steps to further upgrade.

**Emerging digital systems with limited integration** is a category where countries are in the initial stages of digitising their CRVS systems, with limited integration with other government systems.

In **American Samoa**, civil registration is transitioning from a manual, paper-based system to a digitised platform. The digitisation effort is embodied by the development of the Familytrac system, which will be hosted on the SILAS platform. While these developments mark significant steps towards modernising the CRVS system, the integration of this new digital system with other health and government systems is still to come.

The CRVS system in **Cook Islands** is a hybrid of manual and digital processes. The system predominantly relies on paper-based methods, supported by a Microsoft Access database. This database duplicates information from paper records and aids in searching and identifying registration records. However, it does not provide the full functionality or robustness of a comprehensive electronic registration platform. This setup indicates a foundational stage of digitisation, where basic digital tools are being used alongside traditional methods.

**Niue's** CRVS system is undergoing a significant digital transformation, highlighted by the November 2023 implementation of OpenCRVS, an open-source digital solution designed for low-resource settings. While this system enables more streamlined and automated data processing, reducing risks associated with manual data handling, its degree of integration with other government databases or health systems is not fully developed. All earlier records and those relating to marriages and name change remain paper-based, with the intention to add these to OpenCRVS in the future, subject to funding.

**Tokelau's** CRVS system is characterised by its early-stage digitisation efforts and limited integration with other government systems. This is reflected in its gradual shift from manual to digital processes, constrained digital infrastructure and the geographical challenges of remote access and connectivity. While progressing towards modernisation, Tokelau's system still grapples with developing comprehensive digital tools and establishing seamless interoperability with broader governmental databases.

**Tonga's** CRVS system is characterised by a partially digitised civil registry system with potential for integration with external ICT systems. The digital platform for registration, which was initiated through a Commonwealth Secretariat-funded project, aimed to digitise all records from 1875 to 2020 but many historical records are still in physical formats and not fully transferred to electronic systems. However, despite this progress in digital record-keeping, the system does not allow cross-linking registered events, an area where upgrades are currently underway. Furthermore, the platform's design limits efficient cross-referencing of records and lacks any integration with the health sector. The connection with the health sector may be implemented by utilising the nationwide data interoperability layer currently in development.

**Digitised and moderately integrated systems:** These systems have been digitised with a certain proportion of vital events and records stored in digital format while keeping a paper-based format. At the same time, many other government systems can leverage these CRVS systems to access data. In these cases, however, the data exchange protocols are developed on an ad hoc basis between individual systems and the CRVS system.

Data sharing on the national level has not yet been achieved.

**Samoa's** CRVS system is moving towards digital integration but currently it exhibits characteristics of a system that is digitised yet moderately integrated. The Samoa Bureau of Statistics' BDM office initiated the digitisation of civil registration records in 1993. However, the digitisation process has not been completed, with many historical records still in physical formats. The birth notification process in Samoa, previously reliant on manual recording at health facilities and paper-based notifications, has been undergoing changes to address inefficiencies and the issue of duplicate records. The introduction of a new pilot process, where the Tamanu Health Information System currently rolled out at Moto'otua hospital generates digital birth notifications and sends them directly to CRVS and National ID servers, represents a significant step towards improving digital integration. This process not only streamlines the birth notification procedure but also enhances the accuracy of data by linking it with the Ministry of Health for authentication and updating birth certificate details.

In **Solomon Islands**, the Promadis platform is a custom-built ICT solution tailored specifically for civil registration databases. The platform supports various data-sharing protocols like Open Database Connectivity (ODBC), Java Database Connectivity (JDBC), Simple Object Access Protocol (SOAP), and Representational State Transfer (REST), facilitating the exchange and integration of data across different systems and platforms. The system's design for remote accessibility across devices like desktops, tablets, and mobile phones also indicates a focus on increasing accessibility and user engagement. Regular data backups, with snapshots taken every four hours and stored at a National Disaster Management Office's Disaster Recovery facility, ensure data safety and reliability. In Solomon Islands, the system's integration with national identity management and health sector databases, remains a work in progress; currently, the Department of Health can access birth and death information via Promadis but full data sharing with immigration authorities or comprehensive integration with other government systems is not yet established.

**Vanuatu's** CRVS system, underpinned by the fully digitised Register Viz v4 platform, represents a digitised and moderately integrated system. This platform, tailored for efficient data sharing and integration, supports various protocols and formats, enhancing its interoperability with other government databases such as immigration, passports, and the electoral roll. The recent comprehensive digitisation of Vanuatu's CRVS records, accessible online in provincial registration offices and major hospitals, signifies a substantial leap in digital capabilities. However, while the system exhibits a high level of digitisation, its level of integration across all government sectors is still developing.

**Highly integrated and digitised systems:** This category includes systems where there is a high level of electronic data sharing between different government departments.

**Fiji's** CRVS system is a highly integrated and digitised system. Fiji's comprehensive electronic vital-events registration platform for births, deaths, and marriages is a pivotal component of Fiji's DXP, a sophisticated interoperability layer that enables seamless data sharing among various government institutions. Birth notifications from some hospitals (representing approximately 40% of all births occurring in Fiji) are digitally forwarded into the civil registration system. However, the system still maintains many manual elements, such as the initial paper-based notifications in the majority of healthcare facilities. The BDM platform incorporates digitised historic vital event records and shares personal legal identity information on the DXP platform under strict agreements. Governed by an MOU, the DXP balances accessibility with security. The BDM's digital-platform-hosted records can be extracted and shared with the Fiji Bureau of Statistics (FBoS); for information not hosted on the BDM's digital platform, FBoS staff must visit hospitals and take photos of the birth register books and enter this data manually at the FBoS; so there are still gaps in the process of generating vital statistics. A recent business process improvement workshop held in Fiji highlighted the need to standardise processes across the system and overhaul legacy paper systems.



Table 1. Overview of digital transformation stages in CRVS systems across Pacific Island countries

Category	Country	Characteristics
<b>Emerging digital systems with limited integration</b>	American Samoa	Transitioning from manual to digital with the development of Familytrac on SILAS platform; limited integration with other systems.
	Cook Islands	Hybrid of manual and digital processes; relies on paper and a Microsoft Access database for registration records.
	Niue	Implementing OpenCRVS; streamlines data processing with limited integration with other government systems.
	Tokelau	Early-stage digitisation with limited integration and constrained digital infrastructure.
	Tonga	Partially digitised civil registry with potential for integration; ongoing plans for cross-linking registered events.
<b>Digitised and moderately integrated systems</b>	Samoa	Evolving towards digital integration; digitising civil registration records since 1993 with pilot projects to improve integration.
	Solomon Islands	Uses Promadis platform; supports data sharing protocols, full integration with other government systems is in progress.
	Vanuatu	Register Viz v4 platform for efficient data sharing; high digitalisation level and developing integration across sectors.
<b>Highly integrated and digitalised systems</b>	Fiji	Comprehensive electronic registration platform; DXP for seamless data sharing among many government institutions.

## Data-sharing needs and opportunities

Business processes for registration of vital events like births, deaths, marriages, and divorces necessitate sharing of data between civil registration authorities and other stakeholders. For birth and death registration, civil registries rely on notifications communicated by health facilities. For adoption, marriage, and divorce registration, the documentary basis is often provided by courts. In traditional paper-based processes, clients had to physically bring notifications and documents to registration offices. However, where information is processed digitally, it can be directly shared between the issuing authority and civil registration authority in a timely manner. Data exchange allows for more efficient and accurate registration and can assist, for example, when social services need to know about births and deaths to initiate or halt specific welfare benefits.

There are situations where immediate data exchange is not required. For example, statistics authorities require periodic extracts of vital events data that may include anonymised personal records and which in combination with data received from the health authorities are used to produce official vital statistics. Election authorities need periodic updates on newly eligible voters reaching voting age or deceased voters to be removed from voter rolls. In these cases, real-time data sharing is generally not essential. The required information can be extracted and shared periodically, such as monthly or quarterly, to meet the needs of these stakeholders.

The following are some key areas CRVS practitioners in the Pacific consider important in terms of data sharing from the civil registration system:

- Across government agencies, to enable integrated digital identity systems and streamlined e-government services.
- With national statistics organisations to produce official statistics reports.
- With the health sector, to strengthen health information systems and public health decision making.
- For immigration and residency verification, including overseas citizens and migrant tracking.
- For social welfare benefits and pensions, by maintaining accurate records of births and deaths.
- For electoral systems and voter registration, by enabling voter eligibility verification.

- For taxation systems, by supporting identity verification in areas like new account creation.
- For banking and financial services, to verify identities for account openings and transactions.
- For insurance claims processing, by enabling identity verification of beneficiaries.
- For inheritance and land rights issues, by allowing genealogy tracing and identity validation.
- For law enforcement and preventing identity fraud, by enabling data cross-checking across agencies.
- For disaster recovery where paper records are damaged, by re-creating records through data sharing between governments.
- For overseas territories relating to their administrating countries, by enabling various data exchanges and verifications such as for passport issuance.
- For regional and global reporting obligations, by facilitating timely sharing of vital statistics.

Based on feedback from the practitioners from the countries that have participated in the research the following emerge as opportunities for data sharing in the future.

*Table 2. Key data sharing priorities and initiatives across Pacific Island nations*

Country	Data sharing priorities
Samoa	<ul style="list-style-type: none"> <li>▪ Data sharing with border management, e.g. American Samoa &amp; Immigration New Zealand</li> <li>▪ Electoral roll</li> <li>▪ Genealogy (land purposes, ancestors, citizenship, land records, church records)</li> </ul>
Tokelau	<ul style="list-style-type: none"> <li>▪ Pension - Date of Birth</li> <li>▪ Memorandum of understanding with New Zealand, American Samoa &amp; Samoa</li> <li>▪ Some records archived in New Zealand (historical)</li> </ul>
Cook Islands	<ul style="list-style-type: none"> <li>▪ Passport system</li> <li>▪ Social Services, banking</li> <li>▪ Insurance, taxes</li> </ul>
Niue	<ul style="list-style-type: none"> <li>▪ With New Zealand (Niue pension)</li> <li>▪ Relationship with Tonga &amp; Samoa</li> <li>▪ Student loans/taxes</li> <li>▪ Genealogy</li> <li>▪ ID (one ID, multiple uses)</li> <li>▪ Name changes &amp; sharing to American Samoa</li> </ul>
American Samoa	<ul style="list-style-type: none"> <li>▪ Residency genealogy</li> <li>▪ US passport</li> <li>▪ Electoral office eligibility</li> <li>▪ Drivers licence office</li> </ul>
Vanuatu	<ul style="list-style-type: none"> <li>▪ Labour, finance, justice, lands department, police</li> <li>▪ Genealogy</li> <li>▪ Citizenship office, pension</li> <li>▪ Electoral office</li> </ul>
Tonga	<ul style="list-style-type: none"> <li>▪ National ID-birth record discrepancy</li> <li>▪ Health: gender record amendments</li> <li>▪ Paternity records for land entitlements</li> <li>▪ Courts/education/health (med tech)</li> <li>▪ Name changes completed in New Zealand or Australia</li> </ul>
Solomon Islands	<ul style="list-style-type: none"> <li>▪ Interoperability data layer should be created to enable data sharing between already digitalised systems</li> </ul>

At the country level, data sharing involves the exchange of vital information between various governmental departments and agencies. This is crucial for maintaining updated and accurate records of significant life events

like births, deaths, and marriages, which are essential for effective governance, policy making, and service delivery. The complexity here often lies in harmonising disparate systems and ensuring data consistency across various departments, such as health, education, and social services, while adhering to strict data protection and privacy standards.

At the inter-country level, data sharing becomes a vital tool for addressing global challenges such as migration, human trafficking, and international health crises. Countries having significant migration flows between them can greatly benefit from exchanging CRVS data to ensure the continuity of individuals' civil identities and to assist in cross-border law enforcement and social welfare activities.

#### Cooperation between New Zealand, Cook Islands, Niue and Tokelau:

Cook Islands, Niue, Tokelau and New Zealand have historical and constitutional ties. New Zealand provides citizens from Cook Islands, Niue and Tokelau with New Zealand passports.

