KINGDOM OF TONGA

STRENGTHENING ARRANGEMENTS TOWARD AN INTEGRATED GEOSPATIAL MANAGEMENT

SEPTEMBER 2023

This Country Action Plan has been prepared by the Ministry of Lands and Natural Resources under the United Nations Development Account 11th tranche Project 1819D "Strengthening geospatial information management in developing countries towards implementing the 2030 Agenda.

With support from the Secretariat of the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM)

FOREWORD

Tonga is a highly disaster-prone country and its susceptibility is primarily due to its geographical, geological, and socio-economic characteristics. Climate Change-induced disaster risks pose serious adverse impacts on the land and marine environment, prompting great loss of livelihoods in many Pacific Island countries including Tonga. Scientific findings have revealed that these impacts will be exacerbated by future climate change.

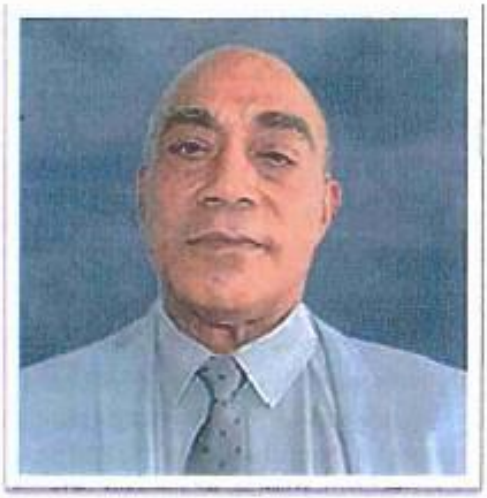
In the light of the aforementioned, the Government of Tonga understands the critical issues presented and the significance to protect the country's Lands and Marine Natural resources to ensure the continuousness of its sustainable socio-economic development is considered, a high priority in its National Tonga Strategic Development Framework (TSDF II 2015-2025).

As a well-coined phrase**: "Everything happens somewhere",** for centuries maps have been used for defense, trade, navigation, land and resources management, infrastructure planning and administration. Decisions are made based on knowledge of the environment provided by maps; the better the maps the better the decisions.

Today, in the digital era, geospatial information provides far more value than just a simple map. It is an essential national information resource with a proven societal, economic and environmental value that enables government systems and services, and national development initiatives, to be integrated using **"LOCATION"** as a common and underpinning reference frame**.** The map representation of the location is simple to understand the issue and addressed promptly. The introduction of the usage of geospatial information in the development of handheld devices and telecommunication technology has allowed us to visualize what is happening – **When**, **Where,** and **Why**.

This National Country Level Action Plan marks a critical milestone in strengthening nationally Integrated Geospatial Information Management in Tonga to provide the integrative platform for all digital data that has a location dimension to it. It highlights 9 strategic pathways to be implemented at all levels towards addressing sub-national, and national priorities and the Sustainable Development Goals for the benefit of all. Using geospatial information and related location-based services benefits citizens, communities, business sectors, governments, and many other stakeholders daily, as it provides a digital connection between a place, its people and their activities, and illustrates what is happening, where, how and why, and the impact of the past, the present and likely future scenarios.

I believe that this national action plan provides an inclusive and engaging mechanism to bring collaboration, coordination and cohesion across our country, including the government, strengthening and integrating arrangements in national geospatial information management. As this plan is implemented, it will harness the opportunities available through Information and Communication Technology, products and services that enable all sectors to be responsive, transparent and accountable in decision-making and service delivery. Through this Action Plan, we demonstrate national leadership, cultivate champions and develop the capacity to achieve our vision for the effective use of geospatial information to measure, monitor, and achieve sustainable social, economic, and environmental development – *leaving no one behind*.



Rev. Honourable Lord Tu'i'afitu

Minister for Lands and Natural Resources (MLNR)

Minister of Lands, Survey and Natural Resources • Tonga Government •

WORD OF THANKS

The Ministry of Lands and Natural Resources would like to extend their sincere thanks to the UNGGIM Secretariat, for providing guidance, support and training in the pursuit of Tonga's Country Action Plan for Integrated Geospatial Information Management. The valuable collations of discussions and collaborations between Tonga and various countries have formed layers of information that are very beneficial for the future of Geospatial Information in Tonga.

Special thanks go out to the Head of Division for Geospatial Information, Mrs Halalilika Etika; Head of sections, Makameane Fifita and Sione Leki; and the remaining staff members of Lands Geographical Information Services for their effort and continuous perseverance for the recognition, acknowledgement and distribution of Geospatial Information within the government of Tonga.

In addition, thank you goes out to the involvement of National Stakeholders, various ministries and departments, private organizations and businesses that provided continuous support and information for the foundation of this In-Country Action Plan. Through your participation and contribution of datasets, the embodiment of data integration was embarked.

Finally, a thank you is also extended to the communities for their valued inputs and contributions to the importance and relevance of Geospatial information for decision makings throughout the country and especially for the development of all areas in life.

I would like to compliment everyone involved for the preparations of this action plan and for the successful pathway to its completion. I am also confident that sharing this action plan is in good favor for all involved, for more accurate and accessible management of geospatial information and for the continuous development and prosperity of Tonga as a nation.

Ms Rosamond Bing

Chief Executive Officer

Ministry of Lands and Natural Resources

Contents

ACRONYMS

Acronym	Explanation
NGAP	National Geospatial Action Plan
DAP	Development Account Project
IGIF	Integrated Geospatial Information Framework
IGIM	Integrated Geospatial Information Management
LGIS	Lands Geospatial Information Services
MDA	Ministry/ Department/ Agencies
MEIDECC	Ministry of Meteorology, Energy, Information, Disaster, Environment and Climate Change
MLNR	Ministry of Lands & Natural Resources
NGAP	National Geospatial Action Plan
NGO	Non-government Organization
PEST	Political, Economic, Social, Technology
PMO	Prime Minister's Office
PMU	Project Management Unit
SIDS	Small Island Developing States
SDG	Sustainable Development Goals
SP	Strategic Pathway
SWOT	Strengths, Weaknesses, Opportunities, Threats
TWG	Technical Working Group
UN	United Nations
UN-GGIM	United Nations – Global Geospatial Information Management

EXECUTIVE SUMMARY

What is geospatial information?

The term Geospatial Information is used to indicate that data that has a geographic component to it. This means that the records in a dataset have locational information tied to them, such as geographic data in the form of coordinates, address, city, or postcode. Fundamental geographical datasets are the primary sets of geographic data required to support national developments.

Geospatial information originated from the term Geographic Information System (GIS) or otherwise known as Geoscience. It is defined that:

> *"…GIS integrates hardware, software, and data for capturing, managing, analysing, and displaying all forms of geographically referenced information. GIS is used to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts. A GIS helps you answer questions and solve problems by looking at your data in a way that is quickly understood and easily shared."*[1]

A more sophisticated level of geospatial information includes the collation of several location-related datasets combined into layers that visualise information such as population density and land use.

Purpose

The overarching purpose of the National Geospatial Action Plan (NGAP) is to strengthen geospatial information management in Tonga to support the implementation of the 2030 Agenda for Sustainable Development and its seventeen Sustainable Development Goals, to support Tonga's National priorities and to respond to national circumstances including emergency management. The aim of Tonga's Action Plan (AP) is to provide the most appropriate and most relevant actions to support and strengthen Tonga's geospatial information management capabilities and make decisions about how to address the gaps, the priority of addressing the gaps, and how to proceed with resolving the gaps through actions.

The proposed establishment of the NGAP was a result of the decision of the Ninth session of the United Nations Committee of Experts on Global Geospatial Information Management (UNGGIM) in August 2019 where six countries, Tonga being one, were invited to leverage the United Nations Integrated Geospatial Information Framework (IGIF) as a mechanism to strengthen their national geospatial management to elevate geospatial information to support the achievement of national development priorities toward achieving the Kingdom's SDG goals and targets.

[1] https://ggim.un.org/faq/

Current Situation

Tonga's current status on geospatial information shows a wide gap in relation to the desired performance/status many organisations wish to observe. The term *'geospatial information'* presents a new concept to many, few of those working with geospatial data and/or information have enough knowledge and experience to leverage geospatial data/ information for other purposes, except that GIS data/ information is to designate study or pilot site's location.

The lack of knowledge and awareness of the socio-economic benefit of integrated geospatial information is one of the most undermining factors.

Methodology

The NGAP was built based on assessment, analysis and consultations with questionnaires and workshops involving various government MDA(s) and non-government organizations of their 'current state' with geospatial information. The articulated national current status present in this NGAP was based on a Baseline Survey. Other assessment includes SWOT and PEST analysis (APPENDIX 6: PEST & SWOT Analysis). These in-country assessments, analysis and consultations were coordinated by the Ministry of Lands and Natural Resources. The questionnaire template used for the baseline survey is in APPENDIX 5: QUESTIONAIRE SHEET and the list of the participating MDAs in APPENDIX 10: Participating MDAs.

The NGAP was formulated based on the Needs Assessment and Gap Analysis Report which provides the information necessary to prepare a detailed National Action Plan covering nine themes – Governance and Institution Arrangements, Policy & Legal, Financial, Data, Innovation, Standards, Partnership, Capacity & Education, and Communication & Engagement to strengthen geospatial information management.

The Needs Assessment and Gap Analysis:

- articulates the collective vision and goals of Tonga and its stakeholders for integrated geospatial information management;
- a review of the current state of integrated geospatial information management and identification of the challenges faced.
- Identify possible strategies of action to minimize or solve the gaps and improve the current state of integrated geospatial information management.

The Needs Assessment and Gap Analysis references the Implementation Guide of the United Nations Integrated Geospatial Information Framework Part 2: Implementation Guide.[2]

Desired Future horizons

The 'desired state' Tonga wishes and aims to achieve through the Development Account Project 1819D, is to be able to successfully establish an organised, reliable and accurate baseline of geospatial information that allows effective and efficient use of geospatial information made possible by data sharing and data integration by MDAs in Tonga. This can be done through progressing towards achieving the

[2] Link to the IGIF Part 2: Implementation Guide

underlying Vision, Mission and Goals developed to empower and educate the people on Integrated Geospatial Information Management and its benefits. IGIM hopes to achieve the most desired of:

i. **Governance and Institution:** enhance work processes between agencies,
    a. *simultaneous update and exchange of* geospatial data and/or information.
    b. *accountable and excellent administrative institution.*
    c. *multi-lateral coordinated collaboration* to sustain knowledge, access to data etc.
ii. **Legal and policy frameworks** are developed to guide and advance the resolution made by decision makers.
    a. Policy and regulation to enforce the National Spatial Planning Act 2012.
    b. Standards for geospatial data management.
    c. Promoting an enabling environment for coordination and collaboration including data sharing, exchange, dissemination and use.
iii. **Data** management use through technological advancement,
    a. *smart transportation.*
    b. *real-time early warning system.*
    c. *online web GIS.*
    d. *UAV and systematic field data capture.*
    e. *automation of geospatial data* digitalisation and referencing.
iv. **Improve human capabilities, capacities and education** and such as;
    a. **Support career opportunities** in geospatial related academic fields (Geophysicist, Geologist, GIS analysts, Environmental analyst, etc.).
    b. **Establish a research centre** to build data analyst capacity, data science and data management.
    c. Enhance in-country imagery capturing techniques, processing, storage, etc.

Not limited to the four strategic pathways, include the financial pathway for a sustainable economic investment;

v. Make **better economic investment** possible and opportunities, especially for private/industry sectors,
    a. harness private and government sector's capacity to use aerial datasets for field data surveying.
    b. increase interest in aerial data capture and data management.
    c. support local GIS & Surveying Consultants.

For those reasons, and to be fully supported by all realms of society it is very important to have a clear understanding of the societal value and benefits of integrating geospatial information and how it can help the general public.

Major Gaps in Capability

The major gaps were collected from various stakeholders and categorised based on each of the nine Strategic Pathways (or themes) of the Integrated Geospatial Information Framework. These identified gaps give an overview of the existing weaknesses in the four-priority pathway's current national performances that need to be achieved.

- **Governance and Institutions**
    - The absence of the national governance model to direct management of geospatial information.
    - The fragmented and siloed institutional structures and lack of leadership create a wider gap in communication and management.
    - Limited scope of the MLNR's GIS capabilities.
    - The lack of knowledge and awareness of the value and benefit of geospatial information.

- **Policy and Legal**
    - No direct policy and legal framework that fully covers specific characteristics of managing geospatial information or integrated geospatial information management.
    - No statutory framework to cover institutional arrangements, divisional standard operating procedures, pricing and other related aspects of geospatial information management.
    - No policy, strategy or legal framework mentions geospatial data and information management.
    - Cooperative and Collaborative mechanisms are needed in place.

- **Data**
    - The absence of the location or geography component of the data decreases its quality, and ability to be spatially analyzed and integrated with other data.
    - Lack of consistent, reliable and complete baseline datasets and updates.
    - Inability to strengthen geospatial data management's capabilities by government-led organizations.
    - There is also a huge lack of understanding of the significance of geospatial reference systems for accurately managed geospatial information.

- **Capacity and Education**
    - There are not enough graduates and qualified personnel in the field of geospatial information in Tonga. For instance; there are not enough geodetic experts in Tonga.
    - Lack of awareness on the significance of qualified geospatial professionals as well as a lack of educational and training opportunities for staff in different disciplines within the geospatial profession.

Strategic Actions

Tonga is very optimistic that the NGAP with respect to the vision, mission and goals will create a positive working environment between government, non-government agencies and the general public for the benefit of its people.

- **Vision**

  "A higher quality of life for all Tongans supported by accessible, accurate and reliable integrated geospatial information."

- **Mission**

  "Promote and support coordination and collaboration to achieve integrated geospatial information management and leverage it as a decision and sustainable solutions to national needs and opportunities."

- **Goals**

There are 7 Goals in total, 4 however are listed as the main priority of the NGAP for its first 5-year period.

1. Establish leadership and coordination necessary to deliver and manage effective integrated geospatial information by 2022 - 2024
2. To develop geospatial guidelines, responsibilities and policy framework by 2022-2026 to promote data standards, sharing and accessibility.
3. To provide accurate, reliable, timely, accessible and fit-for-purpose integrated geospatial information for all users throughout Tonga.
4. To expand capacity development, initiate research and innovation of GIS application progressively with a focus on advancing environmental monitoring, emergency management and disaster risk reduction.

The strategic actions put in place to minimize the major gaps in capability previously discussed were developed based on the IGIF. The NGAP has nine strategic pathways or major thematic priorities that stems as a result of identified gaps and strategic alignment during the Need & Gap Assessment. The nine pathways have allocated actions that are further disaggregated into activities for easier development of indicators to minimize or solve gaps identified in the Need & Gap Assessment. The achievement of each activity per action aggregates to achieve the action and so forth, subsequently all goals; mission and vision are achieved as well.