Participants from these countries acknowledged that the Auckland workshop (October 2023) was a great start for reinforcing their mutual coordination. It was agreed that representatives would continue to meet virtually, every three months facilitated by New Zealand's Department of Internal Affairs International Team with support from SPC, if necessary. The aim is to allow two-way sharing of civil registration records for data verification as part of the applications process for a New Zealand passport or tracking data changes made in the civil registration records across the four countries.

### Challenges in the digital transformation of data sharing for efficient civil registration

The integration of CRVS systems with other ICT platforms in the Pacific faces several key challenges to effective data sharing:

- Health ICT systems lack interoperability and capacity for seamless electronic data exchange with CRVS platforms. This limits digital transfer of essential notifications like births and medical causes of death.
- Urban-rural digital divide as well as main island and outer islands digital divide, with digitised systems concentrated in cities on main island, restricts the volume of data that can be shared from paper-based processes.
- Outdated digital platforms for the processing of registration records which prevents civil registration authorities having full access to and analysis of registered data due to platform limitations.
- Insufficient funding and few skilled staff hinders technology acquisition and maintenance needed for advanced data integration.
- Outdated laws and policies obstruct adopting modern technical solutions aligned with international standards and best practices.
- Poor foundational data quality from issues like duplications and inconsistencies diminishes integrity of shared information.
- Lack of inter-agency coordination and siloed operations lead to duplicated efforts and discrepancies.
- Cultural wariness stemming from mistrust creates reluctance towards sharing personal data.

In the Pacific, **the integration of CRVS with other ICT platforms is limited**. These CRVS platforms occasionally communicate with systems like ID card databases, health systems, statistical databases, and social services but much more work is needed to bring these services to optimum level. The data sharing that does occur typically involves the civil registration platform distributing information to external entities. However, direct communication between registration ICT platforms and other systems ICT platforms is not a widespread practice. This is particularly evident where the civil registration platforms rely heavily on health systems, where the data sharing is paper-based.

**The health ICT systems in the Pacific** often consist of various ICT modules tailored to specific health issues, but not necessarily designed to interconnect or share data electronically with external platforms. This disconnect means that health platforms are not readily able to compile and electronically transmit birth notifications or medical cause of death information. Collaborating with ICT professionals to enhance these health platforms for digital data sharing with CRVS authorities will bridge this gap.


One of the significant challenges facing civil registration authorities is the issue of **outdated digital platforms for the processing of registration records**. These systems often hinder the authorities' ability to fully access and analyse the data they have collected. Original providers of these platforms frequently fail to supply comprehensive documentation on the database structure or the software tools necessary for full data access. This lack of transparency and support means that the data remains trapped within a system that no longer meets needs, complicating efforts to utilise this data for analysis, reporting, or integration with other services. The absence of detailed information on the data structure restricts the ability of authorities to migrate their databases to new, more advanced platforms that are not tied to the original vendor. This vendor lock-in situation poses a significant barrier to integrating civil registration systems. In Vanuatu, solutions have been sought to overcome these limitations by reverse engineering the outdated platforms. This work involves deconstructing the existing database to understand its structure to enable the migration of data to a new generation of database platforms that complies with common database access protocols.

**Digitised platforms for patient and health record processing are often restricted to urban areas.** This limitation means that even when digital data sharing is possible, the volume of data shared is only a proportion of the total. Consequently, CRVS authorities often depend on paper-based notifications from a significant number of health facilities, which are then manually processed at registration and statistics offices. This is the case in Fiji. This system is less efficient compared to using a dedicated CRVS platform in all health facilities.

Another obstacle to data sharing is **insufficient funding and inadequate staffing**. Implementing comprehensive digital systems and data linkages requires substantial upfront investments as well as ongoing funds for maintenance and operations. Successful data sharing depends on having qualified personnel to manage procedures and processes, ensure data quality, analyse information, and provide ongoing support. Ensuring sufficient qualified staff is directly linked to ensuring adequate funding.

Another major obstacle to advancing data exchange capabilities is **the obsolete nature of laws governing civil registration** in many countries. Outdated legislation that predates digital systems and data sharing protocols actively impedes adopting modern technical solutions and processes. Without reforms aligned to international best practices, transitioning from paper-based registration to automated digital workflows is extremely difficult. Additionally, unclear policies around data privacy, ownership, access and sharing inhibit progress. This includes instituting proper governance frameworks specifying standardised data security protections, access controls, and exchange mechanisms across institutions. Updating antiquated laws is crucial for providing a supportive, forward-looking foundation on which new systems and data sharing initiatives can thrive. Comprehensive legislative overhaul is a pivotal challenge civil registration authorities must tackle.

**Lack of data quality** presents a significant barrier to expanding data exchange between civil registration systems and stakeholders. Many agencies face duplications, outdated records, and inconsistencies across their databases. These problems undermine confidence in the accuracy and reliability of the data. Rigorous data cleaning and consolidation is required before introducing more advanced data sharing solutions. Without high quality foundational data, the benefits of timely automated data exchange are diminished; imperfections are propagated through integrated systems. This data improvement process requires considerable resources and time.



**The lack of inter-agency coordination and entrenched siloed operations** of many civil registration authorities inhibit data sharing capabilities. Without proper mechanisms for collaboration, different agencies duplicate efforts resulting in wasted resources and inconsistent records across systems. Where each entity operates in an isolated manner, collecting and managing information in proprietary databases, integration and timely automated data exchange is problematic. Overcoming these deep-rooted silos via unified policies, shared standards, and collaborative frameworks is essential. Progressing from fragmented and insulated agency workflows to coordinated nationwide systems enabling seamless data sharing will require tremendous organisational change.

Some Pacific countries face **cultural reluctance towards expanded data sharing initiatives** stemming from historical mistrust of government sometimes emanating also from past data breaches. Citizens may be apprehensive about providing personal data or consenting to database linkage due to concerns over potential privacy violations or surveillance. This hesitation inhibits implementation of digital ID systems and data integration that depend on public acceptance. Building confidence through robust data protections, transparent policies, and demonstrating responsible data use is key to overcoming ingrained wariness. Gaining citizen trust is essential for realising the full benefits of increased data exchange between agencies.

While there is an eagerness from CRVS leaders to prioritise system upgrades, they find it difficult to secure funding from those who control national budgets. Efforts to collect detailed information on the financial commitments for running existing electronic CRVS platforms or for the digitisation and upgrading of current systems in the Pacific have proven to be somewhat challenging. Several factors contributed to the difficulty in obtaining this information from authorities. Primarily, there appears to be a general lack of clear budget allocation or transparency in the funding for these initiatives. In many cases, countries do not have a dedicated budget for upgrades, as observed in Fiji, where enhancements to the eBDM system are necessary but funding sources remain uncertain. Many countries indicate a need for external funding to support system upgrades, which reflects a broader challenge of resource allocation and financial planning in the region.

Furthermore, the complexity of these digital transformation projects, often involving multiple stakeholders and international partners, adds to the challenge of pinpointing specific budgetary requirements.

Two examples provide a rare glimpse into the scale of investment required for digital transformation projects in the CRVS domain:

A proposed project encompassing the three New Zealand Realm countries aimed at fully digitising their CRVS systems and establishing interoperability with the New Zealand passport system. The budget for this comprehensive project is USD 677,000 broken down into phases:

- new feature development USD 490,115
- rollout USD 134,013
- management and maintenance USD 53,592

In Solomon Islands licensing for upgrade of the Pomadus platform is estimated at AUD 14,200.

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INTERNAL AFFAIRS  
Te Kaitiaki

Product purpose

Problem - release 1

- 1. reducing customer service
- 2. simplifying the user

Solution - release 1

- 1. user stories
- 2. user stories



1

## Pregnancy weeks 0-14

Be a Lead Maternity Carer

# TECHNICAL FOUNDATIONS AND STANDARDS FOR SEAMLESS DATA EXCHANGE

Digital technologies can enable near real-time sharing of vital-events data as soon as a birth, death, marriage or other life event is registered. However, building nationwide systems for instant digital data exchange requires significant investment. For example, to instantly share birth and death notifications digitally, all hospitals need to be computerised and permanently connected online to the central civil registration system. Developing and maintaining such an infrastructure across all facilities demands major spending over time. Courts'-computerisation requires relatively less investment, it still incurs cost.

Though real-time/instant digital data sharing represents an ideal scenario, the key question is whether it is truly necessary. Communicating birth or death notification by email the same day the event occurs would still qualify as timely communication but the cost of implementation is dramatically lower. The costs and benefits must be weighed for different use-cases. The method by which information is shared is informed by timeliness and volume of data to be shared within a specific period of time.

Where stakeholders need periodic data extracts - monthly statistics or quarterly voter roll updates - permanent real-time data-linkage is excessive; periodic batch data transfers are sufficient to meet business needs in these situations.

The size of a country's population and number of vital events like births and deaths are important considerations in weighing the costs and benefits of real-time/instant digital data sharing. In smaller countries, hospitals might have only a few births and deaths to notify in a given period. With such low volumes, the costs likely outweigh any benefits of real-time linkage. In populous countries the system for instant data sharing spreads the cost of investment over many transactions. Current and projected vital-events volumes can inform whether real-time digital data sharing is a cost-effective solution or if periodic updates suffice.

## Periodic data sharing

When immediate data sharing isn't necessary, it's crucial for the data-providing agency to work closely with the recipients to precisely determine the appropriate data requirements and formatting. This collaboration aims to exchange files that contain valid and useful information.

1. The first step involves defining the specific data needs. This includes identifying the exact types of data required, such as names, IDs, dates, etc., focusing only on the necessary data. It's also important to set criteria for data quality, such as completeness, accuracy, and validity, to ensure reliable analytics by recipients. To best plan for the necessary infrastructure, the frequency and schedule of data transfers should be determined (daily, weekly, monthly, etc.), as well as the expected volume of data and its expected growth; understanding the purpose of data usage is also key to ensuring the best data fields. Regulatory/privacy compliance requirements for data handling must be considered.
2. The data file must adhere to standardised formatting for ease of use by the recipient. This means that everyone involved must agree on common data formats that are suitable for their needs, making sure the information can be easily exchanged using consistent structuring of records and fields and using consistent schemas, vocabularies, identifiers and semantics. Timely/real-time data exchange is discussed in more detail later in this document.

Standards commonly applied to periodic data sharing:

3. **ISO/IEC 27001:** This standard is part of the ISO/IEC 27000 family of standards and is specifically focused on information security management systems (ISMS). It provides a framework for establishing,

implementing, maintaining and continually improving an ISMS within the context of the organisation's overall business risks.<sup>5</sup>

4. **ISO/IEC 27701 – Patient Information Management System (PIMS):** This standard is an extension to ISO/IEC 27001 and ISO/IEC 27002 for privacy information management. It provides guidance on the protection of privacy, including how organisations should manage personal information, which is particularly relevant when sharing data that includes personal or sensitive information. It helps organisations establish, implement, maintain, and continually improve a PIMS, which is especially important in light of privacy regulations and the need to maintain the trust of stakeholders when handling personal data.<sup>6</sup>

File formats commonly applied to periodic data sharing:

- **SPSS (.sav, .por):** SPSS (Statistical Package for the Social Sciences) uses .sav files for data sets and .por files for portable files. These formats are specifically designed for SPSS software but can be imported into other statistical programmes with the right tools. <https://www.ibm.com/support/pages/node/620063>
- **SAS (.sas7bdat, .sas7bcatt):** SAS (Statistical Analysis System) utilises .sas7bdat for dataset files and .sas7bcatt for catalogue files. These are proprietary formats used by SAS for storing datasets and variable formats or labels. <https://support.sas.com/documentation>
- **Stata (.dta):** Stata uses the .dta file format for datasets. This format is specific to Stata software and is widely used in academic and research settings. <https://www.stata.com/manuals/d.pdf>
- **R Data Formats (.RData, .rds):** R, an open source and free of charge programming language and environment for statistical computing, uses .RData (or .rda) for storing R workspace data, and .rds for serialised R objects. <https://www.r-project.org/>
- **Excel Files (.xls, .xlsx):** While not exclusive to statistical analysis, Microsoft Excel formats are commonly used for data storage and initial data cleaning before importing into more specialised statistical software.
- **CSV (comma-separated values) and TSV (tab-separated values):** These are universal file formats that are widely supported across various statistical software for data exchange. They are text-based and contain tabular data in plain text, making them easy to import and export. [https://www.w3schools.com/js/js\\_json\\_csv.asp](https://www.w3schools.com/js/js_json_csv.asp)

Digital solutions that produce good results include:

- Software that operates on a remote computer/tablet online in a health facility where notifications can be entered as they occur. In time, all data created can be exported in an encrypted file and communicated to the civil registration authority for import into the main platform. This avoids real-time integration costs. The most frequent versions of this approach are:
  - a web application (an application that runs within web browser) or
  - a stand-alone application that is an extension of the main civil registration digital platform which works online and offline and share that data with the main civil registration platform.
- Rather than a digital data file, notifications can be generated as electronic PDF forms resembling paper notifications but featuring a QR code that stores all data. These can be emailed and imported via a QR code reader, avoiding integration costs. This works well for facilities that only share a few notifications every month.

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5 International Organization for Standardization (ISO). "ISO/IEC 27001:2022 Information technology — Security techniques — Information security management systems — Requirements." ISO/IEC 27001:2022. <https://www.iso.org/standard/27001>

6 International Organization for Standardization (ISO). "ISO/IEC 27701:2019 Security techniques — Extension to ISO/IEC 27001 and ISO/IEC 27002 for privacy information management — Requirements and guidelines." ISO/IEC 27701:2019. <https://www.iso.org/standard/71670.html>

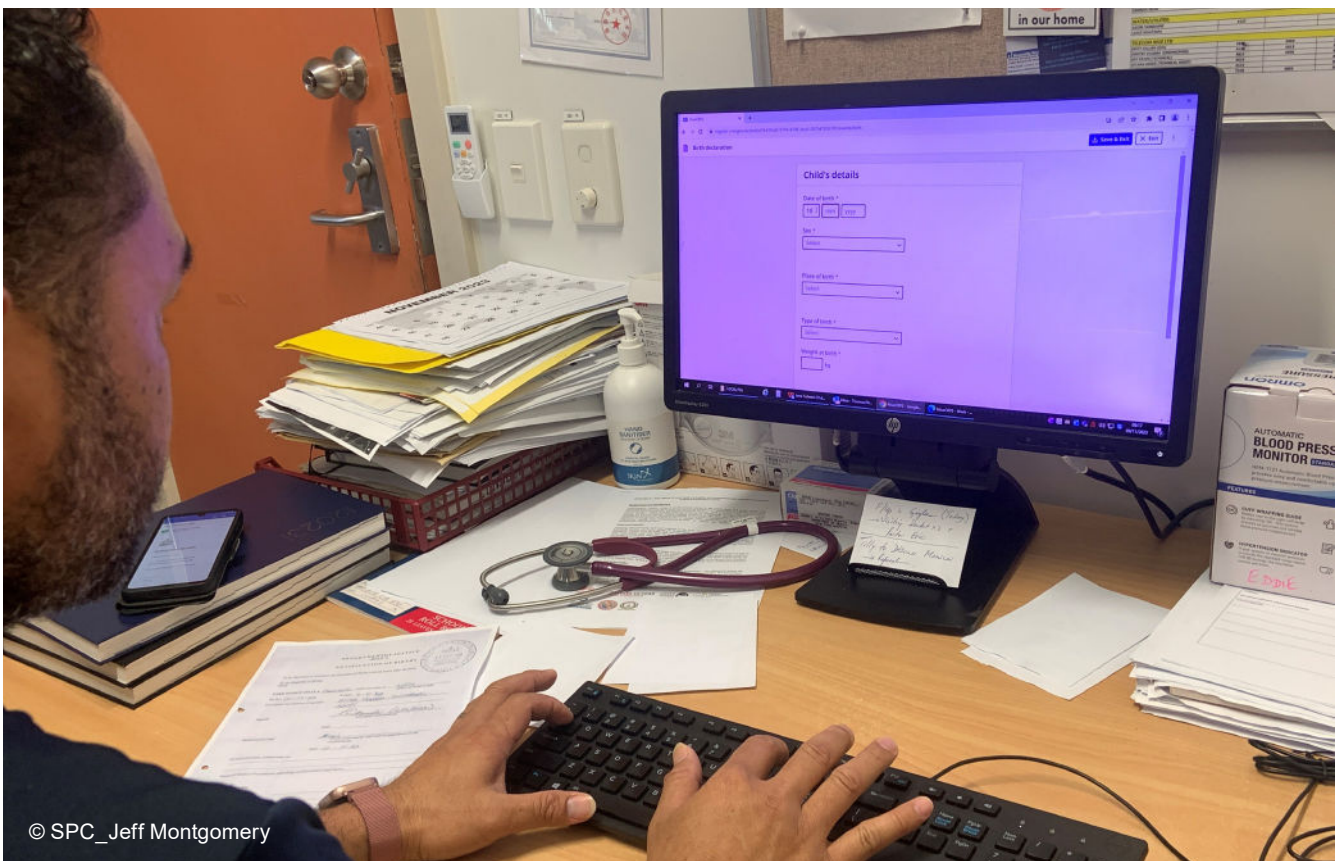


Even in countries where some hospitals register high volumes of events that justify real-time data exchange, there are likely to be many remote health facilities where real-time exchange would not be cost-effective. This suggests that a hybrid system of both real-time and non-real-time data exchange may be optimal:

- Larger, high-volume hospitals and facilities would utilise real-time data integration to immediately share registration data with civil authorities.
- Smaller, remote facilities with lower registration volumes would rely on non-real-time, batched data exchange such as daily encrypted data file transfers or PDF/QR code notifications.
- The civil registration authority would need to have systems capable of ingesting registration data from both real-time and non-real-time feeds.
- This hybrid approach balances the benefits of real-time data for high-volume sites with the cost savings of batch transfers for low-volume sites.
- The hybrid model would provide comprehensive, nationwide registration data to authorities while optimising costs based on the infrastructure and needs of each type of facility.

So, in most countries, a blended real-time and non-real-time exchange system is likely to be the optimal approach to balance costs, needs and nationwide data coverage.

For Pacific countries with small populations and few health facilities, adjusting health facility digital platforms to enable real-time communication with a digital civil registration system would likely not be cost-beneficial. Using a notification module extension of the main civil registration platform in health facilities would provide more advantages. Even if entering notifications in this module requires copying information from paper or digital patient records, this would not pose a major problem since the number of notifications to process is low. Maintenance of such a system is also far less complex than managing real-time data sharing across multiple ICT systems. Given the small-scale context, pursuing a basic notification module extension poses fewer costs than real-time integration between health facility systems and civil registration.



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## Real-time data sharing where timeliness is essential

Where high volumes of data need to be shared in a time-critical manner, establishing real-time data exchange between different ICT systems developed by various vendors remains the most optimal solution. Sharing data across diverse ICT platforms is a multi-layered process with varying complexities and benefits at each level:

1. The basic level involves enabling electronic data exchange between two distinct ICT systems, typically within the same jurisdiction or sector.
2. The second level entails creating a nationwide data-sharing platform that enables data sharing among all government ICT systems.
3. The most advanced level integrates ICT systems across different countries under a regulated framework adhering to international standards. Cross-border data sharing allows for global health surveillance, policy coordination and managing the movement of people across borders.

### Real-time data sharing between two ICT platforms

On a basic level, data sharing can be established to share data between two systems where the ICT systems are able to communicate in a standardised format. Determining the data formats currently in use and assessing their compatibility is an essential prerequisite when determining the capability for data exchange across systems. Open and widely adopted formats improve system interoperability and make data sharing simpler to implement from a technical perspective.

## Data standardisation formats for real-time data sharing

Data standardisation formats are a set of guidelines or structures used to maintain consistency in how data is represented and organised across various applications or organisations.

One key aspect of data standardisation formats is uniformity. For example, “DD-MM-YYYY” compared to “MM/DD/YYYY”. Uniformity is crucial for tasks like merging databases, analysing data across different systems, or ensuring consistent data entry. The data standards are determined by the owners of the systems unless the data formats are dictated by national-level regulations.

Common examples of data standardisation formats include **XML** (eXtensible Markup Language) and **JSON** (JavaScript Object Notation) for structuring data, **SQL** (Structured Query Language) for database management, and **CSV** for simple tabular data. These formats are widely used and accepted across different technological platforms and industries, facilitating smoother data handling and exchange.

**XML** is particularly effective for complex data structures and supports namespaces and schemas for data validation. XML can be used to structure the data package that is being communicated in a way that allows for the detailed specification of data types and structures which is essential for maintaining consistency across different systems. <https://www.w3.org/XML/>

**JSON** is a lightweight data-interchange format that is easy for humans to read and write and easy for machines to deconstruct and generate. JSON is used primarily for its efficiency and simplicity, making it suitable for web API communications. It is particularly effective for mobile and web applications where bandwidth and performance are considerations. <https://www.json.org/json-en.html>

## Application Programming Interfaces (APIs)

An API is a tool that enables different software applications to interact with each other. In the context of sharing between databases, APIs essentially serve as a bridge, ensuring that data is consistently formatted and securely and reliably transferred.

**JDBC** (Java Database Connectivity), is an API in Java that allows for the connection and interaction between Java applications and databases. It provides a set of interfaces and classes that Java programmes use to send SQL queries to databases, retrieve results, and handle database transactions. The JDBC API includes mechanisms to establish a connection with databases, create SQL statements, and execute them to query or update the database. To cater to different types of databases (like MySQL, Oracle, PostgreSQL), specific JDBC driver implementations are provided by various database vendors. These drivers translate the requests made in Java into a format that the specific database understands.

**ODBC** is a standard API used for accessing database management systems (DBMS). It allows applications to connect to a database and execute SQL queries, irrespective of the database system being used. ODBC abstracts database specifics, enabling applications to use the same code to access any database with an ODBC driver. This makes it a versatile tool for applications that need to interact with different types of databases, like SQL Server, MySQL, or Oracle. It is widely used, offering a unified approach to database access, simplifying the development process for applications that need to interact with databases.

## Some healthcare sector data standards

In the context of exchanging data with health ICT systems, implementation and compliance with the following health-related data standards will dramatically facilitate creation of data exchange APIs:

- **FHIR** – This standard defines data formats and elements for exchanging electronic health records. It uses common web standards like JSON and OAuth for easier integration. Adhering to FHIR ensures health data is structured consistently across systems. <https://www.hl7.org/fhir/overview.html>
- **OpenHIE** – This provides architectural frameworks and components for sharing health data at scale. It includes record locator services, shared health records, terminologies, and consent. Using OpenHIE frameworks improves the governance and interoperation of health information exchange. <https://ohie.org>
- **HL7** – A set of standards for transfer of clinical and administrative data between health systems. It has popular messaging standards like v2, which defines data structure and semantics for exchange. HL7 ensures common language and meaning when communicating health data. <https://www.hl7.org>

## Message protocols

In conjunction with standardised data formats, message protocols provide a set of rules and structural conventions that allow data to be packaged, transmitted, and received in an orderly fashion. For example, common internet protocols like HTTP define how messages should be formatted, addressed, routed, and acknowledged between client and server systems. In the context of sharing data between two organisational ICT systems, choosing a suitable protocol ensures messages containing data can flow in a regulated way. This facilitates correct sequencing, error checking, and confirmation of delivery. Without established and compatible messaging protocols, systems cannot reliably exchange data as there would be no handshaking or guarantees for message receipt. Appropriate protocols also handle issues like information security and encryption.