Although all pathways are important to implementing a successful Country Action Plan, it is with the intention that the highest priority leans towards ***SP1: Governance & Institution Arrangements, SP2: Policy and Legal, SP4: Data and SP8: Capacity and Education*** (Figure 1). It is with the realisation that these 4 pathways form a strong foundation of a dynamic and progressive IGIM in Tonga

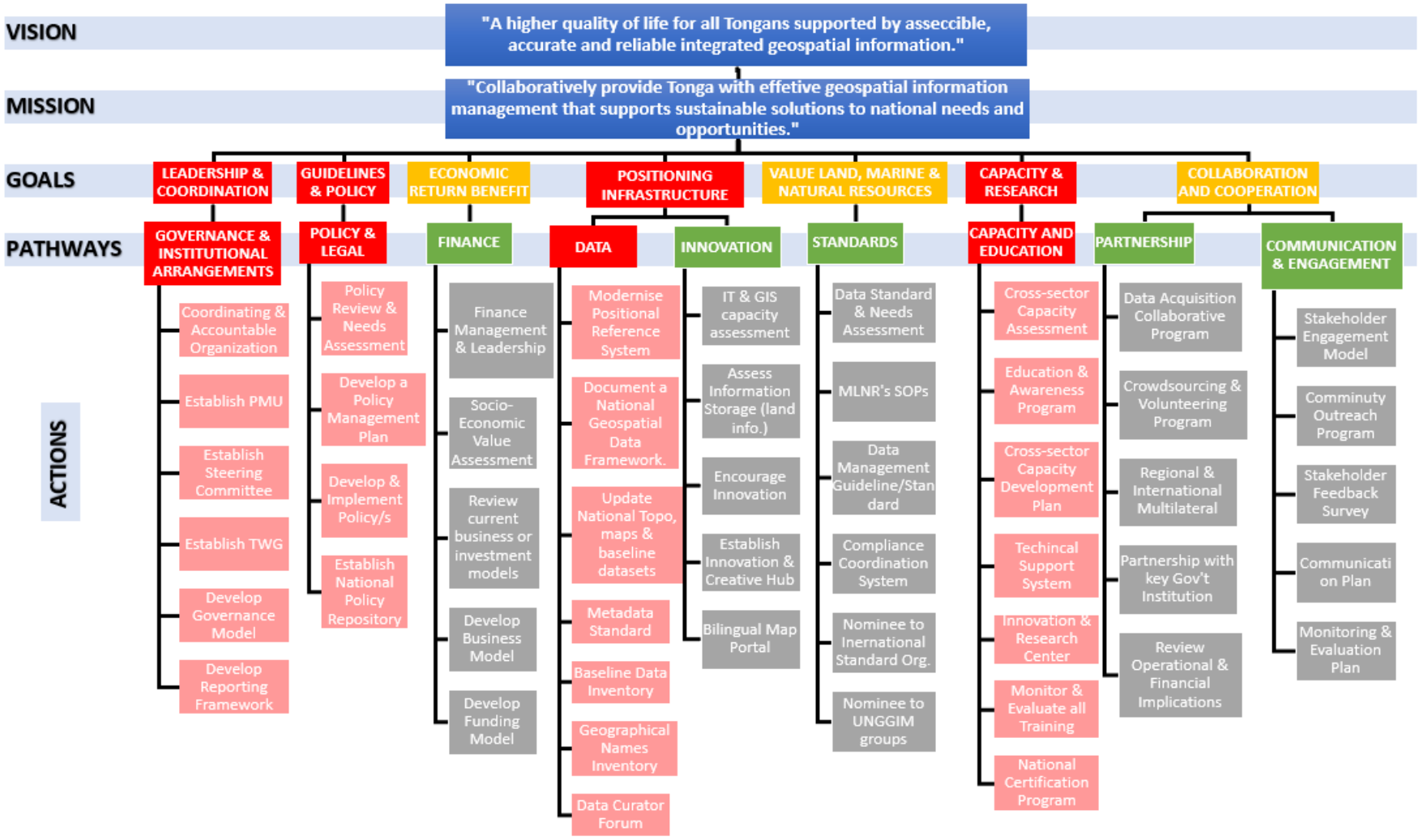


Figure 1: *The following pathway are detailed on certain pages: P1: 43 - 51, P2: 52 - 58, P3: 59 - 65, P4: 66 - 75, P5: 76 - 83, P6: 84 - 91, P7: 92 - 100, P8: 101 - 111, P9: 112 - 1*

The Action Plan is to be launched in 2022 for five years and it is to be biennially reviewed. A total of fifty-two activities are to be implemented within the five-year duration.

Table 1: ***Implementation schedule of the Action Plan***

		Year	1st Year - 2023				2nd Year - 2024				3rd Year - 2025				4th Year - 2026				5th Year - 2027			
		Yearly Quarters	Jan-Mar	Apr-Jun	Jul-Sept	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sept	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sept	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sept	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sept	Oct-Dec
STRATEGIC PATHWAYS	1	Governance & IAs																				
	2	Policy & Legal																				
	3	Financial																				
	4	Data																				
	5	Standards																				
	6	Innovation																				
	7	Partnership																				
	8	Capacity & Education																				
	9	Communication & Engagement																				

Marks End of Year | Priority Pathways | Duration of Implementation | Lag Period

- The pathways are inter-linked; actions in one pathway may be necessary precursors to actions in others. Thus, whilst we have priority pathways, they cannot be the sole focus for resourcing and delivery.
- Governance & Institutional Arrangements and Policy & Legal pathways are the foundation for other pathway activities that follow.
- It is important for Data and Standard to be implemented simultaneously, as they are related - reducing cost in implementation and time. Having completed five pathway activities within 12 months enable it to be updated, improved and altered in Year 3/4 if new requirements are identified or there are unexpected or uncontrolled changes that may occur.
- Innovation and Partnership pathways activities are interdependent on Data and Standard pathways setting an organised and legal platform in place to initiate a partnership program with the local community, joint-ventures etc.
- Capacity building & Education is implemented throughout the project's timeline to enable short-term training.

The Communication & Engagement pathway can be implemented at any time, it is imperative to engage with stakeholders early and consistently throughout the project.

Deliverables

The expected output to be delivered as a consequence of completing each action comes in various forms. Dependent on each action it would deliver in a form of a product, datasets, systems, operating procedures/strategies/program and plans, facility and reports. Each deliverable measures the effectiveness of the activities and the success of the Action Plan. An example of the deliverables includes:

- Full functioning committees.
- Financial management program for business investment and pricing model;
- Data Inventory of baseline datasets;
- Appropriate staff with delegated powers, funding and computing resources
- National Data Portal website;
- Standard Operating Procedure for MLNR information and data management etc.

Outcomes

This Action Plan's primary tangible benefit as a result of completed actions includes:

- Efficient planning and coordination of the government's geospatial information resources and strengthened institutional mandates and political buy-in.
- Consistent standards, affordable pricing and data custodianship encourages growing benefit and values of geospatial information.
- A policy and legal framework that evolves over time, responds to societal progress and technological developments, and keeps pace with fast changing economic, societal and personal landscapes; and
- A Business & Pricing Model that sustains integrated geospatial information management annually and in the longer term.
- Well-defined data supply chains that eliminate duplication and ensure sustainable standardized data is accessible to end users for integration and reuse;

High-capacity development for staff and organizations with strong and closer cooperation and coordination of stakeholder.

Risk Mitigation

Error! Reference source not found. focuses on key pathway activities and their risks of not being able to be achieved. The key pathway's activities and their level of risk likelihood and severity include:

Table 2: *Risks & Mitigation Strategy*

	Risk	Mitigation Strategy
Governance & Institutional	The lack of commitment from the stakeholder community to resource committee/council member roles.	-Reduce scope and minimize the number of meetings to what is achievable. -Increase communication.
	Changing of ministerial portfolios terms affects prioritized agendas.	Incorporate prioritized agendas into the organization's corporate and annual management plans.
Policy & Legal	Government institutions do not adopt the principles underpinning the policies.	Seek further consultation and feedback to understand issues with adoption and the consequences of non-compliance
	The policy is left un-updated to keep pace with changes in technological developments, societal and the economy.	Responsible organizations to include the review of policy management plan and the Policy in their annual plan activities.
	Lack of Integration of government policies.	Cross government stakeholder engagement.
Data	Insufficient time to complete the task.	Prioritized data sets so that those more frequently accessed will have sufficient metadata.
	A requirement for greater levels of consultation than anticipated.	Focus on getting the fundamental data themes/sets right in the first instance.
	Lack of resources (GPS, drones) for data collection and processing.	Prioritise the given deliverables. Engage in collaborations with other stakeholders with similar goals to share resources.
Capacity Building & Education	There is no evidence to indicate the increase of STEM intake students and graduates.	-Review curriculum. -Provide more training and geospatial resources for teachers.
	Graduate STEM students migrate.	-Enforce bonding agreements of 2- 3 years of work in Tonga. -Provide incentives to employees.

Budget Estimation

- The total budget estimation for all pathway activities over the 5-year implementation period is **$8,195,500** inclusive of recurrent and single allocation funding also the consultant fees shown in table 3. The Original funding columns shows the total amount of funding required for the project and after being disbursed over consultant fees and data and technology resources remain a Balance Funding which will be used for other resources such as vehicle/ fueling costs, office equipment, over time wages, workshop and meeting incentives, logistic costs, labor costs, material Costs, Travel Costs, Project Management Costs, In-kind Costs and Ongoing operations and maintenance costs i.e. future recurrent expenditure.

Table 3: *Budget Estimation*

Reference	Original Funding ($)		Balance Funding ($)		Consultant Fees	Data and Technology	Total Capital Required
	Recurrent	Single Allocation	Recurrent	Single Allocation			
SP1: Governance	100,000	960,000	50,000	783,000	300,000	477,000	2,670,000
SP2: Policy & Legal	10,000	130,000	7,500	56,000	40,000	50,000	293,500
SP3: Financial		58,000	-	88,500	26,000	77,500	250,000
SP4: Data	513,000	13,000	405,000	671,000	40,000	360,000	2,002,000
SP5: Innovation	38,000	134,000	20,000	100,000	30,000	186,000	508,000
SP6: Standards	30,000	61,500	10,000	71,000	30,000	30,000	232,500
SP7: Partnership	10,000	80,000	48,000	62,000	10,000	53,000	263,000
SP8: Capacity & Education	35,000	222,000	39,500	660,000	160,000	691,000	1,807,500
SP9: Communication & Engagement	5,000	30,000	11,500	82,000	20,000	20,500	169,000
	Original Recurrent Budget	**Original Single Allocation**	**Recurrent Budget - Balance**	**Single Allocation - Balance**	**Consultant Fees**	**Data and Technology**	**Total Capital Required**
TOTAL	**741,000**	**1,688,500**	**591,500**	**2,573,500**	**656,000**	**1,945,000**	**8,195,500**

Funding Status

There are three ways the funding is to be attained:

i. Government contribution to the National Geospatial Action Plan 2022 - 2026 on behalf of the hosting Ministry.

ii. Co-partnership funding between line organisations as their contribution and willingness to achieve the goals of this action plan.

iii. Funding requested to international and/or regional organisations on behalf of the leading organisation and that of Tonga.

It is also recommended that the business model developed should be able to replace the recurrent budget that has not been fully secured

BACKGROUND

COUNTRY PROFILE

Tonga lies at 21°08'S 175°12'W below the equator in the South Pacific Ocean, with an EEZ covering 761,011 km². It is home to 100,209 population (Census 2021 Preliminary Results, Tonga Statistics Department) dispersed in four of its island groups Tongatapu (main island), Vava'u, Ha'apai and the Niuas (Niuafo'ou & Niuatoputapu). Tonga has a volcanic and coral atoll island formation in which 36 out of 172 are inhabited, with a total landmass of 748km². Tonga has two main seasons, the hot-wet season from November to April otherwise known as the cyclone season and the dry season May to October. The average temperature varies across the archipelago from 27 °C- 24° and an average rainfall of 1600mm with lots of annual variability observed over the years.

KINGDOM OF TONGA

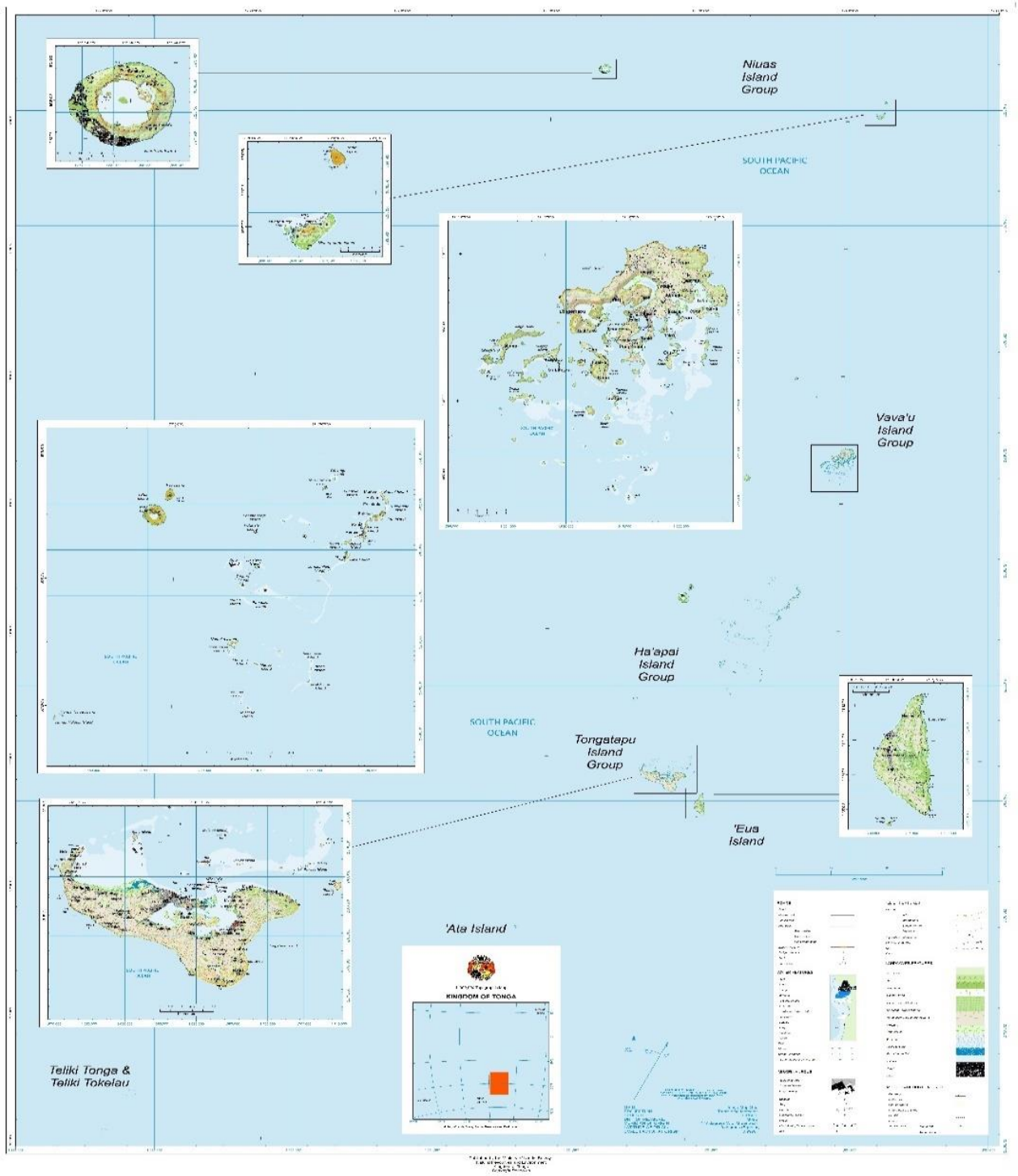


Figure 2: ***Map of Tonga***

History of geospatial information in Tonga

In 2001, tropical cyclone WAKA a category 4 rampaged Tonga leaving behind an estimated economical loss of millions of pa'anga. Tonga's inability to provide evidence-based data to support respond to emergencies of TC WAKA raise the demand for convenient data availability and advance data analysis as evidenced based mechanism.