- **SOAP** is a protocol specification for exchanging structured information in the implementation of web services in computer networks. SOAP is frequently used for its ability to handle complex, structured data transactions. SOAP supports WS-\* (Web Services) standards, which are extensions that add additional capabilities such as security (WS-Security), transactions (WS-AtomicTransaction), and reliable messaging (WS-ReliableMessaging). <https://www.pearsonhighered.com/assets/samplechapter/0/6/7/2/0672326418.pdf>
- **REST** is an architectural style for distributed systems, particularly used for web services. RESTful protocol based API is used often for their simplicity and stateless operations. REST uses standard HTTP methods

(GET, POST, PUT, DELETE), and is favoured for its scalability and performance in web communications. <https://www.codecademy.com/article/what-is-rest>

Real-time data sharing across a national interoperability platform

There is an emerging trend to streamline and simplify data sharing between different government ICT systems and platforms. This relies on the conceptualisation and development of a national data interoperability framework and platform that extends bilateral data exchange into exchanges across most government systems. Rather than building custom point interfaces between agencies, a national platform provides common integration services, open standards, consistent security protocols, and shared data infrastructure. This model makes it faster and easier to add new systems and expand data access to more stakeholders over time based on policy and needs. With appropriate governance, these platforms allow disparate technologies utilised across government bodies to participate in reciprocal, many-to-many data sharing.

National interoperability platforms represent a long-term, scalable approach to accelerate the integration of otherwise disconnected governmental data silos. Moving to this approach as individual systems are upgraded or new systems are built achieves the broader goal of seamless, efficient data flows across whole-of-government as well as external third parties via APIs.


Nationwide interoperability brings cost and time efficiency to organisations, as it reduces the need for expensive custom solutions for integrating various systems and lowers maintenance costs due to easier updates and compatibility. This flexibility and scalability mean that organisations can more easily adapt to new technological requirements and scale their operations by incorporating new interoperable systems. Furthermore, interoperability encourages innovation by discouraging vendor lock-in and allowing for a wider choice of products, services, and novel combinations of different technologies.

Standardisation is the key to sharing vital-events information between healthcare systems and civil registries. Recording details like births and deaths in a centralised civil register relies on hospitals and clinics transmitting notification data after validating events. Rather than use ad hoc methods, implementing interfaces aligned to the national interoperability specifications simplifies transmitting properly formatted birth and death registration details. The healthcare system data adheres to the standardised schemas, messaging protocols, security policies etc. set out by the national framework. This enables automation and efficient incorporation into the civil registry to officially update population statistics. The reliability provided by national platform standards ensures the accurate, timely and secure transfer of these important records for public administration usage. Other agencies can likewise leverage the shared platform to selectively access datasets as relevant for their purposes, applying consistent access controls while benefiting from standardised data structures.

To implement a national interoperability platform for streamlined government data exchange, a public agency would need to provide oversight and establish policies, regulations and governance structures to guide its development and usage.

The oversight agency would need to define common standards and protocols to be followed. For example, regulating the use of standardised APIs, data formats like XML/JSON, and integration patterns based on international standards. Adherence to these common specifications makes integration between diverse systems more seamless.

When it comes to communication protocols and APIs, the formats of specific data fields may require national consensus through a consultative process. The oversight agency would dictate the standards for field structures and semantics that all systems need to implement. This ensures the precise representation of concepts like names, locations, dates, IDs, as systems exchange information. International standards might also be useful such as ISO-compliant data standards used for date and time can be found <https://www.iso.org/obp/ui#iso:std:iso:8601:-1:ed-1:v1:en>.



Appropriate regulations would also need to govern security protocols, access controls, and compliance requirements for sharing data via the national platform. Usage policies balancing innovation with privacy concerns would guide the expansion of data access to more users over time based on society needs.

By regulating the national interoperability framework appropriately, governments can maximise cost savings, flexibility, and automation while ensuring quality, security and responsible data use across public agencies. Adherence to common standards makes adopting and connecting to the framework straightforward for ministries civil registries and healthcare facilities.

Some Pacific examples:

The New Zealand agency in charge of data standards is the StatisticsNZ Chief Executive and Government Chief Data Steward who prescribes mandated standards that all public authorities must adhere to (<https://data.govt.nz/toolkit/data-standards/mandated-standards-register/>). Similarly, nationwide standards for processing and storing of person's name can be found at <https://data.govt.nz/assets/Uploads/Data-content-standards/Person-name-data-standard.pdf>

The Fijian government has established a centralised DXP as its national data interoperability layer, streamlining electronic data sharing among government agencies, including legal identity and personal data. This platform standardises data sharing across various government systems, serving as a unifying bridge through common APIs and formats, thereby eliminating the need for separate point-to-point integrations between systems. Specifically for legal identity data, the DXP adopts a publish-subscribe model. Key registries such as Births, Deaths, and Marriages publish authoritative identity records to the DXP, allowing other agencies, like the Fiji Revenue and Customs Service, to access this verified data directly from the DXP without needing individual integrations with each registry. One of the central requirements for the rollout of the DXP was the data normalisation effort across all stakeholders participating in DXP to ensure that each stakeholder's semantic models of individual data fields comply with the national data field standards.

Tonga has also taken a significant step forward in enhancing its digital infrastructure by developing the Tongan Interoperability Framework (TIF). The primary goal of the TIF is to establish key principles and broad guidelines that will guide the development and implementation of electronic services (<https://digitaltransformation.gov.to/wp-content/uploads/2022/08/TIF-Final.pdf>).

American Samoa, Vanuatu, and Solomon Islands are currently also prioritising the development of a similar framework that would regulate digital data-sharing access to different government actors.

Data verification – sharing without sharing

External systems often need to validate civil registrations certificates, identities and life events against registry data without needing full access to the records. Secure data sharing without sharing can be enabled through purpose-built verification APIs.

An example of sharing without sharing:

A civil registry develops a privacy-focused verification API. The API only returns yes/no confirmation of data accuracy, never exposing actual records. Strict access and identity controls protect against misuse. Encryption and activity-logging provides accountability while high-availability architecture prevents downtime. Adhering to interoperability standards simplifies integration. The API also accommodates new verification use cases over time through modular endpoints. By grounding the API in privacy and security, it earns public trust that is based on rights-preserving regulation; auditability maintains the integrity of the ecosystem.

The API must meet verification needs while limiting data exposure. At minimum, it supports certificate validation to combat fraudulent credentials by checking a certificate ID against the registry. Identity verification of personal attributes like names, ages, and parents is important for countering identity theft. Relationship verification

confirms connections like parenthood and is critical for administering access to government services. Verifying life events ensures claims about births, deaths, and marriages align with the registry sources. By providing only these necessary verification functions rather than full data access, the API reduces exploitation risks.

Access control tiers enable appropriate API use by different groups. Some users may receive maximum access to conduct verifications for public services. Others may have access to some API endpoints. Private sector access can be restricted and monitored. Individual self-service options like identity checks can be carefully rate-limited to control vulnerabilities such as denial-of-service attacks or unauthorised data retrieval.

On the operational side:

- The civil registry running the API needs to provide strong technical support and service level agreements<sup>7</sup> which provide certainty of service to the validating partners.
- Semantic interoperability standards in the API design improve consistency and prevent misinterpretation.
- Proactive security testing and usage monitoring helps optimise performance and pre-empt issues.
- Regulations should define API-specific use cases and prohibit accessing data for unauthorised purposes.
- Agencies and partners sharing the data should integrate these regulations under contractual terms binding them to proper use.
- An independent ethics oversight should be in place which should provide guidance to ensure the API ecosystem respects rights is used strictly under contractual terms.



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7 A service level agreement is a contract or commitment that defines the expected level of service, availability, performance and support that a service provider promises to deliver to its customers.

## CONCLUSIONS AND RECOMMENDATIONS

The implementation of digital data sharing systems in CRVS across the Pacific – within country, between countries and regionally – requires tailored solutions based on the specific requirements and constraints of each country. A flexible, hybrid model that accommodates both real-time and periodic data sharing, underpinned by standardised practices and a strong focus on security and privacy, emerges as a key strategy for effective and sustainable digital transformation in this domain.

Key considerations include:

- The feasibility and justification for real-time digital data sharing depend significantly on the scale of the country's needs. In smaller Pacific countries, where the frequency of vital events is lower, the high investment in real-time systems may not be cost-effective compared to larger countries with higher frequencies of vital events.
- A hybrid approach combining real-time and batched data sharing is often optimal. Larger, urban hospitals with higher volumes of vital events can benefit from real-time data integration, while smaller, rural facilities might find batched data transfers more practical and cost-effective.
- The use of standardised formats and APIs is crucial for the effective sharing of data between different ICT systems. Standards such as FHIR in healthcare are particularly relevant for enhancing data exchange between health systems and civil registries.
- The development of national interoperability frameworks, as seen in Tonga and Fiji, is a key step towards streamlining data sharing across various government systems. These frameworks facilitate scalable and efficient integration of government data sources.
- The adoption of secure and privacy-focused solutions like verification APIs, ensures the responsible handling of sensitive personal data in civil registration records. These APIs provide essential data validation while protecting individual privacy.

Looking ahead, the Pacific region's approach to digital data sharing in CRVS systems is evolving into a pragmatic and methodical one. Tailored to each country's specific context, a flexible approach combining real-time and periodic data sharing is being developed or is likely to emerge. This strategy, underpinned by standardised practices and a commitment to security and privacy, is likely to deliver a more efficient and sustainable future in managing vital records across these diverse island nations.





## APPENDIX 1 – COUNTRY OVERVIEW

Detailed country profiles have been included to provide further insights into the status of digital transformation efforts for health and civil registration systems on a national level. These appendices contain summarised overviews of the progress made in digitising and linking health and civil registration data through technical and legal initiatives within specific national contexts. The country profiles highlight notable successes, ongoing challenges, and future priorities to strengthen digital health and registration interoperability and data exchange at the country level. They serve as an important element to this report by grounding the analysis in the unique digitisation landscapes of individual nations working to modernise siloed analogue processes into an integrated digital ecosystem for health and vital records.

The following overview provides a snapshot of the current status of electronic Civil Registration and Vital Statistics (eCRVS) systems, health ICT platforms, and nationwide interoperability platforms across various Pacific countries. This summary aims to shed light on the diverse approaches and stages of digital transformation in civil registration and health data management within these nations. It highlights the unique digital infrastructures and strategies employed, reflecting each country's commitment to enhancing data management, efficiency, and interconnectivity in vital event registration and healthcare services.

*Table 3. Comparative Overview of eCRVS Systems, Health ICT Platforms, and National Data Exchange Platforms in Pacific Countries*

Country	eCRVS system	Health ICT platform	Nation-wide data exchange platform
American Samoa	Familytrac (in development)	Familytrac	SILAS
Cook Islands	Paper-based	MedTech	N/A
Niue	OpenCRVS (in development)	MedTech	N/A
Fiji	eBDM (functional in one hospital)	PATIS Plus	DXP
Tokelau	Paper-based	N/A	N/A
Tonga	Commonwealth Secretariat-funded Project (partially digitised)	National Health Information System (NHIS)	N/A
Solomon Islands	Promadis	District Health Information System 2 (DHIS2)	Solomon Islands Government's (SIG) Connect
Samoa	Life Data System (LDS)	Tamanu (replacing PATIS)	N/A
Vanuatu	Register Viz v4	DHIS2	N/A

### AMERICAN SAMOA

#### *Civil registration platform*

In American Samoa, the civil registration process is undergoing a significant transition from a manual, paper-based system to a digitised platform. Currently, civil registration is not digitalised; records are maintained in hard copy format. These paper records are manually scanned at the Office of Vital Statistics in Faga'alu. This is the first step towards digitisation. Following scanning, the data is then backed up on a server located at the Department of Homeland Security's main office in Tafuna, providing a rudimentary level of digital preservation and security for these critical documents.

To advance this digitisation effort, authorities in American Samoa are collaborating with Familytrac, a platform developer tasked with creating a modernised system. The development of this system began in 2022, and once completed, it will be hosted on SILAS.

### *Health ICT platform*

SILAS is a fully documented database system that adheres to the HL7/FHIR standard. By using this standard, SILAS ensures compatibility and interoperability with other health systems, facilitating the sharing and integration of health data across various healthcare stakeholders. Currently, this platform connects local health entities, such as the American Samoa Department of Health and the LBJ Tropical Medical Centre, for the purpose of data sharing. This connectivity allows for coordinated care and streamlined resource deployment.

SILAS enables the sharing of health data with the CDC through a flat file (CSV style), aligning with national reporting requirements and supporting epidemiological research. The collaboration between Familytrac and LBJ Tropical Medical Center is particularly focused on integrating health information into SILAS, ensuring that healthcare providers have access to comprehensive and up-to-date patient information. This integration is key to improving the quality of healthcare delivered and patient outcomes in American Samoa.

### *Data sharing initiatives*

SILAS will eventually become the central integration platform within American Samoa's healthcare ecosystem, facilitating the seamless communication and consolidation of health and vital statistics data across various entities. Employing the HL7-FHIR standard for data interchange, SILAS will enhance the efficiency of communication among different health-related entities not only in American Samoa but also with other United States CRVS and health authorities:

- The Department of Health, alongside initiatives like Helping Babies Hear and Early Intervention and maternal and child health information.
- The Vital Statistics Cooperative Program will be integrated into SILAS, emphasising the strategic collection and analysis of vital statistics.
- Reporting of notifiable conditions and electronic case reports, enabling prompt and precise reporting to public health authorities.
- The Electronic Health Record system from the LBJ Tropical Medical Center will be integrated with SILAS
- The Steve system, operated by NAPHSIS, for the verification of vital events records, ensuring the integrity and verification of vital statistics within the broader health and statistics systems.

## **COOK ISLANDS**

In Cook Islands, the CRVS system operates effectively - nearly all births and deaths within the country are formally registered. This efficient system is underpinned by direct information sharing in the format of email messages, between the Ministry of Health and the national registry office at the Ministry of Justice. The registration process features the issue of legal birth or death certificates.

The Cook Islands' approach to CRVS is unique in its integration of financial incentives for new parents, emphasising the importance of formal registration for identity documentation such as passports, bank accounts, and school enrolment. Death certificates, essential for inheritance-related purposes, are mandated for all deaths, either through medical certification or coronial review. The system enforces compulsory reporting of all births and deaths irrespective of citizenship, with specific time frames and defined responsibilities for reporting.

The existing process is predominantly paper-based, supported by a Microsoft Access database that duplicates information from paper records. This database aids in searching and identifying registration records but lacks the robustness of a fully-fledged electronic platform, particularly in safeguarding against record amendments.

Cook Islands is aware of the need to develop a comprehensive electronic platform for the registration of vital events. An analysis of the registration business processes was conducted in October 2023 to inform the development of future processes for electronic registration. This transition towards digitisation is aimed at enhancing efficiency and security in the management of vital records.

In addition to the improvements in the registration of vital events, the Ministry of Justice is proposing to develop a national ID database. This database is envisaged to be structured around unique identification numbers for each citizen, both residing in the country and abroad. It aims to consolidate all vital event registrations to a single record, offering a solution to changing personal information over time. This anticipated move towards a more integrated and digitised approach reflects a strategic alignment with contemporary needs and technological advancements.

## FIJI

### *Electronic vital events registration platform*

The Birth, Death, and Marriage (BDM) office under the Ministry of Justice in Fiji plays a crucial role in the registration of these vital events. The registration process in Fiji is primarily electronic, but it is initiated through paper-based notifications of birth and death issued by healthcare facilities. In the case of births, seven hospitals have the capability to forward birth notifications digitally by entering data directly into a web application operated by the BDM. However, this digital approach is not yet extended to death notifications. In November 2023 Fiji CRVS stakeholders undertook the analysis of registration business processes in line with the CRVS Improvement Framework methodology expected to result in adopting policies aimed at improving the efficiency of vital-events-registration business processes

Birth records in hospitals are still maintained in a non-digital format. In contrast, the medical causes of death are centrally digitised in the Patis Plus health platform. However, there is currently no electronic data-sharing mechanism between the Partis Plus system and the BDM platform.

The BDM platform itself makes use of already digitised historic vital-event records. Personal legal identity information managed by the BDM is also shared on the DXP. This information is shared with a limited number of government institutions; such sharing is governed by signed MOUs. However, no such data-sharing agreement or mechanism is currently in place with the health sector.

For the purpose of producing vital statistics, all necessary records are extracted from the BDM's digital platform and shared with the Fiji Bureau of Statistics in the form of Excel files. This data extraction and sharing allows accurate and timely vital statistics, which are essential for informed decision making and policy formulation in various sectors, including health and governance.

### *Health ICT platform*

One of the key components of Fiji's health ICT infrastructure is the PIMS, often referred to as PATIS Plus. PATIS Plus is an advanced version of the Pacific Area Travel Information System (PATIS) and serves as the core electronic medical records system in Fiji. It is designed to store, manage, and retrieve patient information efficiently, facilitating improved patient care, and enabling better data management for healthcare providers. PATIS Plus plays a crucial role in various hospitals and health centres across Fiji, offering several functionalities:

- Electronic Medical Records maintains an electronic database of patient records, including medical history, diagnoses, treatments, and other relevant health information. This system allows for easy access and sharing of patient data among healthcare professionals, ensuring continuity and consistency in patient care.
- Healthcare Administration: Beyond patient care, PATIS Plus assists in administrative tasks like scheduling appointments, managing hospital resources, and tracking patient admissions and discharges. This aspect helps in optimising resource allocation and reducing administrative burdens on healthcare staff.

The integration of electronic data sharing between healthcare facilities and the BDM system in Fiji began with a direct entry method at the Colonial War Memorial (CWM) Hospital. This system was expanded to seven other hospitals which use PIMS or PATIS Plus health information management software. In these facilities, BDM introduced eBDM birth notification web application which runs independently from health management software. Information is manually transferred from PATIS Plus into the digital eBDM notification platform. In the eight hospitals electronically connected to the BDM Office, including CWM, the informant, typically a parent or guardian, obtains an A4 printout of birth notification and presents it at the BDM Office. This printout serves as a physical record of the electronically stored data. BDM customer service officers retrieve the electronic record linked to this printout and complete only a few necessary fields, as most information is already electronically recorded.

In contrast, for births in areas not electronically linked to the BDM system, the process is more traditional. Informants present an A5 paper Notice of Birth for manual birth registration in the BDM system. This approach maintains the traditional method of registration where electronic connectivity is not available.

### *Nation-wide data sharing*

The Fijian government has implemented a centralised DXP as the national data interoperability layer to facilitate electronic data sharing between government agencies including legal identity personal data. Like in many other countries the data interoperability layer provides a standard way for various government systems to share information. It acts as a bridge that connects disparate data sources and consuming applications using common APIs and formats. This eliminates the need for point-to-point connections between each.

The DXP serves as the interoperability layer for legal identity data in Fiji. It leverages a publish-subscribe model where the source registry, Births, Deaths and Marriages, publishes authoritative identity records to the DXP. Other agencies can then subscribe to this verified legal identity data from the DXP instead of having to integrate directly with the registry. For example, the Fiji Revenue and Customs Service subscribes to identity information from the Births, Deaths and Marriages registry via the DXP.<sup>8</sup>

This reduces duplication and inconsistencies. The DXP acts as the single 'source of truth' for data originating from the civil registry. This trusted data can then be used across government. The publish-subscribe architecture establishes a clear separation between data providers and consumers. The interoperability enabled by the DXP is governed by strict policies and agreements governing access and usage of the published data.

## **NIUE**

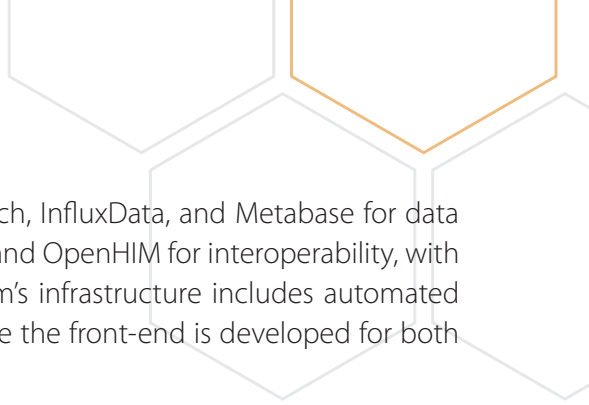
In Niue, the recent digital transformation of the CRVS system is a significant step towards modernising national administrative systems,<sup>9</sup> specifically vital events like births and deaths. The Health Department in Niue is tasked with notifying these events from both health facilities and the wider community. The Civil Registration Office (CRO), a part of the Department of Justice, Land Surveying and Community Services, then takes on the responsibility of civil registration and issuing legal identity documents such as birth certificates. Governed by the Births and Deaths Registration regulations of 1984, the CRVS system in Niue mandates the compulsory registration of all on-island births and deaths and allows for the registration of off-island events.

The digital transformation in Niue's civil registration system is marked by the implementation of the OpenCRVS system in November 2023. This open-source solution is tailored for low-resource settings and enhances operational efficiency by streamlining and automating data processing. OpenCRVS allows various stakeholders, from midwives to registration officers, to collaboratively manage birth registrations and genealogy details, allowing the digital issue of birth certificates and enabling the Statistics Office to monitor vital events. Its

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8 Fiji E-Gov Survey MSQ 2022, <https://publicadministration.un.org/egovkb/Portals/egovkb/MSQ2022/Fiji%20E-Gov%20Survey%20MSQ%202022.pdf>

9 <https://sdd.spc.int/news/2023/11/09/niue-first-country-world-fully-implement-opencrvs-software>



layered architecture integrates technologies like MongoDB, Elasticsearch, InfluxData, and Metabase for data management and analysis. The back-end employs HL7 FHIR standards and OpenHIM for interoperability, with a focus on secure, scalable and manageable microservices. The system's infrastructure includes automated deployment processes and robust performance monitoring tools, while the front-end is developed for both desktop and mobile platforms.

The configuration of the OpenCRVS system may be tailored to facilitate the digital exchange of birth and death notifications with the MedTech digital platform, a system dedicated to the digital management of health records. This connectivity is essential to ensure that notifications of vital events are communicated promptly and accurately between the civil registration system and healthcare services.

Discussion has started with the New Zealand civil registration and passport issuing authorities to share data on birth and death events of Niue citizens. This collaboration would provide Niue with comprehensive updates directly from New Zealand, rather than relying solely on returning residents for information, facilitating faster and more efficient processes for Niueans who die abroad, and streamline the process and reduce the cost of applying for a NZ passport.

The new digital platform will also play a crucial role in sharing data with social services. For instance, digitally generated reports on new birth and death events enable social services to add or remove beneficiaries more efficiently, without requiring extensive documentary evidence. This simplification of processes will be complemented by the development of digital verification platforms for birth certificates and the processing of social allowances.

## TOKELAU

In Tokelau, the process of registering births and deaths, while primarily paper-based, is beginning to embrace digital tools. Although notification of birth and death is completed manually by designated informants one each of Tokelau's islands, registration is done by a designated registration official based in Samoa at the Tokelau's government offices. Often it takes days before notifications are shipped by sea to the Samoa office where they are formally registered and where the registration records are kept. These registration documents are entered as digital records only in the instances when a request for a certificate is made.

In recent years, Tokelau has made efforts to digitise its civil registration system. This is part of a broader move towards e-governance, aiming to enhance the efficiency and transparency of administrative processes. The introduction of a document management system marks a significant step in this direction, facilitating better information sharing and data management. This system allows for a more centralised approach to record-keeping, potentially enabling shared access to digital records among different offices, including those based in Samoa that provide support services to Tokelau. This limited digitisation opens possibilities for data sharing, streamlined administrative procedures, and improved service delivery, albeit within the constraints of available infrastructure and resources.

## TONGA

### *Civil Registration Platform*

Civil registration in Tonga is located in the Office of the Registrar-General, operating under the Ministry of Justice. The Registrar-General, appointed by the Prime Minister with the Cabinet's consent, oversees the system, supported by sub-registrars across Tongatapu and other islands. The system's main objective is to maintain a comprehensive and centralised repository of vital records, which include birth, death and marriage registers. The system faces several challenges in terms of digitisation and data sharing.