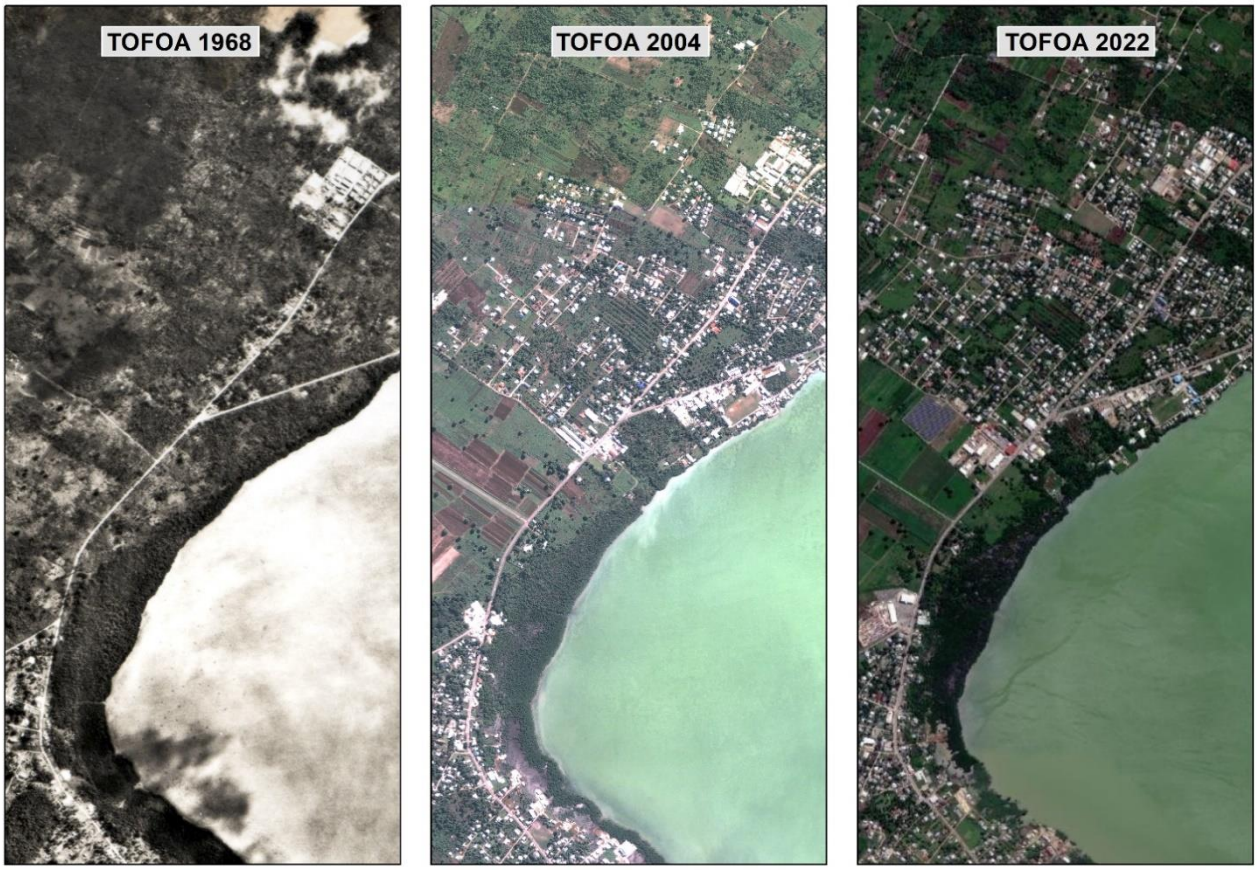


Figure 3:*A comparison of the aerial imageries of Tofoa from 1968, 2004 and 2022.*

INTRODUCTION

What is geospatial information?

Geospatial information originated from the term Geographic Information System (GIS) or otherwise known as Geoscience. It is defined that:

> *"…GIS integrates hardware, software, and data for capturing, managing, analysing, and displaying all forms of geographically referenced information. GIS is used to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts. A GIS helps you answer questions and solve problems by looking at your data in a way that is quickly understood and easily shared."*

A more sophisticated level of geospatial information includes collation of several location-related datasets combined into layers that visualise information such as population density and land use.

Geospatial Information Management (GIM) encompasses the management, leadership, structures and practises required for the successful operation of GIS within an entity, nationally, regionally or globally.

Technological advancement in GIS tools help collect, process and analyse geospatial data. Tools such as satellites, aircraft and unmanned aerial vehicles (drones) for capturing of image datasets, GPS tools and various GIS/mapping software for drawing or digitalisation of topographical datasets and their processing, analysis and reporting.

Today, geospatial information describes the physical location of features around us on, above, and below, planet Earth. It also describes the relationships of these 'geographic' features with other features and associated information. In other words, geospatial information is data that is referenced to a location or place, such as geographic coordinates, an address, a building, or even a vehicle travelling along a road. It describes the location of 'where' all things are, and provides the digital connection between people, their place, their activities, and their environment. In this regard, geospatial information reflects the digital version of our physical world, in which all human, economic, and environmental activity takes place. Comprising both data and enabling technologies, geospatial information touches many sectors and thematic areas across the entire development paradigm. Due to its cross-cutting nature, geospatial information is a critical component of a national infrastructure and knowledge economy that provides a nation's blueprint of what happens where, and the means to integrate a wide variety of government services that contribute to economic growth, national security, sustainable social development, environmental sustainability, and national prosperity.

Tonga – Action Plan

The Kingdom of Tonga's Action Plan provides detailed steps towards achieving the short-term and long-term strategic goals for strengthening integrated geospatial information management and draws on the recommended methods documented in the Integrated Geospatial Information Framework (IGIF) Part 2: Implementation Guide, along with justification of the approach. The Framework provides the strategic guidance that has enabled this country-level action plan to be prepared and implemented.

This Action Plan was developed as part of a United Nations Development Account 11th tranche Project 1819D "Strengthening geospatial information management in developing countries towards implementing the 2030 Agenda" focuses on improving and strengthening national geospatial information management capacities.

The project supports six target countries (Burkin Faso, Ethiopia, Fiji, Mongolia, Nepal and Tonga) to increase awareness and understanding of nationally integrated geospatial information management develop and strengthen national leadership capacities and mechanisms. The project provided opportunities for capacity development by referencing globally agreed frameworks and guides, and will recognize national circumstances and culture in the capacity development process. The DA11 Project ended in June 2022 and was followed by the SDG Data Alliance project to support for the ongoing completion, communication and early implementation of the action plan.

Direct benefits of the NGAP include encapsulating new and innovative approaches to national geospatial information management, implementing integrated evidence-based decision-making solutions, and maximizing and leveraging national information systems that are tailored to Tonga's situations and circumstances.

The approach will assist Tonga to move towards, e-service, e-commerce and smart technologies and geo-analysis to improve services to citizens, build capacity for using technologies, provide evidenced based system and enhance informed government decision-making processes. Especially on climate change and disaster management, facilitate private sector development, take practical actions to achieve a digital transformation, and to bridge the geospatial digital divide in the implementation of national strategic priorities and the 2030 Agenda for Sustainable Development.

Integrated geospatial information FRAMEWORK (IGIF)

The United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) at its eighth session in August 2018 adopted the *Integrated Geospatial Information Framework*[3]. This Overarching Strategic Framework provides a basis, a reference and a mechanism for countries to develop and strengthen their national and sub-national arrangements in geospatial information management and related infrastructures and capacities.

The Integrated Geospatial Information Framework envisages that governments will achieve sustainable social, economic and environmental development through the effective use of national geospatial information systems and capabilities for evidence-based policy and decision-making.

The IGIF vision is for the efficient use of geospatial information by all countries to effectively measure, monitor and achieve sustainable social, economic and environmental development – *leaving no one behind*.

In order to strengthen Integrated Geospatial Information, it is anticipated that Tonga will promote and support the required innovation, leadership, coordination and standards in order to develop, strengthen, integrate and deliver national geospatial information policy, data, systems, tools, services and capabilities into their national development policies, strategies and arrangements.

The objective of the Framework is to translate concepts into practical implementation guidance for use by Member States. It does this by leveraging seven (7) underpinning principles, providing eight (8) goals and nine (9) strategic pathways as a guide for governments to establish more effective geospatial information management practices and policies (Figure 1). The objective of the nine strategic pathways is to guide governments towards implementing integrated geospatial information systems in a way that will deliver a vision for sustainable social, economic and environmental development.

Project Plan Components

The NGAP project consists of four components, the first three for the development, consultation and preparation of the NGAP. The objective of each component and the anticipated outcomes are illustrated in Figure 4 and explained in more detail below.

[3]Committee of Experts on Global Geospatial Information Management, eighth session, Decision 8/113, August 2018

Figure 4: *Project Plan component. Source:* (United Nation, 2019)

Figure 5: *First internal meeting held within the MLNR, with Head of Sections, Divisions, Technical staff and the CEO, 8th July, 2019*

The first national workshop commenced with a presentation from a MLNR's GIS officer on "What is Geospatial Information?", and its use case scenarios or application related to various sectors, as captured in Figure 5, 6 and 7 to which several stakeholders attended and discussed on the relevancy of GIS within the government. For example; disaster damage assessments, environmental management of protected areas, asset management of utilities datasets, spatial planning of infrastructure developments, etc. The presentation aimed to convey what is Geospatial, how it works, its technologies and highlighted the value and benefit of geospatial information and the final product used to guide and support decision making.

Figure 7: *Group discussion on the PEST Analysis. Presenter: Mr. Pesa Tu'iano representing the consultancy firms and presenting on the Technological theme for IGIM.*

Figure 6: *Participating members of the invited stakeholders who attended the 1st National Stakeholder Workshop on Integrated Geospatial Information Management. 23rd July, 2019.*

The first session focused on briefing the below list at an administrative/organisational level or level 2 of the Development Account Project Plan:

- The Integrated Geospatial Information Framework.
- Nine strategic pathways were briefed,
- Development Account Project plan and its underlying activities and
- Strategically alignment to international, national and organisational priorities.

The second session focused at level 3 or to individual technical expert representing MDAs:

- Q&A session on Activity 4 and Activity 5 (these were delivered 5 days prior to the workshop). Refer to APPENDIX 9: IGIF (Integrated Geospatial Information Framework): Activity 4 & 5 Template and MDA table.
- A group discussion conducted the PEST Analysis (focus group approach) of a minimum of six people per group, a total of four groups. Refer to *Appendix 10: PEST Analysis.*
- The SWOT analysis was conducted in an open group discussion method Refer to Appendix 10: SWOT Analysis.

Generally, out of the thirty-four stakeholders, twenty-six attended the workshop. Refer to Appendix 9 for list of participating stakeholders five of the ten organizations who submitted their surveys requested a one-to-one meeting to help answering their surveys. A follow-up second meeting was held for 6 MDAs that missed the first National Stakeholder Workshop (Figure 8).

Figure 8: ***Second national stakeholder workshop for stakeholders who that didn't join in the first national stakeholder workshop, 27th Aug, 2019***

Strategic Context and Rationale alignment

1. Relationship to Sustainable Development Goals

The 2030 Agenda for Sustainable Development provides the global policy to guide the way countries collectively manage and transform the social, economic and environmental dimensions of people, planet and prosperity.

The broad and transformative nature of the 2030 Agenda for Sustainable Development also provides tremendous opportunity for the geospatial community to meet the unprecedented need for more data covering all aspects of sustainable development. The 2030 Agenda requires new data acquisition and integration approaches and the need for "high quality, timely, reliable and disaggregated data, including earth observations and geospatial information", and with commensurate new and innovative data sources and methods.

Geospatial information provides the integrative platform for all digital data that has a location dimension. All countries and all sectors need geospatial information for national development and decision-making.

Geospatial information has the very real potential for forming a new and emerging "data ecosystem" for sustainable development. Integrated information systems that are comprehensive and coordinated, are able to provide evidence on the state of the Earth, people, events and activities, and to deliver timely information necessary for citizens, organizations and governments to build accountability and make well-informed evidenced-based decision.

As a consequence, there is a need to significantly support Tonga to work towards national integrated geospatial information management systems through the formulation of appropriate frameworks, guidelines and methodologies that can be piloted and implemented within and across government, sectors and people.

This project leverages the Integrated Geospatial Information Framework, developed by UN-GGIM and the World Bank in collaboration with Member States, to deliver training designed to assist Tonga to strengthen their geospatial information management capabilities and capacity. Refer to APPENDIX 8: UNGGIM Background for the Integrated Geospatial Information Framework.

2. Holistic Alignment

During the development of this NGAP a needed alignment of the SDG to the NGAP was developed at different level of International (SDG Agenda and IGIF), Regional, National (Tonga's overarching framework – TSDF II) and sector level strategies and plans. Some regional frameworks have significant focus while others have cross-sectoral focus such as the UN Pacific Strategy 2018-2022. The NGAP consists of 7 goals that supports the Ten (10) national strategic drivers (thematic areas): six (6) from the TSDF II and four (4) from existing sectoral plan that drives the focus of this Plan in relation to the Sustainable Development Goals (SDGs). Subsequently the Goals trickle down with actions per pathways. For this purpose, a summary of the alignment of strategic drivers to the SDGs follows.

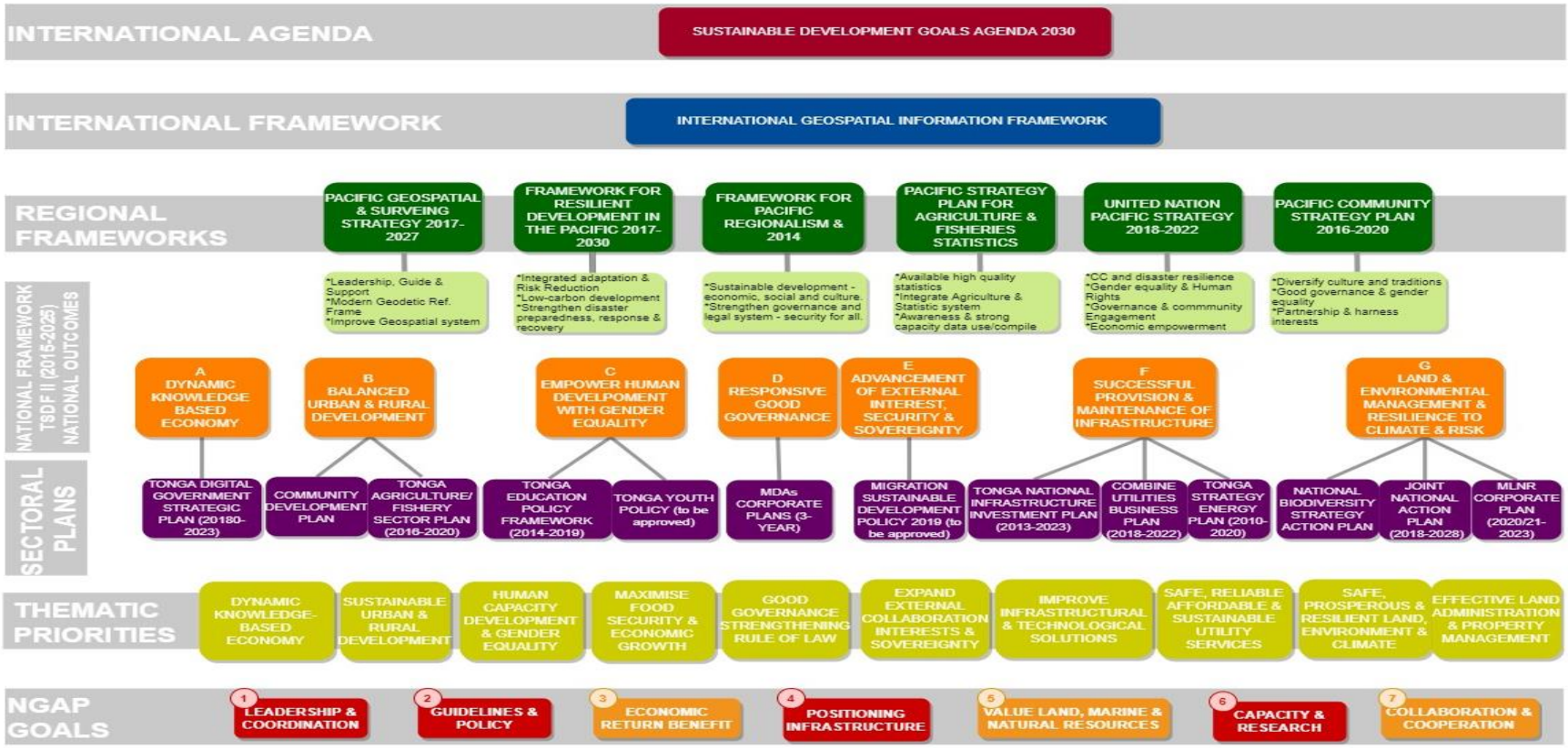


Figure 9: *Alignment of NGAP Goals to International, Regional and National Frameworks.*

The overarching strategy framework that oversees the GoT national outcomes rests in the ***Tonga Strategic development Framework-Two (TSDF II)***, a 10-year term and is a result of the previous TSDF (2011-2014). As documented by the Ministry of Finance and National Planning (2015), the TSDF II vision *"A more progressive Tonga: Enhancing our Inheritance"* captured the motto, culture and results framework that map across various government organisations level plans and budget sectors which coherently links with national priorities. These priorities are reflected on established national policy and legality as well as supported through international strategies and agreements.

The TSDF II's national outcome aligns Tonga's priorities to international primacies such as the UN Sustainable Development Goals 2030 Agenda. The national outcomes disaggregate into twenty-nine organisational outcomes (OO) that enable organisational level implementation. The cascading system of planning for the TSDF II links from national to organisation and staff levels; and aims to be delivered with all level contributes to the same cascading result. The pyramid cascading system is observed as the Monitoring and Evaluation Plan where the ten-year TSDF guide medium term sector and district/island master plans, three-year rolling, Corporate Plans and Budgets, and Annual Divisional, Staff Plans and Job Descriptions for all MDAs

The NGAP seeks to strengthen and accelerate the progress of the existing national framework TSDF II as NGAP better complement the TSDF II current progress by acting as a key evidence-based provider. The NGAP is a cross cutting sector plan across all pillars and national outcomes. The most direct relation of NGAP to organisational outcomes is observable in*: Table 4: Significance of NGAP Pathways to the National Outcomes (TSDF II).*

Strengthening Integrated Geospatial Information Management

The Kingdom of Tonga Country-level Action Plan will be delivered through a Vision, Mission, seven (7) Goals and nine (9) Strategic Pathways. Following the Pathways, are several actions that trickle down to activities that enable the implementation of each action and its' activity.

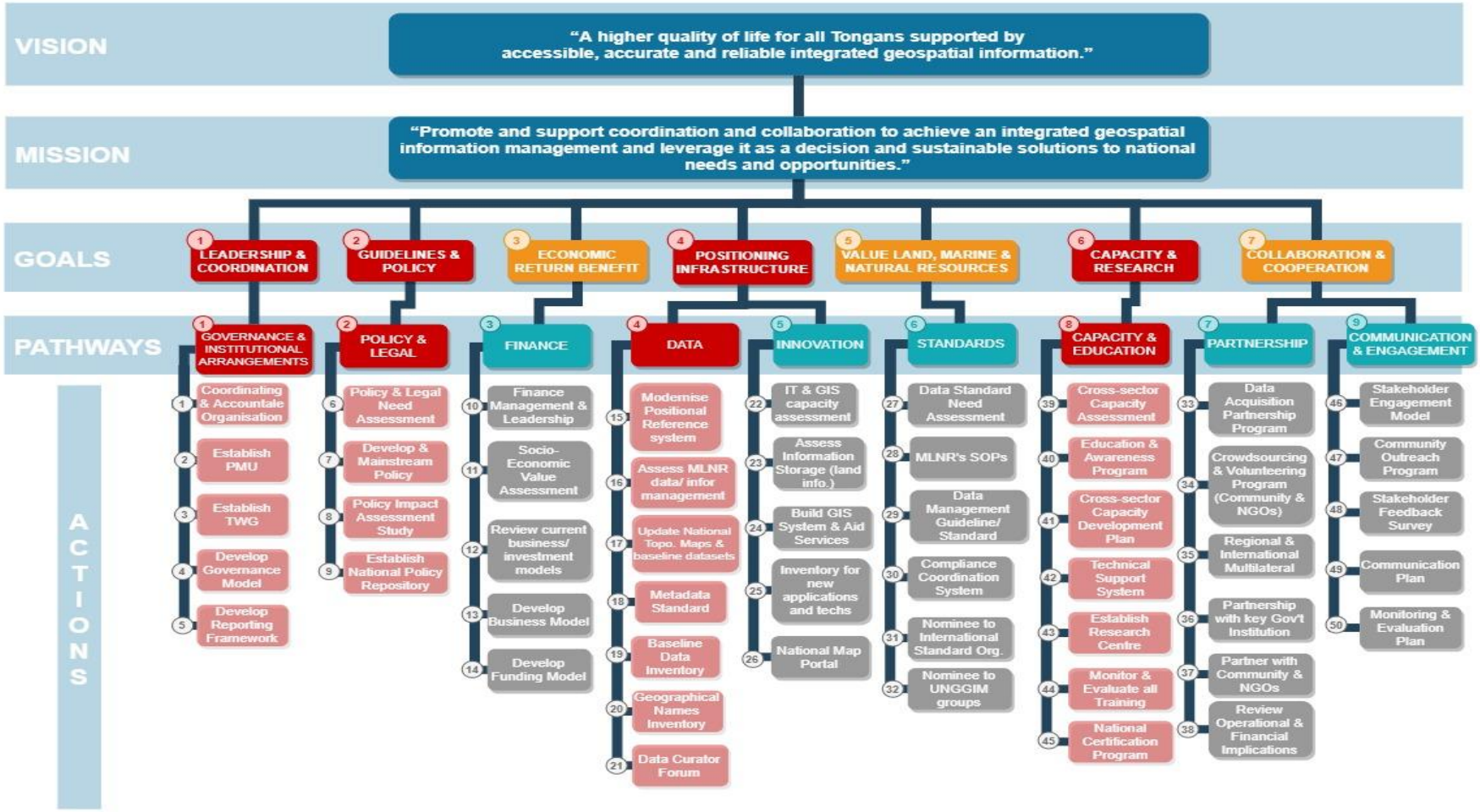


Figure 10:The following pathways are detailed at certain pages: P1: 43 - 51 – pg28-36, P2: 52 - 58 – pg37-44, P3: 59 - 65 – pg45-53, P4: 66 - 75-pg54-67, P5: 76 - 83 – pg68-78, P6: 84 - 91 – pg79-87, P7: 92 - 100 – pg88-98, P8: 101 - 111 – pg99-112, P9: 112 - 119

Pathways Descriptions

1. **Governance and Institutions** – aims to attain political endorsement, strengthen institutional mandates and build a cooperative data sharing environment through a shared understanding of the value of an Integrated Geospatial Information Framework, and the roles and responsibilities to achieve the vision.
2. **Policy and Legal** – aims to address current legal and policy issues by improving the laws and policies associated with, and having an impact on, geospatial information management, and by proactively monitoring the legal and policy environment, particularly with respect to the issues raised by emerging technologies and the evolving innovative and creative use of geospatial information.
3. **Financial** – aims to achieve an understanding of the implementation costs and ongoing financial commitment necessary to deliver integrated geospatial information management that can be sustained and maintained in the longer term.
4. **Data** – aims to enable data custodians to meet their data management, sharing and reuse obligations to government and the user community through the execution of well-defined data supply chains for organizing, planning, acquiring, integrating, curating, publishing and archiving geospatial information.
5. **Innovation** – aims to stimulate the use of the latest technologies, process improvements and innovations so that governments, no matter what their current situation is, may leapfrog to state-of-the-art geospatial information management systems and practices
6. **Standards** – aims to enable different information systems to communicate and exchange data, enable knowledge discovery and differencing between systems using unambiguous meaning, and provide users with lawful access to and reuse of geospatial information.
7. **Partnerships** - aims to create and sustain the value of geospatial information through a culture based on trusted partnerships and strategic alliances that recognize common needs and aspirations, and national priorities
8. **Capacity and Education:** to raise awareness and develop and strengthen the skills, instincts, abilities, processes and resources that organizations and communities require to utilize geospatial information for decision-making
9. **Communication and Engagement:** aims to deliver effective and efficient communication and engagement processes to encourage greater input from stakeholders in order to achieve transparent decision-making processes when implementing the Integrated Geospatial Information Framework

Table 4:Significance of NGAP Pathways to the National Outcomes (TSDF II)

NGAP – Goals		1 Leadership	2 Policy Framework	5 Economic Benefit	3Quality 4 Value	7 Research &Training	3 Quality 4 Value	6 Inclusive & Awareness	7 Research &Training	6 Inclusive & Awareness
TSDF II (2015-2025)										
National Outcome	**Pillars**	Governance	Policy & Legal	Finance	Data	Innovation	Standard	Partnership	Capacity & Education	Communication & Engagement
A. Dynamic, knowledge-based economy.	1.Economic									
B. Balanced urban & rural development across island groups.	2.Social Institutions									
C. Empower human development with gender equality.										
D. Responsive good-governance.	3.Political Institutions									
E. Advancement of our external interests, security and Sovereignty.										
F. Successful provision and maintenance of infrastructure.	4.Infrastructure & Technology Inputs									
G. Effective land & environmental management and resilience to climate & risk.	5.National Resources & Environmental Inputs									
KEY	Most Significant ☐	Moderate ☒	Less ☐	None ☐						

Vision and Mission

The Vision for the Country Action Plan was constructed with the need to align Tonga's national strategy: Tonga Strategy Development Framework II 2015- 2025 (TSDF II) with UN's overarching strategy the Integrated Geospatial Integrated Framework or IGIF.

"A quality life for all Tongans supported by accessible, accurate and reliable integrated geospatial information."

The Mission was developed with the understanding that it should reflect how the Vision is to be achieved taking into account the core values that shape the behavior of what needed to achieve the Vision, and this is through strengthening communication and participation of the nation.

"Collaboratively provide Tonga with effective geospatial information management that supports sustainable solutions to national needs and opportunities."

Goal and Objectives

The Goals were created to mirror the desired outcome that requires actions, specifically aligning with core strategic initiatives and priorities of the nation. The Goals touched on many aspects of the IGIF in relation to Tonga's prioritized areas. Compromises of:

1. *Establish leadership and coordination necessary to deliver and manage effective integrated geospatial information by 2026*
2. *To develop geospatial guidelines and policy framework by 2022-2026 to promote data standards, sharing and accessibility.*
3. *To develop a modernized National Positioning Infrastructure to ensure accurate and reliable positions are produced for the management of geospatial data and for all positioning users throughout Tonga.*
4. *To increase the impact of Land administration, Marine and Natural Resources geospatial information to attain national sustainable development objectives.*
5. *Develop a progressive sustainable national economic return benefit plan by 2022 – 2026 to create opportunities that enhance higher socio-economic quality of life for all.*
6. *To expand capacity development, initiate research and innovation of GIS application progressively with a focus on advancing emergency management, disaster risk reduction, and environmental monitoring.*
7. *Increase and sustain inclusive collaboration and cooperation of geospatial information users to build awareness, strengthen relationships and support geospatial information benefits.*

This National Action Plan is intended to review its progress every two and a half years during the month of June/July to identify activities that requires acceleration and activities that have been successfully implemented for identifying lesson learnt. The NAP will be revised at the end of the fifth year to revise new priorities in the NAP in terms of their pathways and activities and seek renewal of the NAP.

Structure of this Document

The Country-level Action Plan is categorized according to the IGIF Strategic Pathways: Each Strategic Pathway identifies:

Agencies involved – Identifies stakeholders with interest or responsibilities for Strategic Pathway Actions.

Contact Person – To be contacted for more information on the Strategic Pathway Actions

Background and Rationale – Information for the reader so that they understand why the activities have been identified. This section includes a brief statement on the current situation and gaps in capabilities

Proposed Approach – This section provides a broad overview of how each action in the strategic pathway interrelates. It includes examples and diagrams to assist the reader in understanding the broader framework in which the activities are contained. Some of these examples are adopted/adapted from the IGIF Part 2: Implementation Guide.

Objectives – These are the objectives of delivering the approach (Strategic Pathway). They are important to include in the Country Action plan as they can be incorporated in future business cases or when seeking approvals, such as for a new governance model, as they explain the rationale for undertaking the activity.

Actions – This section lists the actions and their activities within each action. These activities are incorporated into a Gantt chart. Actions are determined through the Country Needs Assessment and Gap Analysis. The Integrated Geospatial Information Framework Part 2: Implementation Guide is used as a reference to determine what activities can be implemented to address gaps in current capabilities

Implementation Timeframe – This section includes a Gantt chart (also referred to as a schedule) that includes action timeframes, and the interdependencies between activities and tasks within and across strategic pathways. It is visualization (Gantt chart) of the Action Plan's activities. See APPENDIX 3: IMPLEMENTATION SCHEDULE for the complete Implementation Schedule in this document.