The digital platform for registration, initiated through a Commonwealth Secretariat-funded project in 2012, aimed to digitise all records from 1875 to 2020 although there are still many records in paper form only. The

civil registry system does not use personal identification numbers, leading to potential inaccuracies in linking vital event documents to an individual's data. As well, documents are categorised by event type rather than being linked to individual profiles. The health sector's role in providing information about births or deaths complicates the scenario. However, there is an annual validation process involving the Ministry of Health, the Statistics Department, and the Registrar-General Office to reconcile data discrepancies for the purposes of compiling statistics, albeit with limitations in identifying unregistered births or deaths.

Plans are underway to develop a digital registration platform in Tonga, which aims to incorporate advanced features for efficient and secure data exchange. A notable aspect of this proposed system is the potential use of RESTful standards to streamline data communication within the system and with external entities. The platform may include a feature for generating and assigning Unique Identifier Numbers to individuals, which will be crucial in developing accurate and distinct profiles for all Tongan citizens and foreign residents, linking an individual's vital statistics documents, such as birth, death, and marriage records.

The envisioned platform is expected to integrate with the NHIS and the Ministry of Health. This integration would be pivotal for the automated receipt of birth and death notifications, thereby improving registration process times and accuracy. The future system is also planned to be highly interoperable with the National ID system and various government agencies.

### *Health Data Management Platform*

The NHIS being implemented in Tonga is developed with the support of VAMED Management und Service GmbH, a globally recognised healthcare sector supplier. This system is expected to substantially improve the efficiency and effectiveness of health services across the country.

A standout feature of the NHIS is its integrated nature, allowing healthcare professionals across various health centres and hospitals in Tonga to access critical patient information instantaneously. This capability provides accurate data for disease surveillance and other reporting purposes. The centralised system, based at the national referral hospital in Tongatapu, leverages existing fibre optic cables and satellite technology to ensure seamless access from all healthcare facilities. This level of integration ensures that regardless of location, healthcare providers can access and update patient information, thus improving the continuity and quality of care.

For patients, the NHIS promises greater confidentiality and safety of personal health information, thanks to stringent controls on user access potentially building trust in the healthcare system and ensuring patient privacy. The NHIS encompasses a complete suite of modules for hospitals, including outpatient, inpatient, accident and emergency, allied health, vaccination, appointments, operating theatre, pharmacy, radiology, laboratory, billing, medical records, and auditing. Health centres and maternal health clinics have a customised version of the system.

Technical implementation standards are a critical component of the NHIS. The system is designed to support data exchange via HL7 versions 2.x, 3, and FHIR. These standards are essential for ensuring efficient and secure data communication within the healthcare ecosystem. HL7 FHIR is a modern framework enabling easier exchange of electronic health records. The system also supports data exchange via web services, including RESTful web services. This compatibility with RESTful standards is crucial for integrating with various external systems and applications, to enhance the system's functionality and reach.

Integration with Tonga's existing health information management system (DHIS2, or Fanafana Ola) is another key aspect. The NHIS is expected to use DHIS2 as a primary reporting tool, with data loads from the health information system to DHIS2 facilitated via the DHIS2 web service interface and/or reporting tools. The vendor, alongside the Ministry of Health IT staff, will work on identifying and implementing necessary changes to the DHIS2 configuration to support this integration.

## *Data sharing initiatives*

In Tonga's evolving civil registration system, several key systems are expected to be interoperable to ensure efficient and accurate data management. The NHIS is anticipated to play a crucial role in automatically notifying births and deaths for civil registration. The integration with the National ID system is also expected to provide biometric identity verification and facilitate the sharing of records for reconciliation and verification purposes. This integration will maintain demographic records for Tongan citizens and residents.<sup>10</sup>

Additionally, the Orchestrator or Identity Access Management system is expected to be integral in verifying and authenticating identities, crucial for safeguarding data integrity and privacy. Its integration is anticipated to manage access to the National Portal, where e-services for CRVS are displayed and managed.

An API-based Integration Platform is expected to facilitate secure data exchanges with other government systems, such as the Electoral Register, Ministry of Internal Affairs, and Courts System, based on inter-ministerial agreements. This platform is envisaged to support the standardised sharing of information while complying with data protection regulations.

Integration with the Federated ID system for identity verification via the Digital Identification Database (DID) is seen as fundamental. This system is expected to enhance the overall functionality and reliability of identity management within the civil registration framework. These anticipated integrations are poised to create a robust, interconnected network that significantly improves the efficiency, accuracy, and reliability of CRVS management in Tonga.

## **SOLOMON ISLANDS**

### *Civil registration platform*

Solomon Islands uses Promadis, an external vendor-built ICT. It was first procured in 2014 and saw an upgrade in 2023. The vendor has supplied comprehensive documentation, covering crucial aspects of the database design, such as table contents, relationships between tables, and data types. This level of documentation is essential for understanding the structure and design principles of the database, enabling its effective maintenance and scalability. The software supports various data-sharing protocols, including ODBC, JDBC, ADO.NET, SOAP, REST, LDAP, FTP, and SFTP. These protocols facilitate the exchange and integration of data across different systems and platforms. The database supports several data exchange formats, including CSV, XML, JSON, and SQL, making it versatile in terms of interoperability with other systems.

Promadis is a web-based database management system designed for civil registration. Accessible through various devices like desktops, tablets, and mobile phones, it facilitates remote access to civil registry data.

Regular backups are carried out, with data snapshots taken every four hours and stored offsite at a National Disaster Management Office Disaster Recovery facility. This approach guarantees data safety in case of any damage to the main system.

The Department of Health can access birth and death information via a user login, while other sites have the capability to access Promadis using SFTP and APIs; data extracts are available as CSV files. Although not currently sharing data with immigration authorities, national identity management, health sector databases or other government ICT systems, Promadis is equipped to do so if required, suggesting potential for expansion in the future. Efforts to link Promadis with the District Health Information System are in their initial stages.

### *Health ICT platform*

The Ministry of Health and Medical Services is responsible for the recording of births and deaths in health

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10 Tonga Interoperability Framework, <https://digitaltransformation.gov.to/wp-content/uploads/2022/08/TIF-Final.pdf>

facilities and the community, with collation of these records at the national level undertaken by the Health Information System Office located in Honiara. The process of entering birth and death notifications into the Promadis database differs significantly between the national and local facilities.

At the national referral hospital in Honiara, the staff are equipped to enter both birth and death notifications directly into the Promadis system. This direct input method ensures immediate digitisation and integration of the data into the electronic civil registration system, streamlining the process considerably.

Health facilities outside the national referral hospital follow a multi-stepped procedure. For births, the process begins with the completion of a Notification of Birth form. These forms are then collected and sent to the National Health Information System Office, usually accompanying the monthly health reports. Upon receipt, the Health Information System Office staff enter the information from these forms into the Ministry of Health and Medical Services system. Subsequently, these forms are transferred to the Ministry of Home Affairs for the formal registration process. After registration, Ministry of Home Affairs sends the birth certificates back to the Health Information System Office, which then distributes them to the respective health facilities for collection by parents.

A specific database for tracking deaths has been developed as part of the DHIS2 electronic platform. It comprehensively records all deaths that are medically certified or notified by a nurse. This includes deaths occurring both within health facilities and in the community. The database also includes cause of death information, when available. Death notification forms are physically sent to the central Health Information System Office. Once there, they undergo digitisation and are entered into this Death Tracker database. After digitisation, this data can be manually shared with the Civil Registration Office. Efforts are underway to develop mechanisms for electronic transfer of this data.

### *Nation-wide data sharing*

SIG Connect is a key component of the Solomon Islands Government's efforts to enhance its digital capabilities and public service delivery. This government access network connects various Honiara-based government institutions, serving around 6,500 government employees and 4,000 end devices. The primary role of SIG Connect is to provide a reliable link between users and the hosting environment. This includes facilitating communication and data exchange among different government entities.

While SIG Connect and the associated ICT infrastructure improvements are crucial for enhancing government capabilities, they do not constitute a data interoperability layer. Data interoperability involves the ability of different information technology systems and software applications to communicate, exchange data, and use the information that has been exchanged efficiently and effectively. In contrast, SIG Connect primarily serves as a network connecting government institutions and a hosting platform for data and applications. Although SIG Connect and the new data centre facilitate data storage, management, and internal communication within the government network, they don't inherently ensure that different systems can seamlessly share and process data across different platforms or departments.<sup>11</sup>

## **SAMOA**

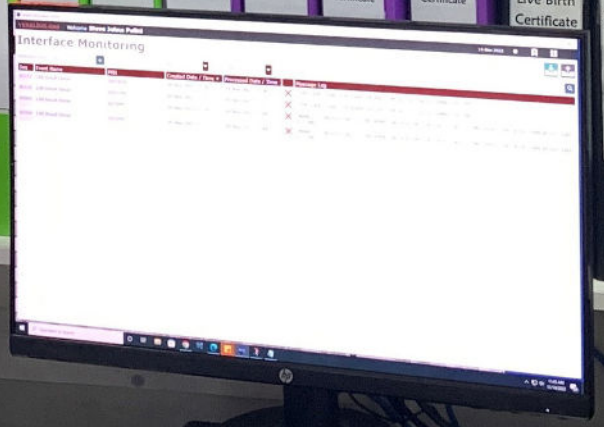
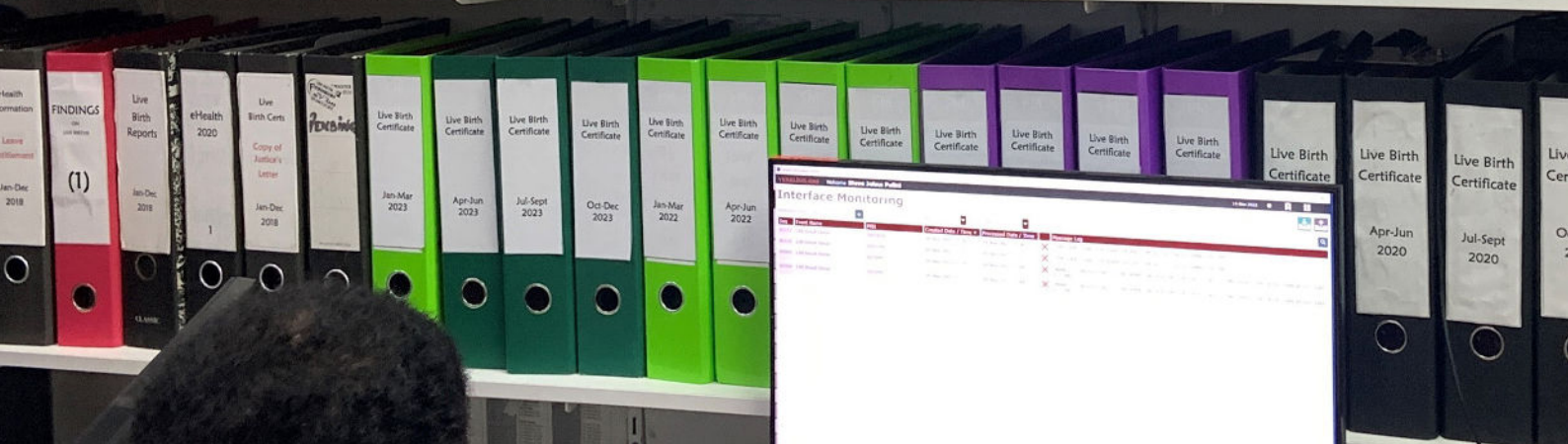
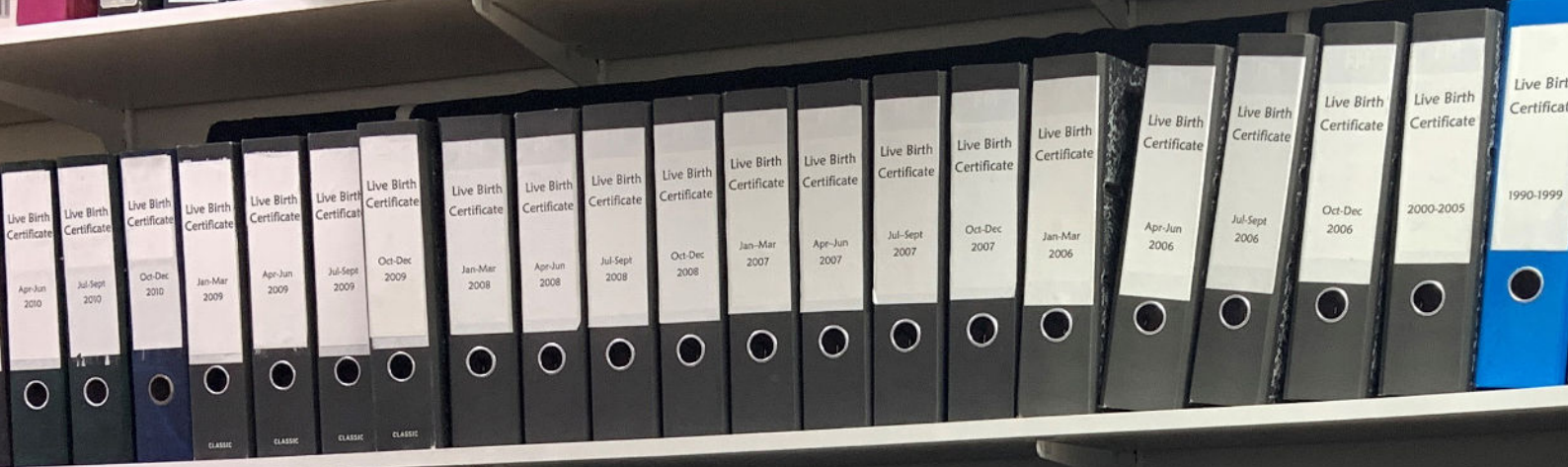
### *Civil Registration Platform*

The Samoa Bureau of Statistics' BDM office began digitising its paper-based civil registration records in 1993. However, not all historical records have been fully scanned and transferred to electronic systems, with many still in physical formats. This has imposed space constraints for storage and makes the paper documents

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<sup>11</sup> <https://solomons.gov.sb/ministry-of-finance-and-treasury/sig-ict-services/>





vulnerable to damage or loss. Even for recent registrations stored digitally on servers or cloud platforms, BDM maintains additional paper copies as back-up, minimising the benefits of digital transformation.

BDM utilises LDS software to administer vital events registration. This system was implemented in 1999 when BDM was under the Ministry of Justice and Courts Administration. During subsequent transfers to the Ministry of Finance in 2004 and finally the Bureau of Statistics in 2007, the LDS software became obsolete but continued to be used with limited upgrades.

The outdated architecture and coding language makes LDS non-interoperable with modern systems like the PATIS medical records platform. The lack of interoperability requires manual notification processes like transferring paper B10 forms between agencies. BDM's operations are also constrained by having only 13 licences for 18 staff members, restricting system access and hampering productivity and digitisation initiatives.

BDM's civil registration processes are hampered by ageing IT infrastructure, lack of interoperability, paper-dependency, and absence of comprehensive data analytics capabilities. A modernised, integrated system is imperative to unlock the full potential of digitised civil registration services in Samoa.<sup>12</sup>

### *Health Data Management Platform*

Until 2020, Samoa's approach to health information management was highly fragmented, unreliable, and paper-based. Core systems like PATIS, Community Health Nursing Information System (CHNIS), pharmacy, and immunisation registries operate in silos with no interoperability. Health workers predominantly use paper and spreadsheets to manually collect, analyse, and report data. Patient records are also duplicated across different facilities with no consolidation. In 2020, Samoa's healthcare system witnessed a significant overhaul with the introduction of the Tamanu system in Moto'otua hospital, replacing the prior PATIS system. This transition was primarily driven by the need for more efficient and accurate data management, particularly in response to the COVID-19 pandemic. The Tamanu system brought in a sophisticated database of patient records, ensuring better handling of vaccination coverage, contact tracing, and population health statistics.

The integration of identification systems with health records, a key aspect of Samoa's healthcare digital transformation, involves linking a unique national ID to an individual's health records. In Samoa, this integration was realised through the Tamanu system and the National ID initiative. The National ID initiative involved registering the population and assigning unique National IDs, which were then used in the Tamanu system as a unique identifier for each patient.

The Tamanu system is equipped with several functionalities. It generates unique National Health Numbers for individuals, facilitating the streamlined management of patient records. The system allows for detailed recording of birth and death events, encompassing comprehensive information about the individuals involved. Furthermore, the system's capability to export data in user-friendly formats, like Excel, significantly aids in inter-agency data sharing and collaboration.

### *Data sharing initiatives*

The National ID Bill 2023 was discussed by Samoa's Economic Sector Committee. The bill involves a series of transformative changes in the healthcare system, particularly focusing on the management of birth and death records. The primary challenges identified include the consistent change in names, often due to the use of Matai Titles in the first name field and discrepancies in health records, highlighted by the presence of nearly 700,000 patient records against a population of just over 200,000. This disparity suggests potential duplications or errors in the health information system. Another significant challenge is the varying availability

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12 Strengthening the birth registration system in Samoa Intelligence report, UNDP <https://www.undp.org/sites/g/files/zskgke326/files/2023-04/Intelligence%20Report%20on%20Birth%20Registration%20System%20in%20Samoa.pdf>

and consistency of birth documentation. Not everyone in Samoa has a birth certificate, leading to the use of alternative documents like passports or drivers' licences for identification. However, this approach is complicated by occasional discrepancies in dates of birth across different documents. The process of adoption and its recording in health systems add to the complexity.

Previously, the birth notification process in Samoa involved recording the birth of a child at a health facility on the HIS, followed by issuing a hard copy of the birth notification to the mother for registration at the Samoa Bureau of Statistics. This process, governed by the Births, Deaths and Marriages Act 2002, often faced challenges, particularly when mothers did not return with the record, leading to the creation of duplicate records. To address these issues, a new pilot process has been introduced. This process digitises birth notifications, where the health information system generates a digital birth notification after a child's birth and sends it to CRVS and the National ID servers. This updated system is designed to allow the Ministry of Health to authenticate the identity of the child when the mother brings the child back for health checks. It also facilitates updating the Ministry of Health system with the corresponding birth certificate number and name.

In line with these changes, the National ID Bill 2023 also emphasises the integration of biometrics and the reintroduction of the National Health Card. This initiative aims to minimise the creation of duplicate patient records and ensure proper identification of biological mothers, particularly in adoption scenarios. The reintroduction of the National Health Card is a strategic response to the current challenges, aiming to streamline patient identification and record-keeping in the healthcare system.

## VANUATU

### *Civil registration platform*

Vanuatu uses a custom-built digital platform for civil registration data called Register Viz v5, which is built as a completely new platform for records management that only resembles the legacy platform Register Viz v4 in keeping the name. Unlike the legacy Register Viz v4, the new V5 platform database is structured with SQL and stored on a server at the premises of the Office of the Government Chief Information Officer (OGCIO). The system enables integration and sharing of data through an API and supports various data-sharing protocols such as ODBC, JDBC, REST, and data exchange formats like CSV, XML, and JSON. National identity cards are issued and integrated into the same platform, managed by a single national certified ID authority. The database has both on-site and off-site back-up, which is a critical requirement for record security purposes, particularly in situations of national disasters where records and civil registration infrastructure are at a critical risk of loss and damage.

Register-Viz is linked to the immigration and passports department database and the electoral roll. The database is available online in each provincial registration office and at the major hospitals. It operates two main windows, one for data capture and the other for data viewing. Authorised civil registration officers with access to the system are assigned administrative rights to access all records through the 'view' mode but cannot make changes to existing records.

The Vanuatu National Statistics Office (VNSO) is integrated into the government's network and utilises Register Viz v5, installed by the IT Civil Registry and Identity Management System (CRIM) team at the VNSO office, which allows them to access records in a 'view only' mode. VNSO personnel can view the records, they do not have the capability to edit or alter them in any way. This restricted access format is also shared with other government departments, including Customs, Police, Health, Education, and State Law.

The development of an upgraded version of Register Viz v5 is underway, indicating ongoing development and enhancement of the CRVS system's capabilities. The platform is crafted with inherent interoperability capabilities, which makes it highly adaptable to a variety of existing systems.

A central aspect of its architecture is the service mesh approach. This approach is characterised by the use of decentralised software components. These components are designed to communicate flexibly with one another, which is a significant departure from more traditional, monolithic software architectures where components are tightly integrated and interdependent. The decentralised nature of a service mesh architecture allows for greater agility and scalability. Each component or 'node' in the mesh can operate independently yet remains part of the broader network, facilitating efficient data.

This architecture is beneficial when integrating with a variety of systems, including advanced applications like biometric registration. Biometric registration systems, which are increasingly prevalent in modern digital infrastructures, require a high degree of precision and security. The service mesh architecture enables the system to incorporate these sophisticated components seamlessly, ensuring that they communicate effectively with the rest of the system without compromising their unique operational requirements.

Another critical feature of the system is its compatibility with legacy systems. Many organisations operate on older technology systems that are deeply embedded in their operations. Replacing these systems entirely is often impractical, costly, and disruptive. The system's ability to create interoperability layers around these legacy systems is a significant advantage. By doing so, it effectively integrates these older systems into the new service mesh architecture. This integration means that legacy systems do not need to be discarded or entirely overhauled; instead, they can be modernised and made part of a more advanced and interconnected network.

### *Health ICT platform*

In Vanuatu, the health system database for processing health records is organised using the DHIS2 platform. Managed locally with assistance from the World Health Organisation since 2013, DHIS2 facilitates ongoing health data management and is documented with details on its database schema, including tables content, relationships, and data types. The system stores complete information from medical certificates of birth and death, but it is currently not storing information in line with the ICD cause of death standards. It accepts several data sharing protocols like ODBC, JDBC, , SOAP, REST, FTP and SFTP and supports data formats such as CSV, XML, JSON and SQL. The health system database does not share information with other ICT systems of the government nor with national statistics authorities.

### *Nation-wide data sharing*

The OGCIO in Vanuatu plays a pivotal role in the management and implementation of ICT initiatives across the public sector. The OGCIO acts as the custodian of the national ICT policy, spearheading digital development strategies and frequently collaborating with international partners to augment Vanuatu's ICT infrastructure. It hosts about 90% of the data from government departments. The OGCIO is responsible for maintaining data centres and offering helpdesk services for GBN users. The servers under OGCIO's management host various databases, including the Civil Registry information management system (RegisterViz4), the Court Management System, ASYCUDA (Automated Systems for Customs Data) World and the Police Information Management System.

The OGCIO's role does not equate to establishing a data interoperability layer. The OGCIO primarily focuses on data hosting, management and network connectivity, rather than enabling different systems to interoperate at a data level. Data can be stored and accessed centrally but it remains siloed within its specific systems, limiting the potential for comprehensive, cross-platform data utilisation and analysis.