Deliverables – These are the products/systems/reports that are expected to be delivered as a consequence of completing the activities.

Outcomes – This section identifies the things that change because an activity has been completed i.e., the real or tangible differences that are being made towards strengthening integrated geospatial information management, and as a consequence to achieving on the SDGs and thus to people's lives. The outcomes can be written as benefits.

Risk & Mitigation – With any action plan there is a risk of not being able to complete activities. This section identifies the risks, their likelihood and severity, and the risk mitigation strategy that need to be put in place.

Budget Estimation - This section identifies the budget required for each action. Note: The investment required for each action will be identified in each pathway's funding status and proposed investment model under the Financial Strategic Pathway 3. See APPENDIX 1: NGAP CHRONOLOGY for the complete Implementation Schedule in this document.

Funding Status – This section identifies the funding sources or the approach to being used to seek funding or in-kind support, such as potential partnerships. The funding sources and potential partnerships will be identified in relevant activities under the Financial Strategic Pathway 3.

Monitoring and Evaluation

The Action Plan will be monitored and evaluated by the LGIS Division, MLNR. By the direction of the LGIS Division, Head of Division will have allocated officers responsible for monitoring, evaluation and keeping track of how Actions progressed overtime within the allocated timeline; the required man-power and resources needed to implement each action successfully within organisational, national and/or international best practises.

The LGIS Division is also responsible for collecting and reporting at agreed interval to the Steering Committee and Technical Working Group and all relevant stakeholder parties of the progress reports. Reporting on when the scheduled completion data is attained or in threat of not being met based on the indicators and relevant threats or risks to activities.

A Monitoring and Evaluation template is provided, and to be populated throughout the project timeline. The M&E form consist of columns depicting the:

- ***Strategic Pathway***: The nine (9) strategic pathways of the IGIF.
- ***Objective***: Specific target to attain in relation to each Action. If an objective is not met, corrective action may be/ is required.
- ***Outcomes***: General achievement of the Actions.
- ***Success Indicators:*** used to monitor and evaluate progress towards strengthening integrated geospatial information management. Success can be gauged by measuring progress towards achieving the objectives for each Strategic Pathway. Achievement of objectives indicates you are on the right path towards achieving your strategic goals. It is worthwhile, documenting contributing factors and extenuating circumstances that may justify leaving the objective as-is, or changing it.
- ***Means of Verification***: Relevant evidence that verifies the status or the success indicators outcome.
- ***Traffic Lights***: Similarly, to traffic lights; denote the progress and status of the M&E of the Action Plan.

  Green = Objective has been achieved

  Amber/ Orange-brown = Objective is on track to be delivered

  Red = Objective is delayed and requires review and action

- **Progress Comments**: Additional recommendations, or other useful aspects relevant to the Actions that need to be considered in the project's duration.

  See APPENDIX 4: MONITORING AND EVALUATION for an example on Monitoring and Evaluation in this document

Reporting Framework

The reporting frameworks (*Figure 11*) will include formal updates to the Leadership committee having consisted of the Technical Working Group, MLNR and Cabinet (if required). These will be delivered by the Director of the LGIS Division. Stakeholders will also be informed of progress by the PMU and relevant officers at the agreed time.

Agencies responsible for the implementation of specific Strategic Pathways designated under the Action Plan are required to provide a quarterly and annual plan report to the PMU. The LGIS will then compile these reports and update the MLNR and Working Group at a regular basis. Meetings and workshop can be held at the request of stakeholder and not limited to the duration of the project and will be host by the PMU and MLNR. Responsible agency's participating officers will be their contact officer for updates and other responsible duties allocated as according to the Action Plan. The reporting obligations of responsible agencies per Pathway should include in the form of the M&E template whether activities are successfully achieved, behind or are not achieved and the reason behind these statuses. Relevant recommendation is also required to resolve uprising issues or unexpected changes to the predetermined activities

Figure 11:Reporting Framework for the M&E framework and review timeline during the project's duration

SP1. GOVERNANCE AND INSTITUTIONS

Establish leadership, governance model, institutional arrangements and a clear value proposition to achieve multi-disciplinary and multi-sectorial participation and commitment.

1.1 Agencies Involved

Lead and Monitoring Ministry: LGIS Division - Ministry of Land & Natural Resources

Implementation Agency: Ministry of Lands & Natural Resources, Public Service Commission and Prime Minister's Office.

Stakeholder Community: Key stakeholders and large government organisation that generates data, such as the MLNR, MEIDECC, Ministry of Infrastructure, MAFF, Tonga Statistics Department; and government departments who are significant users of geospatial information.

1.2 Contact Persons

The CEO or person(s) to be assigned/authorized by the CEO, to oversee and provide result orientation of this Strategic Pathway.

MINISTRY OF LANDS & NATURAL RESOURCES ✸ Chief Executive Officer ✸ HoD - Land Geospatial Information Service ✸ HoD - Corporate Services Division	PUBLIC SERVICE COMMISSION ✸ Oversight Division NATIONAL PLANNING & PMO ✸ HoD – National Planning Division

1.3 Background and Rationale

Institutional coordination and collaboration are to be strengthened in order to strengthen integrated geospatial information management. Currently, institutional arrangements are based on official channels of information flow. The approach is subject to a high degree of bureaucracy for data requests, preparation and official mandates of the government or NGOs, and data transfers. Delays are frequent and are often due to the amount of demand; level of approval needed to release information and expensive administrative costs of data or information.

Fast tracking procedures is possible in the event of 'declared state emergencies' as supporting national institution are already mandated in place. However, with everyday procedures, process is reliant on personal relationships or urgent requests, personnel changes may cause collapse in relation. For example; the ministerial portfolios changes of decision makers every 4 years. These changes may either keep or change the existing priorities/ personal relationships.

The absence of the national governance model to direct management of geospatial information perhaps is the key capacity that needs to be resolved prior to establish additional actions. In addition, the fragmented and silo institutional structures and leadership create a wider gap in communication and management. The GIS section in the Ministry of Lands and Natural Resources manages geospatial information but is limited within the Ministry's scope of functions and values.

Other weaknesses include the need to strengthen the existing leader or champion to spearhead the directing and formulation of necessary institutional structures and value proposition of geospatial information across various audiences, ranging from a government organisation to interested individuals.

There is a need to develop enduring underpinning structures. The emerging changes in the geospatial information industry require new governance arrangements that take into account the balance between public and private sectors, data sources and data users. It is also important to recognise the potential contribution from research and development bodies. For this purpose, the underlying actions are formulated to better govern, direct and manage geospatial information management.

1.4 Proposed Approach

The Kingdom of Tonga proposes the following Governance Model (Figure 12 and

Figure 13) that includes the official recognition of the Ministry of Lands & Natural Resources, Lands Geospatial Information Division (LGIS) as the coordinator and accountable for overseeing the implementation of the NGAP with other administrative unit established (Leadership Committee) to assist conducting communication channels and carrying out the responsibility to assist relevant stakeholders under the guiding principles of the IGIF.

Stakeholders are broadly grouped into four (4) Institutional Structures, they are essential considering their level of influence and impact on IGIM; i.) Government organisation, ii.) Public enterprises, iii.) Private enterprises, iv.) Non-profit organisation and v.) People. the elements that build the context of the Governance & Institutions pathway: Value proposition, institutional arrangements, leadership and governance model. All of these factors are conveyed using the defined communication channels.

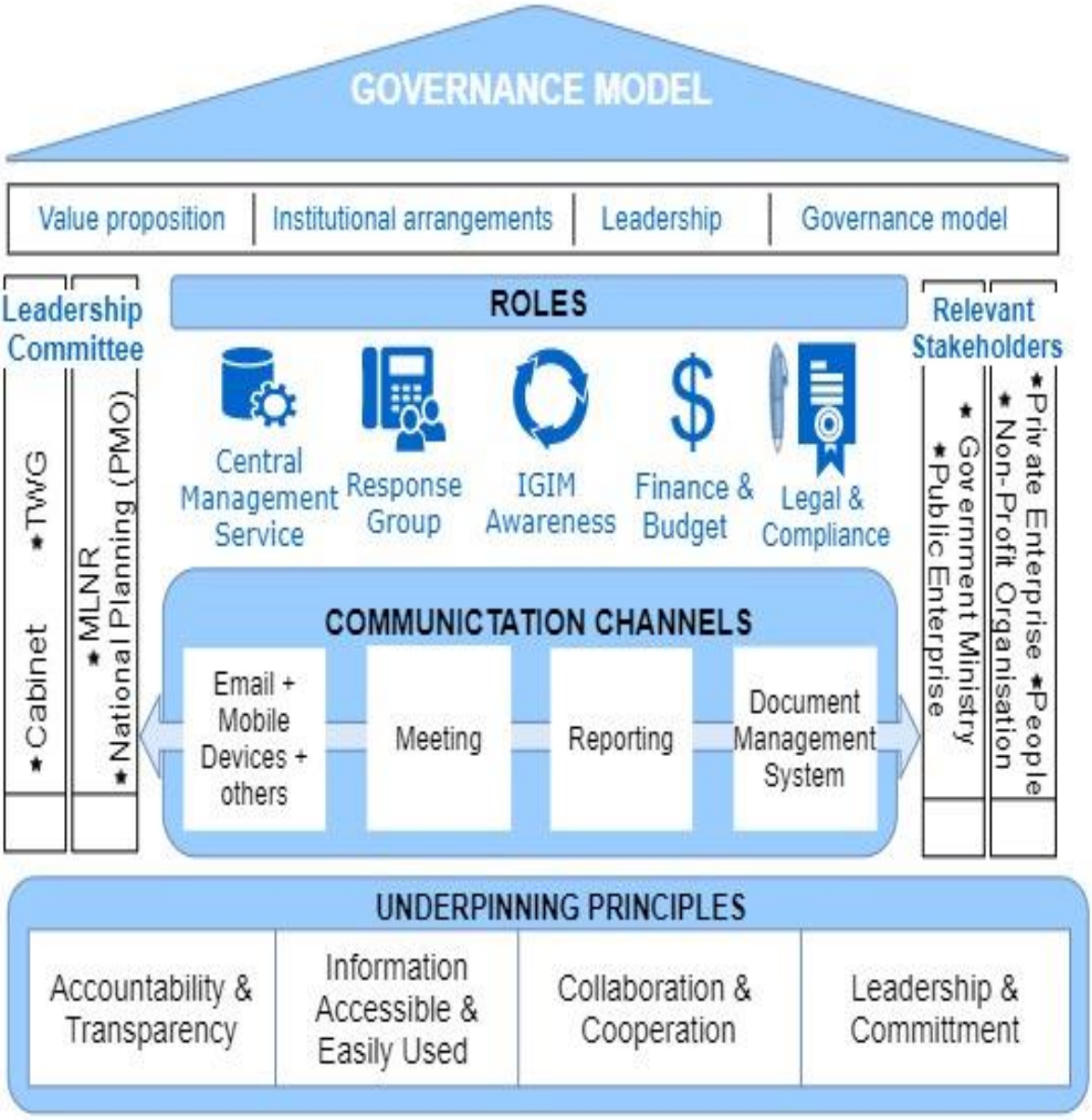


Figure 12: *Proposed Approach - Governance Model*

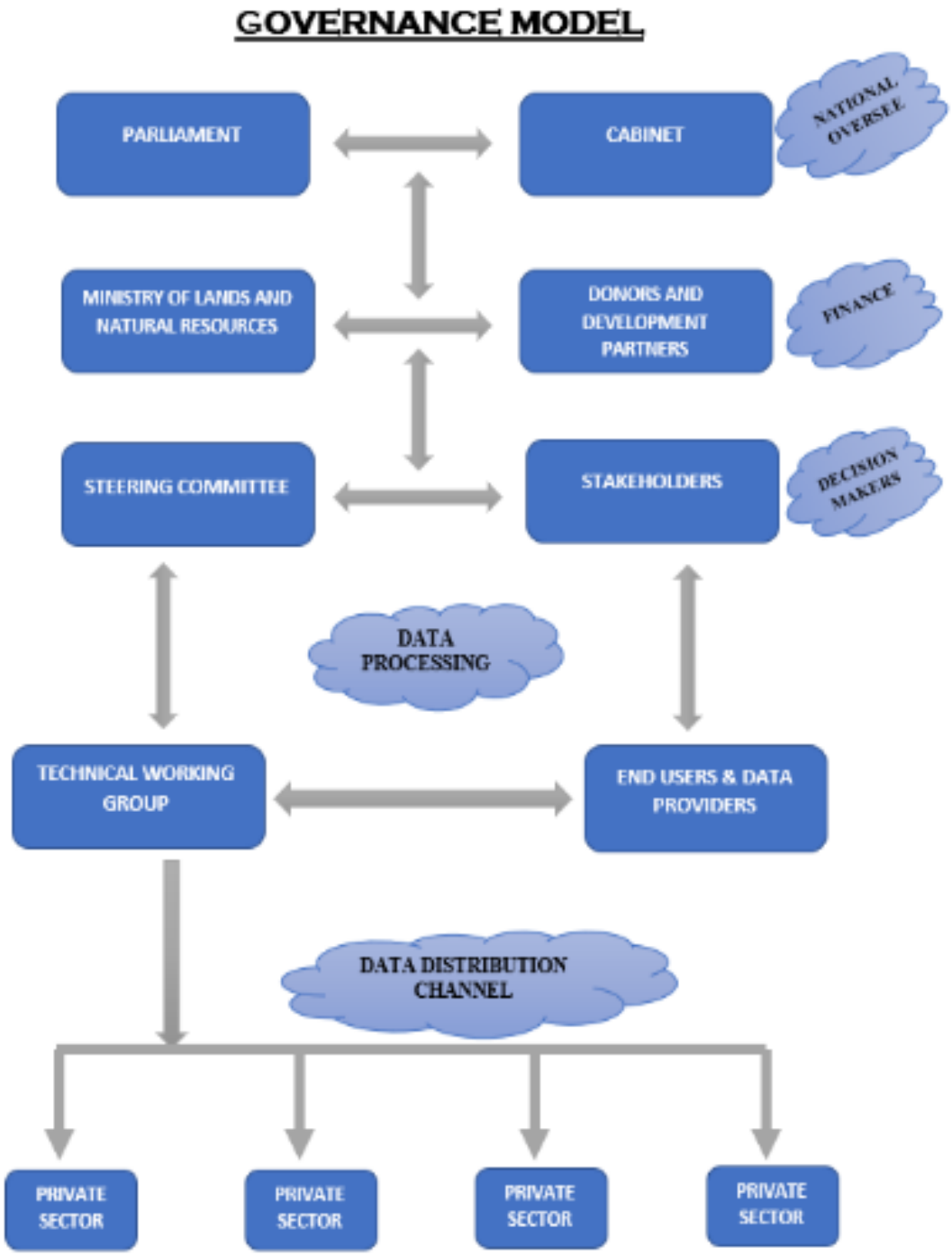


Figure 13: *Governance Model - Roles and Processing Management*

1.5 Objectives

The overarching aim is to attain political endorsement, strengthen institutional mandates and build a cooperative data sharing environment through a shared understanding of the value of an Integrated Geospatial Information Framework. Through a mandates clear delegated levels of authority and roles and responsibilities for strengthening integrated geospatial information management to achieve the vision.