## APPENDIX 2 – CASE STUDY – TOWARDS UNIVERSAL CRVS DATA SHARING STANDARDS

There is an absence of international standards regarding the specific format for storing information within civil registration records and their digital counterparts. This crucial aspect of civil registration – the format and structure of record storage – is predominantly governed by national regulations. Each civil registration authority possesses complete autonomy to define its own standards and specifications for the databases that store these records. This poses challenges, particularly when it comes to the interoperability and comparability of records across jurisdictions. Some ramifications of this include:

- In the Pacific some territories are mandated to share their civil registration data across jurisdictions eg, American Samoa vital-event records are shared with other United States civil registration authorities and NZ Realm countries need to meet NZ passport requirements.
- The ongoing transition towards digitised data processing in civil registration systems necessitates the leveraging of existing standards to facilitate efficient data sharing. For external data sharing, authorities can leverage existing standards described in the section on periodic data sharing, developing special modules that extract data and format them in line with these standards.
- Where timeliness is paramount, such as in the sharing of birth and death information with health systems, civil registration authorities can leverage existing established health digital data processing standards in the context of real-time data exchange where such is deemed viable.
- The FHIR - (see above for a full explanation) data standard is a framework developed by the HL7 organisation. FHIR is designed to enable healthcare information to be available, discoverable, and understandable globally, and to support a wide range of applications, including electronic health records (EHRs), data sharing between healthcare providers, mobile apps, cloud communications, and data analysis applications in clinical and research settings.
- The FHIR API is a prominent example within the healthcare domain, demonstrating how specialised APIs can effectively meet the demands of intricate medical data management. FHIR acts as an efficient translator for the complex language of healthcare data, facilitating seamless sharing of vital events information between healthcare providers and civil registries.
- The FHIR system in the United States has greatly improved the way vital events data, like births and deaths, is managed and shared. This system helps healthcare providers and government agencies exchange this information quickly and efficiently. FHIR ensures that births and deaths are reported accurately and promptly from healthcare facilities to state and national record offices, which is important for legal, administrative, and health monitoring. It standardises the format and transmission of this data, reducing errors and inconsistencies that can occur with manual entry or different electronic reporting methods. This leads to more reliable and accurate records. FHIR also plays a crucial role in public health surveillance, allowing for faster collection and analysis of birth and death data, including causes of death. This is essential for tracking public health trends, responding to health crises, and policy making. The system bridges the gap between healthcare IT systems and civil registration, ensuring that data from healthcare settings is seamlessly integrated into civil registries and other government databases. It also aids researchers and statisticians by providing standardised data for a wide range of research projects and analyses, contributing to a better understanding of health trends. FHIR also makes it easier to share data across states in the U.S., where each state maintains its own records, improving the management and accessibility of vital statistics at a national level.
- HL7 FHIR has full compliance with the European Interoperability Framework with respect to all dimensions considered within the core interoperability principles (legal, organisational, semantic and technical) and

has been widely adopted in Denmark, France, Finland, Hungary, Portugal, the Czech Republic, and the Netherlands.<sup>13</sup>

- The newly emerging public-good registration platform, OpenCRVS, which is currently implemented in **Niue**, is designed to align with the OpenHIE architectural standard, and it utilises FHIR to enhance its operations. This integration allows OpenCRVS to seamlessly connect civil registration to health services and other systems. Using OpenHIM, which is a FHIR standard, OpenCRVS can effectively receive birth and death notifications from hospital settings.
- In **American Samoa**, the adoption of the FHIR standard is a key element in the transformation of their civil registration and health data management systems. The transition from a manual, paper-based civil registration process to a digitised platform is underway, with current efforts focusing on converting hard copy records into digital formats. This initial step towards digitisation involves scanning paper records at the Office of Vital Statistics and backing up the data at the Department of Homeland Security's office.
- The SILAS interoperability platform in American Samoa is set to become the central integration platform within American Samoa's healthcare system. Moreover, SILAS will interface with the Steve system operated by NAPHSIS for verifying vital events records, ensuring data integrity. By employing the FHIR standard for data interchange, SILAS is expected to greatly improve communication among different health-related entities within American Samoa and with other U.S. CRVS and health authorities. This integration is anticipated to lead to better health outcomes and more informed public health decisions, demonstrating the significant impact of FHIR in transforming health data management and sharing.

## Advantages resulting from adhering to FHIR standard

The FHIR API is an exemplar within the healthcare domain, representing a specialised form of API designed for the intricate needs of medical data management. Its application in civil registration systems is akin to an efficient translator, adept in handling the complex language of healthcare data. FHIR provides a framework where data regarding births, deaths, vaccinations, and other vital events can be shared seamlessly between healthcare providers and civil registries.

For instance, when a child is born, the details of the birth are captured in a healthcare facility's system. Using FHIR, this information can be transmitted directly to the civil registration system to officially record the birth. This process ensures that the data is accurate, timely, and formatted correctly for the civil registry's requirements. The standardisation of data exchange, as facilitated by FHIR, is crucial in scenarios where accuracy and timeliness of data are critical, such as in the calculation of vital statistics for public health planning.

Moreover, FHIR's use of RESTful architecture, a method based on simple, communication over the internet, aligns well with modern web-based civil registration systems. This approach simplifies the integration of disparate systems, allowing for more streamlined data exchange processes. In essence, FHIR takes the robust standards of healthcare information technology and adapts them to the web, creating a method of interoperability that is both advanced and accessible.

The adoption of the FHIR standard in database design, particularly for those containing vital statistics and healthcare information, opens the door for external systems to effectively communicate and interact with these databases. This interoperability is achieved through the use of FHIR standard libraries, which external systems can utilise to write software tailored for accessing FHIR-based resources. The significance of this capability is multifaceted and profoundly impacts the way data is managed and utilised across various platforms.

FHIR standard libraries provide a common language for different systems to communicate. This standardisation is crucial in a landscape where data is often siloed within disparate systems, each with its unique architecture

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13 <https://tehdas.eu/app/uploads/2023/10/tehdas-recommendations-to-enhance-interoperability.pdf>

and data format. By using FHIR libraries, software developers can create applications that can access, retrieve, and interpret data from FHIR-compliant databases regardless of their underlying differences. This uniformity in data exchange protocols and formats ensures that information can flow seamlessly between systems, enhancing data accessibility and usability.

FHIR's flexibility in accommodating various data models, including those relevant to both healthcare and civil registration, makes it an invaluable tool for developers. This flexibility means that applications can be tailored to meet the specific needs of different sectors, whether it be healthcare, government, insurance, or research. The ability to customise applications while maintaining a standard protocol for data exchange is a significant advantage, ensuring that these applications remain interoperable with a wide range of systems.

In the civil registration system, leveraging FHIR standard for specialised data requests demonstrates its utility and flexibility. Consider a situation where an administrative body needs to obtain information on all nationals over the age of 18 who have changed their names in the past month. The process involves a structured API request to the civil registration's system. This request might be formulated as follows:

<https://www.nationalcivilregistry.org/api/namechange/age/18/date/lastmonth>

Breaking down this request:

- <https://www.nationalcivilregistry.org> is the base URL of the national civil registry's system.
- **/api/** indicates that the request is being sent to an API endpoint.
- **namechange/** specifies the type of record being requested, which in this case is a name change.
- **age/18/** filters the records to include only individuals who are older than 18 years.
- **date/lastmonth** further narrows down the data to those name changes that occurred in the past month.

When the civil registration system receives this request, it processes the query and returns data pertaining to all individuals over 18 who changed their names in the specified time frame. The data is formatted according to the API's standards, ensuring consistency and ease of interpretation.

In a real-world application, this process would also involve secure authentication and authorisation to protect sensitive personal data. The FHIR standard, with its emphasis on security and standardised data formats, makes it an ideal choice for such operations in civil registration systems.

This scenario showcases the power of APIs in handling complex, specific data queries in civil registration, demonstrating their role in enhancing the efficiency and capability of government and administrative systems in managing and utilising vital records.

However, the seemingly straightforward one-line request to a civil registry's system, such as <https://www.nationalcivilregistry.org/api/namechange/age/18/date/lastmonth>, hides the reality of extensive and intricate coding that underpins it. Behind this concise and clear request lies a complex web of code that, without the aid of standardised libraries like those offered by FHIR standard, would be daunting, time-consuming, and expensive to create for every individual use case.

This request, while appearing simple to the end user, is the result of a sophisticated architecture designed to interpret and process such queries efficiently. The **/api/** segment indicates that the request is routed to a specific API endpoint, a junction where the civil registry's data can be accessed in a structured manner. The subsequent segments, **namechange/**, **age/18/**, and **date/lastmonth**, represent a hierarchy of filters and parameters that the system must interpret and apply to retrieve the correct data.

Developing the back-end functionality to handle such requests without standardised libraries would require programmers to manually code the logic for parsing each segment of the URL, validate the input data, interact

with the database to execute the query, and format the response appropriately. Each of these steps involves a series of complex operations, including security checks, data validation, database querying, and error handling.

Standardised libraries, like those provided by FHIR, streamline this process significantly. They offer pre-built functions and structures for common operations, such as data retrieval, filtering, and authentication. This means that developers can leverage these libraries to handle much of the heavy lifting, reducing the amount of custom code that needs to be written. For instance, a FHIR library might include functions to parse URL parameters, query the database using those parameters, and return the data in a standard format, all while ensuring compliance with security and data privacy standards.

Without standardised libraries, consistency and reliability across different use cases becomes a challenge. Each new query type or data request might require a bespoke coding solution, increasing the risk of inconsistencies and errors. Standardised libraries mitigate this risk by providing a uniform framework for handling requests, ensuring that each query is processed in a consistent and reliable manner.

The utilisation of the FHIR standard in systems like OpenCRVS brings significant advantages, particularly in terms of support from the broader software development community and vendors. FHIR, being a widely recognised and adopted standard, benefits from a large and active community of developers and technology companies. This extensive support network facilitates easier and more efficient software development and upgrades. Developers can access a wealth of resources, tools, and shared knowledge, making it more straightforward to implement FHIR in various applications. Furthermore, the widespread adoption by vendors ensures continuous improvement and compatibility across different healthcare and data management systems.



# APPENDIX 3 – CHECKLIST FOR THE DECISION MAKING ON DATA SHARING

## 1. **Identify data needs and requirements**

- Determine specific data fields required for sharing (e.g., names, dates, IDs).
- Establish the intended frequency and schedule of data transfer (daily, weekly, monthly, etc.).
- Assess current and projected data volumes and growth.
- Understand the specific use cases and objectives of data usage by recipients.
- Analyse any regulatory compliance requirements related to data privacy and security.
- Evaluate database architectures and platforms on both the source and destination systems.
- Decide on real-time or batch sharing based on volume and timeliness needs.

## 2. **Choose appropriate data sharing method**

- Assess whether real-time data sharing is necessary or if periodic transfer suffices. Conduct a cost-benefit analysis.
- Consider current and projected volumes of vital events. High volumes may justify the need for real-time sharing.
- Determine an optimal hybrid model that balances real-time sharing for high-volume sites with periodic transfers for lower volume sites. Design interfaces accordingly for real-time sharing or proceed to the next step for periodic sharing.

## 3. **Standardise data formats**

- Agree on common standardised data interchange formats like CSV, XML, etc.
- Ensure consistent structuring of records and fields according to standards.
- Use standard schemas, vocabularies, and identifiers for semantic interoperability.
- Include necessary metadata and allow for format extensibility.
- Assess format compatibility with the database platforms of both systems. Choose a format that is portable and compatible with the recipient's systems.

## 4. **Implement data security**

- Encrypt data both in transit and at rest as per best practices.
- Restrict data access to authorised personnel only, aligned with the principle of least privilege.
- Comply with applicable local data protection and privacy regulations.
- Conduct periodic security audits, risk assessments, and update protocols as necessary. Ensure strong security foundations to build confidence and prevent breaches.

## 5. **Build APIs for system integration**

- Design standards-based APIs for seamless data exchange between source and destination systems.
- Ensure API interoperability using common protocols like REST, gRPC, FHIR, etc.
- Utilise JDBC/ODBC for database connectivity and data manipulation.
- Adhere to industry data standards like HL7, OpenHIE for health data exchange.
- Design APIs to be modular and microservice-based to accommodate future enhancements. Ensure that APIs are well-designed for automated data flows.

6. **Define verification APIs**

- Develop verification APIs that validate identities, events, and certificates without exposing full records.
- Implement strong access controls for verification APIs, aligned with the principle of least privilege.
- Monitor verification API usage to prevent abuse, such as excessive requests.
- Enable certificate validation against registry data to combat fraud. Verification APIs should allow authorised confirmation of data while minimising exposure risks.

7. **Set up governance oversight**

- Appoint a public agency to provide governance and oversight.
- Enforce data regulations on security, privacy, usage authorisations, and accountability.
- Mandate contractual data sharing agreements between stakeholders to ensure compliance.
- Conduct periodic audits and risk assessments to proactively identify and address issues.