Specific objectives (per action) for formalising the geospatial information management Governance and Institutional Framework in the Kingdom of Tonga are to:

- To identify the leading organisation to manage, integrate and share geospatial information.
- To establish a team responsible for coordinating and implementation of the NGAP 2022 – 2026 and the future implementation of such activities in the future.
- Establish a Steering Committee to coordinate and manage the overall performance of the activities implemented.
- Provide a focal point for strategy national imperatives and institutional requirements to provide direction, support and endorsement of mandates to achieve the Goals, Mission and Vision.
- Offer a governance model that is easily accessible and credible to participating institutions, which clearly outlines roles, responsibilities and tasks allocated to each of the stakeholders.
- Require regular cross-sector and cross-committee reporting and monitoring, complemented by re-evaluation of performance expectations and adjustments where necessary.

1.6 Actions

Action 1. **Official recognition that the Ministry of Lands & Natural Resources, Lands Geospatial Information System Division as the central hub for the coordination and accountability for all integrated geospatial information management activities.**

a1.1. Review the organisational structure.

a1.2. Determine number of staff required and create Position (job) Descriptions for permanent/contract roles and their responsibilities adhering to the PSC policy.

Action 2. **Establish a Project Management Unit (PMU) to ensure the deliverance of all project obligations and operationalize approved mandates of the TWG.**

a2.1. Determine number of staff required and create Term of Reference (TOR) for contract/consultancy roles and their responsibilities.

a2.2. Facilitate frameworks for IGIM with Administrative support on Data, technical, policy, capacity building and financial working groups to advise the Coordination Unit and TWG.

a2.3. Develop a reporting framework for frequency of PMU to deliver monitoring and reporting structure.

Action 3. **Establish a Steering Committee**

a3.1 Provide support, guidance and oversight of project progress.

Action 4. Establish a Technical Working Group to strategic direction and endorsement of the Action Plan on IGIM.

a4.1 Identify and address issues raised by the Steering committee and reports on progress.

Action 5. Identify and address issues raised by the Steering committee and reports on progress. Develop and implement a Governance Model – that defines the roles and responsibilities of key institutions, and processes and procedures.

a5.1. Provide a description of each institution, Groups/Unit and the Coordinating Unit and their delegated powers, roles and responsibilities in respect to the Framework.

a5.2. Identify hosting or responsible organisation to update and maintain the inventory

Action 6. Develop a Reporting Framework

a6.1. Monitor and determine data collected is reliable.

a6.2. Provide the methodology and procedures for reporting

1.7 Implementation Timeframe

The Governance and Institutions pathway implementation timeframe shown in table 5 is intended to start on the first month of the first year, and it is the first vital action to initiate in order to initiate the actions in the other 8 pathways.

Table 5: Implementation scheduled for Strategic Pathway – Governance & Institutions

SP1	Governance and Institutions	PLAN START (month)	PLAN DURATION (month)
Action 01	Official recognition that the Ministry of Lands & Natural Resources, Lands Geospatial Information System Division as the central hub for the coordination and accountability for all integrated geospatial information activities.	1	3
Action 02	Establish a Project Management Unit (PMU) to ensure the deliverance of all project obligations and operationalise approved mandates of the TWG.	2	3
Action 03	Establish a Steering Committee.	2	3
Action 04	Establish a Technical Working Group to strategic direction and endorsement of the Action Plan on IGIM.	4	2
Action 05	Develop and implement a Governance Model – that defines the roles and responsibilities of key institutions, and processes and procedures.	5	2
Action 06	Develop a Reporting Framework.	4	2

1.8 Deliverables

This section includes the products/systems/reports that are expected to be delivered as a consequence of completing the actions.

- Approval for the national recognition of the Kingdom of Tonga's geospatial information management division, government organisation.
- Terms of Reference for the PMU and TWG.
- Appropriate staff with delegated powers, funding and computing resources for the LGIS Division, PMU, Steering Committee and TWG.
- Strengthening of monitoring and evaluation skills in budgeting for the development of the spatial system in the future.
- A Governance Model that shows interrelationships between key institutions and the promotion of collaboration, communication and cooperation given their unique roles and responsibilities.
- Fully functioning LGIS Division, PMU, Steering Committee and TWG.

- A Reporting Framework for effective multi-stakeholder reporting of activities under the Country-level Action Plan.

1.9 Outcomes

The real or tangible differences that are being made based on outcomes from Strategic Pathway 1 towards strengthening integrated geospatial information management, and as a consequence to achieving on the SDGs and thus to people's lives.

- Clear, effective and fully functioning governing system on IGIM.
- Efficient planning and coordination of the government's geospatial information resources through the establishment of a PMU.
- Strengthened institutional mandates and political buy-in.
- Safeguarding geospatial investments by measuring and monitoring progress throughout the program schedule ad budget.
- A cooperative and easy data sharing environment.
- A shared understanding of the value of integrated geospatial information management.

1.10 Risk Mitigation

The risk to not being able to complete the actions their likelihood and severity, and the risk mitigation strategy that needs to be put in place. The ability to deliver actions associated with the Governance and Institutions Strategic Pathway has the following associated risks:

Table 6:Risk & Mitigation Strategy for pathway – Governance & Institutional Arrangements

Risk	Likelihood (1 low-5 high)	Severity (1 low-5 high)	Mitigation Strategy
Lack of Communication between leading ministry, implementing agencies and stakeholders.	3	5	Seek clarification on issues and develop new arrangements based on the feedback.
MLNR is recognized as a central Geospatial Information Hub.	3	3	Door to Door visitations to other Ministries and to emphasize the collective management required to make orderly and transparency between co-ministries.
Limited Resources & Staffing.	3	3	• Early start on developing and processing of activities, so any shortages can be addressed earlier. • Review contract package and TOR to attract potential employees but still execute the actions.
Changing ministerial portfolios terms affect prioritized agendas.	3	5	• Incorporate prioritised agendas into the organisation corporate and annual management plans. • Educational/Informative materials are prepared beforehand in any case of ministerial portfolio changes.

1.11 Budget Estimation

Please refer to APPENDIX 2: BUDGET ESTIMATES

1.12 Funding Status

Action 1 - 5 has the potential to achieve funding from the Government as part of their financial year – annual budget contribution to the Ministry of Lands & Natural Resources.

Otherwise, funding is to be provided from co-funding with 2 or 3 key institutions

SP2. POLICY AND LEGAL

Establish a robust legal and policy framework to institute national geospatial legalization and policy to enable the availability, accessibility, exchange, application and management of integrated geospatial information.

2.1 Agencies Involved

Lead Ministry: LGIS Division and CSD Division – MLNR and Ministry of Justice

Committees: Ministry of Justice, a Policy/Legal Consultant with direction from the TWG, LGIS and PMU.

Relevant Stakeholders: Compliance and policy officers of organisation that generate and are curator of data.

2.2 Contact Persons

The CEO or person(s) to be assigned/authorized by the CEO, to oversee and provide result orientation of this Strategic Pathway.

MINISTRY OF LANDS & NATURAL RESOURCES

- Chief Executive Officer
- HoD – Corporate Service Division
- HoD – Lands Geospatial Information Services

MINISTRY OF JUSTICE

- Legal Advisor

PUBLIC SERVANT COMMISSION

Oversight Division

NATIONAL PLANNING

HoD

2.3 Background and Rationale

Currently there are no policies or legislation for the management, and sharing of geospatial information in Tonga that is inclusive to public, private and non-profit organisation. Government organisations however have data sharing mandates which consist of a lengthy paper work process, while most NGOs do not have a policy on management of their spatial information. No statutory framework results in inaccessible information, costly information, inconsistent information standards and many more that are more complex for interoperability. Policy's slow reaction to adopt new changes caused by new technology pressures its ineffective.

Policies are required to promote best practice in geospatial data management, particularly in the areas of accessibility to, and usability of, geospatial information. When policies are developed in conjunction with government organisations and the private sector, policies can be used to overcome many barriers to information access, such as organisational boundaries; lack of consistent information standards; and use of incompatible or inappropriate technologies. For example; the lack of standards, specifically of using datum or positioning for geospatial information in various organisation and agencies is very common in Tonga.

2.4 Proposed Approach

The proposed Policy and Legal Framework (*Figure 14*) considers all aspects of the geospatial data management life cycle: from creation and initial storage; its dissemination and use as an information product; to the time when it becomes obsolete and is deleted. The data life-cycle management approach involves institutional in-house procedures and practices for policy compliance.

The Proposed Policy Framework is designed to address the concerns of government agencies through an integrated approach that:

- Explains the role of organisations within the broader context of geospatial information management through the introduction of a Data Custodianship Policy, Regulation and compliance system in place, method and conditions for Data sharing/release, Data pricing and establishment of the Policy Repository.
- The four elements that define the Policy and Legal pathway addresses the concerns of data security and sensitivity, issue of unaware of an existing policy and specifies the implementation and accountable organisations/ divisions and norms/ policies to be adopted by organisations in the course of their normal operations

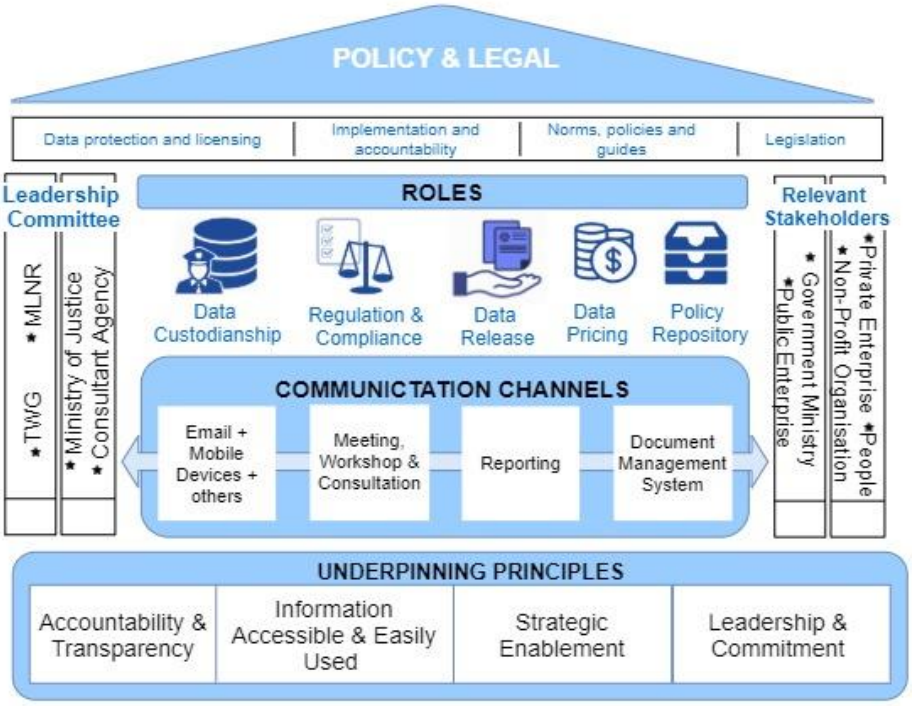


Figure 14: Proposed Approach for Policy & Legal Model

2.5 Objectives

The overarching aim is to address current legal and policy issues by improving the laws and policies associated with, and has impact on, geospatial information management, by proactively monitoring the legal and policy environment particularly with regard to designating the official responsibility for the production of data, sharing of data and with respect to the issues raised by emerging technologies and the evolving innovative and creative use of geospatial information.

Specific objectives for formalising the Policy and Legal Framework are to provide the foundation for:

- Gain and Practice authority to collect, manage and disseminate integrated geospatial information.
- Easy efficient and equitable access to spatial data and effective, least cost management and sharing of data.
- Preserving confidentiality, privacy, security and intellectual property rights.
- Promoting public/private partnerships to foster innovation and value-adding.
- Forming alliance with legal experts on necessary measures regarding policy and legal topics that advance, authorize or impact integrated geospatial information.
- Compatible spatial data standards consistent with internationally recognized standards and guidelines.
- Policy can be maintained and provided at a single repository yet be able to evolve with developing technologies and innovative creativity at long term.
- Stakeholders contribute and accept the National IGIM Policy.

2.6 Actions

Action 7. Undertake a Policy and Legal Review and Needs Assessment.

a7.1. Contract the Policy and Legal consultant, outlining specific tasks, deliverables and schedules to be carried out.

a7.2. Conduct a Policy Impact Assessment Study.

a7.3. Develop the Geospatial Information Management Policy to guide the implementation of the NGAP. (With reference to Add C).

Action 8. Develop a Policy Management Plan.

a8.1. Develop a Reporting Framework to monitor the benefits of policy adoption overtime.

Action 9. Develop and Implement Policy/s – mainstream geospatial information into MDAs Corporate Plans for licensing and pricing framework, with specific fees and charges. It will have national open data policies and data sharing (for imagery and topographical) at national/regional and international level for the people. And availability of the data for 'emergency', custodianship, security and standards for geospatial data management.

a9.1. Prepare and draft the IGIM Policy Plan with input from the government, legal parties and interested parties.

Action 10. Establish and maintain a national geospatial policy repository.

a10.1. Establish a policy repository system/ library.

a10.2. Develop and enforce a Policy Repository System compliance strategy.

2.7 Implementation Timeframe

The Policy and Legal pathway implementation timeframe shown in *Table 7* is intended to start on the first year overlapping into the second year, with exception to Action 8, which is to start on the 1st Quarter of the 4th Year to produce the most effective result of the Policy being used and enforced.

This pathway is needed to be implemented as it is the foundation for the other dependent actions

Table 7:Implementation scheduled for Strategic Pathway – Policy & Legal.

SP2	POLICY & LEGAL ACTION	PLAN START	PLAN DURATION
Action 07	Undertake a Policy and Legal Review and Needs Assessment.	5	3
Action 08	Develop and Implement Policy/s – that declares or includes geospatial information for licensing, pricing framework (specify fees and charges), national open data policies, data sharing, custodianship, security and standards for geospatial data management.	8	7
Action 09	Develop a Policy Management Plan.	12	3
Action 10	Establish and maintain a national policy repository.	14	4

2.8 Deliverables

This section includes products/systems/reports that are expected to be delivered as a consequence of completing the actions.

- A set of policies designed to promote best practice and efficient geospatial data management and exchange.
- A Legal and Policy Management Plan, Compliance Strategy and Reporting Framework for sound policy governance
- A Policy Repository System that is available to stakeholder and public for references and research.
- Awareness and acceptance by stakeholders.

2.9 Outcomes

The real or tangible differences that are being made towards strengthening integrated geospatial information management, supporting national priorities, circumstances and addressing national conditions as a consequence to achieving on the SDGs and thus improving people's lives.

A policy and legal enabling environment maximize the utility of geospatial information and safeguards a jurisdiction or entity's interest;

- A rational Integrated Geospatial Information Management that is fully functioning and effectively enforced as a sound governance tool.
- Effective and secure management, sharing, integration and application of geospatial information;
- Easy and accessible data with consistent standards and affordable pricing, and data custodianship to which encourages growing benefit and values of geospatial information.
- Develop clear expectations on policies specifying roles and responsibilities of government and stakeholders.
- A policy and legal framework that evolves over time, responds to societal progress and technological developments, keeps pace with fast changing economic, societal and personal landscapes.

2.10 Risk Mitigation

The ability to deliver actions associated with the Legal and Policy Strategic Pathway has the following associated risks:

Risk	Likelihood (1 low-5 high)	Severity (1 low-5 high)	Mitigation Strategy
No existing policy on the Geospatial Information System in Tonga to form a foundation of commitment and flow of communication channel.	2	5	Identify a channel of communicating between stakeholders and implementors. Follow up schedules for confirmation of understanding. Seek further consultation and feedback to understand issues with adoption and the consequences of non-compliance. Carry out a stakeholder's workshop focusing on specific issues or underlying concerns.
Lack of awareness on Geospatial Information policy, its uses and its benefits.	1	4	Hire consultant and carry out continuous training with MLNR, relating Ministries and users. Seek support from government leadership and conduct further education and awareness training with respect to policy compliance and value.
Delay in policy management and evaluation progress.	3	3	Responsible organization to include the review of policy management plan and the Policy in their annual plan activities.
Lack in Geospatial Information capacity and skills.	3	1	Provide more trainings. Seek further consultation and feedback to understand issues and provide capacity training where appropriate to enable them to be independently compliant. Which can be addressed through a stakeholder's workshop focusing on specific issues or underlying concerns.

Table 8: Risk & Mitigation Strategy for pathway - Policy & Legal Framework

2.11 Budget Estimation

Refer to *APPENDIX 2: BUDGET ESTIMATES*

2.12 Funding Status

All single allocated budgets are to be attained via requesting for donor funding, while recurrent budgets are to be attained as part of the Government's contribution to the Ministry of Justice who to be hosting the Policy Repository System and to the MLNR who would be co-coordinating the establishment of policies and consultant recruitment.

SP3. FINANCIAL

Establish a business model, financial partnerships and identify investment needs and funding sources, as well as the benefits realization milestones associated with activities for strengthening integrated geospatial information management.

3.1 Agencies Involved

Lead Ministry: LGIS Division - MLNR and Ministry of Finance

Committees: TWG, PMU and LGIS Division - MLNR

Stakeholder Community: Department of Finance, Cabinet, Partner key organisation, UN (donors)

3.2 Contact Persons

The CEO or person(s) to be assigned/authorized by the CEO, to oversee and provide result orientation of this Strategic Pathway.

MINISTRY OF LANDS & NATURAL RESOURCES

- Chief Executive Officer
- HoD – Corporate Service Division
- HoD – Lands Geospatial Information Services

MINISTRY OF FINANCE

- Development Aid

3.3 Background and Rationale

Currently, there is no funding for a whole-of-government initiative to strengthen integrated geospatial information management. Funding for geospatial data collection and management is through individual departmental budgets. Very little to no investment and business made from geospatial related tools, data and services. For example; the LGIS Division map sales using geospatial information focused on cadastral maps, and complimentary datasets and maps for disaster risk management and environmental monitoring management.

New investment is required to make arrangements for a governing system, develop ample policy, and infrastructure to enable online data sharing, data management and integration procedures, raising awareness and building the capacity of relevant stakeholders.

Perhaps the clearest weakness in Tonga is the lack of knowledge and understanding of the value and benefit of geospatial information, such as it contributes to most of the development activities within the country like dataset for land management, emergency response and demographic statistics.

Accurate and reliable geospatial information adds value which can leverage as an evidence-based mechanism across multiple sectors for planning, risk assessments, monitoring and evaluation of change and others. Geospatial information and its technological equipment make data acquisition and analysis faster, more accurate and least labour cost.

Proposed Approach

The proposed Financial Model (*Figure 15*) considers how funding can be secured to support the implementation of the Action but also how to sustain and further invest on IGIM when the project finishes.

As the leading agency, MLNR will monitor and oversee the functioning and managing of the action plan activities and costing. They will act as a central financing agent, to which finances will be given to stakeholders and other implementing agencies according to their roles and responsibilities. Roles and responsibilities per implementing agency will be outlined through the action plan, emphasising on the activity and schedule to which will be given by MLNR. Financial management and distribution will be monitored by MLNR on an arranged schedule agreed upon by the Steering Committee.

The establishment of benefit and opportunity realisation of geospatial information value and a realistic, practical and attractive business model to attract political buy-in and that of businesses for joint ventures and mutual benefit partnership. The Proposed Financial Model is design to address the concerns of government agencies through an integrated approach that:

- Explains the role of organisations within the broader context of geospatial information management through the introduction of a Financial Management program, Socio-economic assessment, development of a business, pricing and funding model.
- The model is founded on four underpinning principles and is conveyed between relevant stakeholders and the leading committee. The four elements of this pathway define addresses the concerns of pricing and business gradual growth, issue of stable funding and financing management that organisations can adopt and sustain long term.

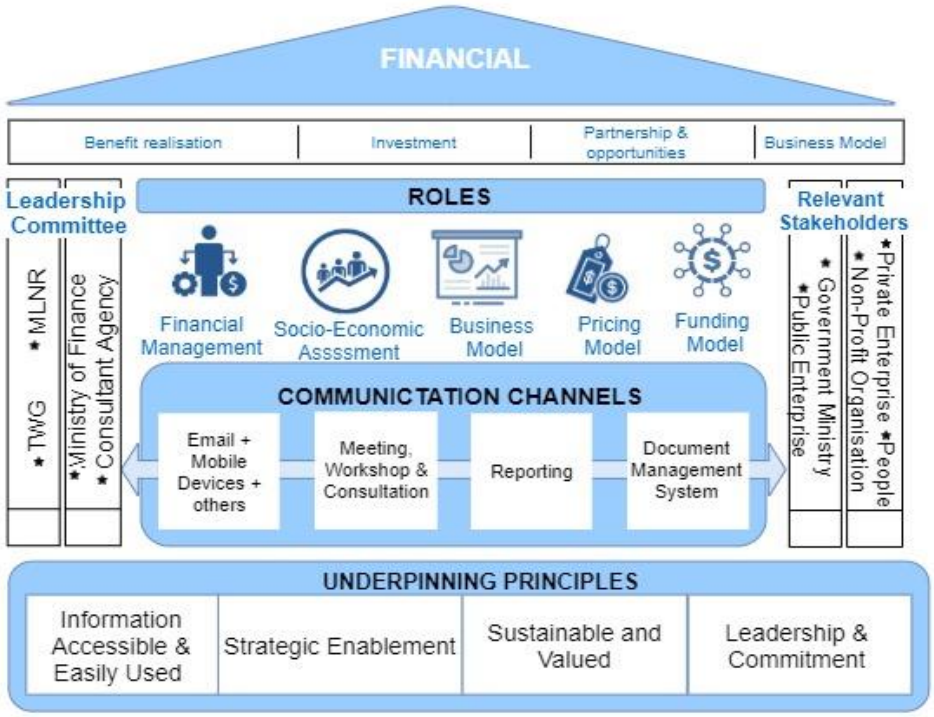


Figure 15:Proposed Financial Framework

3.5 Objectives

The overarching aim is to address financial issues by providing sufficient funds to support and strengthen integrated geospatial information management, by proactively funding the establishment of technological facilities and application software with regard to promote online sharing and accessing of data, capacity training, innovation and opportunities resulted from the creative use of geospatial information.

Specific objectives for formalising this strategic pathway are to provide the foundation for:

- Sustainable funding for management of geospatial information and the staffing levels to lead and maintain the quality of information equivalent to its cost.
- To assess and report on the socio-economic value of geospatial information to stakeholders.
    - It can be a proposal document to form the pillar for improvement, as a socio-economic value is still a developing impact. A Lesson Learned Template can be a starting point to identifying the way forward.
- Funding for a technology infrastructure that enables data sharing, discovery and reuse of information, and the funds to support ongoing operation and maintenance
- To provide a robust business model and pricing for stakeholders and the MLNR, promoting public support; opportunities for economic development and investments, and contributing to addressing environmental concerns.

To provide an efficient, easy and faster method to request for financial assistant or in-kind in support of IGIM.

3.6 Actions

The actions for establishing a sustainable investment framework for integrated geospatial information management have been identified to deliver a business model, creation of a financial plan, achieve an understanding of the implementation costs and ongoing financial commitment necessary to deliver integrated geospatial information management that can be sustained and maintained in the longer term.

Action 11. Establish Financial Program Management and Leadership.

a11.1. Endorse the PMU to become the Financial Program Management with direction from LGIS, MLNR and the TWG.

a11.2. Develop Financial Program Management Plan and provide capacity training for effective and functioning program.

Action 12. Conduct a Socio-Economic Impact Assessment

a12.1. Hire a Financial Analyst expert (TOR) to conduct a Socio-Economic Value Assessment and for identification of changes and efforts needed to be made for future progression.

Action 13. Undertake a Review of current Business Models, Investment Programs and Government budget allocation/programs to identify investments needs and sources of funding.

a13.1. Financial Analyst expert to conduct assessment on Business Models, Investment Programs and budgeting.

Action 14. Develop a dynamic and compatible Business & Pricing Model for sustaining IGIM and that is relevant to all data curator organisations and users.

a14.1. Financial Analyst to prepare SMART business and pricing model for LGIS and relevant institutions that requires a business plan.

a14.2. Incorporate feedback into the Business & Pricing Model where is appropriate.

a14.3. Implement the Business & Pricing Model for trial purposes.

Action 15. Develop a Funding Model (Benefit Request Form) for requesting of funding, in-kinds, maintenances, procurements and services related to IGIM. (Standard Procedures and request form).

a15.1. PMU to develop a Benefit Request Form for requesting of funding, in-kinds, maintenance, procurement and services related to the Action Plan – IGIM. Carry out a Gap Analysis Assessment to stakeholder and 50% of the Integrated Geospatial Information users (from general public) for requesting of funds, in-kinds, maintenance, procurement and services related to the Action Plan – IGIM.

3.7 Implementation Schedule

The Financial pathway implementation timeframe shown in table 9 is intended to start on the 4th Quarter of the 1st year overlapping into the second year, and these actions focused on assessing and producing a business model for Tonga to gain the most investment return of using geospatial information.

This pathway is interdependent on pathway 1 and 2.

Table 9: Risk & Mitigation Strategy for pathway – Financial pathway.

SP3	Financial - ACTION	PLAN START	PLAN DURATION
Action 11	Establish Financial Program Management and Leadership.	12	1
Action 12	Conduct a Socio-Economic Value Assessment.	5	3
Action 13	Undertake a Review of current Business Models, Investment Programs and Government budget allocation/programs to identify investments needs and sources of funding.	14	2
Action 14	Develop a dynamic and compatible Business & Pricing Model for sustaining IGIM and that is relevant to all data curator organisations.	16	2
Action 15	Develop a standard method for funding request (Benefit Request Form) to be use by stakeholders' for requesting of financials, in-kinds, maintenances, procurements and services related to IGIM.	13	1

3.8 Deliverables

This section, include the products/systems/reports that are expected to be delivered as a consequence of completing the actions.

- A team efficiently and cautiously managing financial programs.
- A Socio-Economic Value Assessment.
- A report highlighting investment needs and priorities.
- A business and pricing model for integrated geospatial information management.
- A standard Benefit Request Form.

3.9 Outcomes

- Capacity building skills and staff in financial management to be absorbed by the MLNR, Ministry of Finance and key stakeholders.
- Socio-economic benefit of geospatial information can be monetized for further awareness educational campaign.
- A Business & Pricing Model that sustains integrated geospatial information management annually and in the longer term.
- Faster and easier ways to request for financial assistant and can be adopted to use for data request, sharing etc.

3.10 Risk Mitigation

The ability to deliver actions associated with the Financial Strategic Pathway has the following associated risks:

Table 10: Risk & Mitigation Strategy for pathway –Financial pathway

Risk	Likelihood (1 low-5 high)	Severity (1 low-5 high)	Mitigation Strategy
There is no definite measuring tool to the National socio-economic benefits of Geospatial Information System.	2	5	Produce a Geospatial strategy with real life examples that articulates the benefits of geospatial information.
Lacking in budgeting due to sudden change in finances influctuation. Lacking in Business & Pricing Model from influctuation were not useful, nor accepted by stakeholders.	3	3	• Seek further consultation and feedback to understand issues with adoption of changes. • Perform trial set-up of the Business & Pricing Model before acceptance of the final product. • Review Business & Pricing Model annually to adopt new changes.
The Benefit Request Form and its standard procedures method were not functioning as it claims to be.	2	2	• Seek further consultation and feedback to understand issues. • Include it in the mandates of the organisation or policy.

3.11 Budget Estimation

Refer to *APPENDIX 2: BUDGET ESTIMATES*

3.12 Funding Status

All funding for this strategic pathway is to be attained as part of the Government's contribution to the Ministry of Lands and co-partnering with the Ministry of Finance and utility companies including Tonga Power Ltd, Tonga Water Board and Tonga Post Ltd. to develop a business and pricing model for them.

SP4. DATA

Establish a geospatial data framework and custodianship guidelines for best practice collection and management of integrated geospatial information that is appropriate to cross sector and multidisciplinary collaboration.

4.1 Agencies Involved

Lead Ministry: Ministry of Lands and Natural Resources, Ministry of Infrastructure and Ministry of Meteorology, Energy, Information, Disaster, Environment, Climate Change and Communication, Ministry of Agriculture, Food and Forestry, Tonga Statistical Department

Implementation Agency: LGIS Division (MLNR), Lands Transport Division (MOI), Environment (MEIDECC), Ministry of Fishery, MAFF, Tonga Statistical Department, Ministry of Public Enterprises

Stakeholder Community: Organisations responsible for generating data, such as the Ministry of Lands & Natural Resources departments, His Majesty's Armed Force, Civil Aviation, Marine & Ports, Civil Society Organisation, Public enterprises, private enterprises, non-profit organisations and Government departments who are significant users of geospatial information.

4.2 Contact Persons

The CEO or person(s) to be assigned/authorized by the CEO, to oversee and provide result orientation of this Strategic Pathway.

MINISTRY OF LANDS & NATURAL RESOURCES

- HoD & HoSs– LGIS Division
- HoD & HoS – Surveying & Geodesy Division
- HoD & HoS – Land Administration Division
- Senior Technical Officer – Natural Resources Division
- Senior Technical Officer – National Spatial Planning Office

MINISTRY OF INFRASTRUCTURE

- HoD – Lands Transport Division
- HoD – Marine Division
- HoD – Building Inspection Division

MINISTRY OF AGRICULTURE, FOOD & FORESTRY

- HoD – Agricultural Census Division
- HoD – Forestry Division

TONGA STATISTICS OFFICE

- Chief Executive Officer

4.3 Background and Rationale

Currently, it is difficult to know what information is available and where it is held. This has led to several organizations collecting the same information though incomplete and inconsistent although baseline datasets have known custodianship, some highly important datasets have not been acquired for example: Street address. There are numerous geospatial data sets collected for specific business and project needs across stakeholders. The number and quality of other significant data sets is unknown. Socio-economic data is available from the Tonga Statistics Department; however, the usability of this data is not well understood. Integrated data is hard to come by, to gain an overall outlook on a specific location, one has to visit several different ministries and different analyzation of a common data, which at times they are not the same and may vary from ministry to ministry. For example, finding the population, depth and vulnerability of a location to build a new school. One has to go to Ministry of Statistics, Ministry of Lands and Natural Resources, Ministry of Education, Ministry of Health for several data on population numbers, schooling ages; there is the need for land availability, vulnerability and safety; seeking health standards and issues in the village; and of course, permission form the Ministry of Education. With no central collection site, a portal hub where a managing team and allocate these data and easily distribute them, it would be difficult for the public when carrying development plans or decision making.

The National Geospatial Data Framework provides a way to organise geospatial data so that it can be easily accessed by users, and managed by data custodians and system administrators. The National Geospatial Data Framework supports best practice data management and ensures that institutions are able to meet their obligations to government, improve the efficiency of work processes, and make data available for sharing, validation and reuse.

To consolidate and ensure the accuracy and reliability of the Geospatial Data Framework, a modern and more improved National Geospatial Reference System to provide accurate and updated positions for all users of geospatial information to be reference to or based on. A modernised geospatial reference frame ensures data interoperability, and supports data sharing and reuse. Current geodetic datum supports traditional application such as surveying and mapping but not so much on modern applications such as smart transport climate change and early warning systems. The understanding of geospatial reference system and geodetic datums in Tonga is still very low.

There is a need to understand what geospatial information is collected, how it is collected, where it is referenced to, by whom and for what purpose it is used for. The National Geospatial Data Framework will enable everyone and everything to be spatially connected anywhere and anytime throughout Tonga.

4.4 Proposed Approach

A key deliverable of the Country-level Action Plan is the formalisation of the Geospatial Data Framework into commonly recognised themes. The proposed approach to Tonga's National Geospatial Data Framework is to implement three primary tiers of information:

- List available and non-available dataset inventory of geospatial data holdings; which organizations has the required data, the data coverage, data definitions and data date, and any additional information needed.

- List available and non-available data use, which is most important and of high demand. To which requires interaction with the users.
- Fundamental data themes that support multiple purposes.
    - Specific business application data layers, such as flooding zone, agricultural/land use zones etc.
    - Socio- economic layers, such as census data etc.
- Establish Geospatial Data Strategy and the Geodetic Strategy to include updating of topographical datasets, CORS network, metadata, frequency of update, technological instruments etc.
- Identify leadership roles and responsibilities of data supply chains and interlinkages, custodianship, value adders and other geospatial information users.
- Communication channels including mobile medium, face to face method includes meeting, workshop and others, use to reach stakeholders.

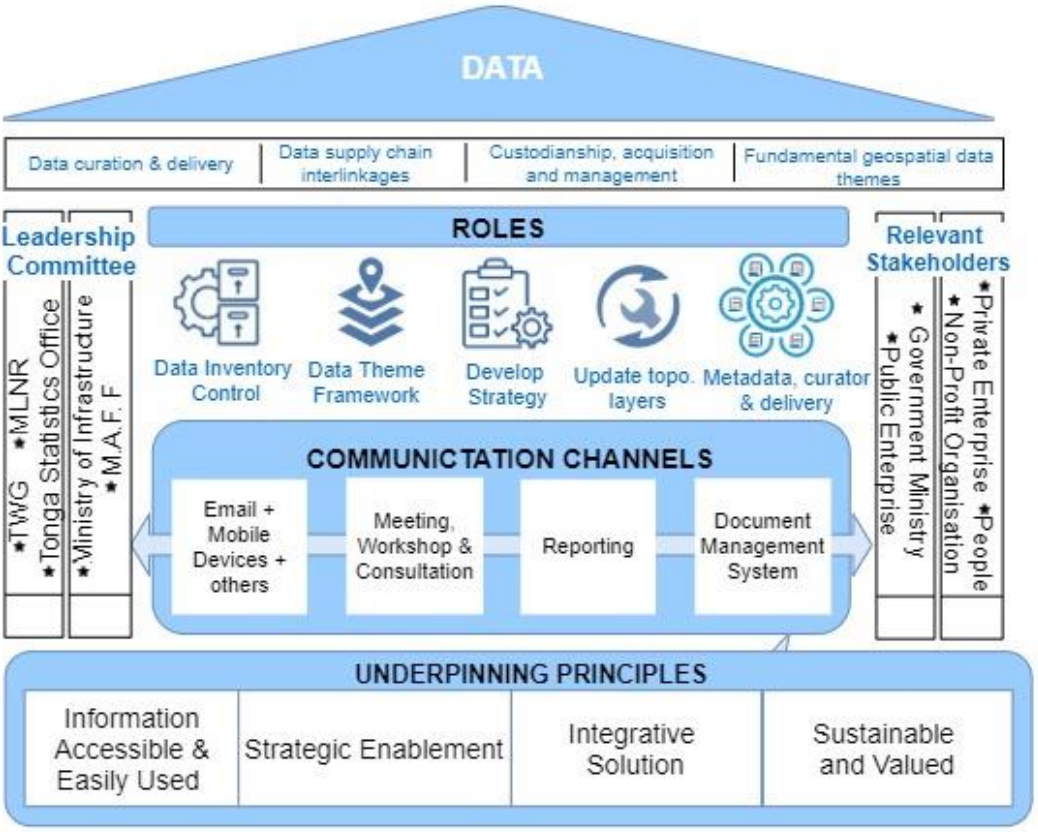


Figure 16: Proposed Data Model for Tonga.

4.5 Objectives

The overarching aim is to enable data custodians to meet their data management, sharing and reuse obligations to government and the user community through the execution of well-defined data supply chains for organizing, planning, acquiring, integrating, curating, publishing and archiving geospatial information.

Specific objectives for implementing the Data Framework are to:

- Ensure geospatial information are reference to a modern and fit-for-purpose geospatial reference system and national geodetic datums.
- Understand the range of geospatial data sets and data themes currently collected by government and non-government organizations and any gaps in data coverage and quality.
- Define data custodians for each data set to ensure the responsible management and ongoing integrity of the data sets through discussions and engagement with relevant stakeholders.
- Deliver best practice quality management processes to manage the completeness, accuracy and consistency of data for a specified purpose.
- Ensure data are compliant with a compliance standard and managed within approved guidelines.
- Ensure that Geographical Names are recognized and recorded to preserve culture but also to enhance completeness and accuracy of geospatial data collected.
- Ensure data are held in a secure environment and with adequate provision for long-term care including disaster recovery and backup procedures.
- Define the purpose of Metadata and its standards to ensure datasets are being labelled and described in a consistent and complete manner for references.

4.6 Actions

Action 16. Develop a Geodetic Network Strategy to modernize and standardize the National Geodetic Datum Reference and coordinate system.

a16.1. Hiring of Consultant.

a16.2. Develop a fit-for-purpose geodetic datum to meets all needs.

a16.3. Develop an accurate, modern, and fit-for-purpose height system l for Tonga that supports climate change mitigation and resilience.

a16.4. Develop a National GNSS infrastructure and geodetic controls to provide authoritative and accurate network in support of positioning applications,

a16.5. Procure relevant GNSS campaign sets.

a16.6. To develop standards to ensure positioning information is findable, accessible, interoperable and reusable.

a16.7. Ensure long-term operation of national geospatial reference systems and self-reliance through a culture of learning and capacity development.

Action 17. Document a National Geospatial Data Framework.

a17.1. Hiring of Consultant.

a17.2. Produce and Implement National Geospatial Data Framework (to be implemented in line with Policy).

a17.3. Prepare a Change Management Plan - Document 'Current State to Future State' for each data theme/data set in accordance with the current IGIF Management Plan.

Action 18. Conduct data collection or Update Baseline layers and maps: National Topographical maps and baseline layers –Map Edition.

a18.1. Design and establish a National Geospatial Data Hub to store, back up or host geospatial data.

a18.2. Develop a Geospatial Data Work Plan with measurable outcomes:

a18.3. *National Navigation Chart update – Chart Edition*.

a18.4. Vulnerability Risk, Ecosystem and Community Profiles.

Action 19. Create, Document and Share Metadata Standard and Checklist

a19.1. Develop the Data Set Profiles Checklist

a19.2. Develop a Geospatial Management Compliance Strategy to protect and encourage data custodianship/ ownership/ acquisition management.

Action 20. Document a Data Inventory of all baseline datasets currently collected by government

a20.1. Develop a Guideline for Data Inventory through assessing data sets and identifying data custodianship, value-adder and user of data.

Action 21. Create a Geographical Names Inventory and update and maintain it. Eg: Road names

a21.1. Hiring of Consultant.

a21.2. Based on the dataset profiles, compile a list of geographical features and names in Tongan and English e.g.: local and mythical names of places, features etc.

a21.3. Create a standard compliance strategy of what, when, why and how the Inventory is recorded and made accessible.

Action 22. Develop a Data Curator and Delivery Forum to build capacity of GIM.

a22.1. Establish a Forum participation through stakeholders, with a structured body and managing template to which they would follow and document the results after every meeting.

4.7 Implementation Schedule

The Data pathway implementation timeframe shown in table 11 is intended to start on the 1st Quarter of the 2nd year and fully executed on the same year, and these actions focused on assessing and organising of geospatial data to attain the quality level that is needed for Tonga to gain the most investment return.

This pathway is interdependent on pathway 1 and 2, and partial interdepended on pathway 3.

Table 11: Implementation scheduled for Strategic Pathway – Data pathway.

SP4	Data - ACTION	PLAN START	PLAN DURATION (Number of months)
Action 16	Develop a Geodetic Network Strategy to modernize and standardize the National Geodetic Datum Reference and coordinate system.	Jan	5
Action 17	Document a National Geospatial Data Framework.	Jan	3
Action 18	Conduct data collection and update the National Topographical maps and baseline layers – Map Edition.	18	8
Action 19	Create, Document and Share Metadata Standard and Checklist.	15	3
Action 20	Document a Data Inventory of all baseline datasets currently collected by government.	13	3
Action 21	Create a Geographical Names Inventory and update and maintain it. E.g.: Road names.	14	2
Action 22	Develop a Data Curator and Delivery Forum to build capacity of GIM.	15	2

4.8 Deliverables

The Geospatial Spatial Data Framework – A Publication for reference by government, private sector and the community. Includes data theme classifications, responsible organizations, data sets, data purpose, pricing and licensing arrangements, applicable data standards, data access/sharing arrangements, compliance strategy, data support infrastructures and technologies.

- Three hired consultants
  - 1x consultant to deliver Action 16.
  - 1x consultant to deliver Actions 17, 18, 19, 20 and 22.
  - 1x consultant to deliver Action 21.
- A functional National Geospatial Data Hub (Server).
- Description Data Inventory registry in the form of a standard profile.
- Descriptive Metadata for each Data Theme in the form of a standard profile.
- A National Geographical Name Dictionary in bilingual language.

- An instruction manual for metadata creation.
- National Topographic Map.
- National Navigation Chart.
- National Vulnerability Risk Maps, Community Profiles and Ecosystem/environmental baseline data.
- Geodetic equipment and capacity building of staff.
- A developed geodetic system with a densified network and progress towards a national CORS network.
- Progress toward a national height system and geoid model.
- Participation and contribution in international geodetic activities.
- Production of geodetic best practice guidelines and procedures.
- A Data Curator & Delivery Forum.
- Newsletter of the Status of current and future data sets and data themes.
- Highly trained data curators.

4.9 Outcomes

- A more accurate and fit-for-purpose referencing system for geospatial information.
- Increased range and scope of authoritative, integrated geospatial data available for decision-making and policy-setting to address economic, social and environmental challenges;
- Critical mass of centrally coordinated data discovery to support national development and innovation, leading to economic growth and improved quality of life for citizens;
- Cost reduction through productivity improvements achieved via well-defined data supply chains that eliminate duplication and ensure standardized data is accessible to end users for integration and reuse;
- Available update of topographical, navigation, vulnerability and ecosystem maps and data to support infrastructural development, tourists, sailor/mariner, students and public.
- Ability to monitor and measure progress towards achieving broad socio-economic benefits, including the sustainable development goals, through access to quality geospatial information.
- Procurement of geodetic survey equipment and training to support the implementation of the activities.
- A developed national geodetic network.
- A vertical reference frame and geoid model for Tonga.
- Increase awareness and educational level contribution with the local geographical names, thus preserving history and local legends.
- Effective and efficient data interoperability, accuracy, consistency and reliability of geospatial data and information resulting in a high accountable organisations and valuable data/information.

- High-capacity development for staff and organisations.
- Strong and closer cooperation and coordination of data curators (supply chain) stakeholders.

4.10 Risk Mitigation

The ability to deliver actions associated with the Data Strategic Pathway has the following associated risks:

Table 12: Risk & Mitigation Strategy for pathway – Data.

Risk	Likelihood (1 low-5 high)	Severity (1 low-5 high)	Mitigation Strategy
Positioning Infrastructure and Geospatial Referencing System are too complicated or complex that relevant stakeholders do not adopt it.	2	4	• Geodetic Survey for the ministry to carry out stakeholder's consultation to update understanding and knowledge. • Consult using understandable language with real life scenarios cases to convey message
Delays in receiving equipment and resources due to long procurement processes.	3	4	Prioritize technical procurement and staff training/capacity building.
Training and capability building are not completed.	3	4	Prioritize technical staff training & capacity building.
Insufficient time to complete the task.	3	3	Prioritize data sets so that those more frequently accessed and are most important will have sufficient metadata.
Not enough funding to provide for the underlying infrastructure technologies.	3	4	Prioritize the main activities and review activities to be more realistic and can be accommodated based on a target minimum budget.
A requirement for greater levels of consultation than anticipated.	3	2	Focus on getting the fundamental data themes/sets right in the first instance.
Changing business activities in one or more organizations.	3	1	A change in custodianship to be managed according to custodianship policy/guidelines.
Data producers consider the task of creating metadata difficult.	3	1	Provide manual and a training program or Evaluate production process and capture metadata as part of data creation or through software functions.
Data Inventory, Geographical Name Dictionary and Data Themes are not managed/ updated/reviewed after its establishment or after the duration of the project	3	1	Responsible organizations to include these activities in their Corporate Plan and Annual Management Plan as mandated tasks part of the allocated staff as their performance duty.

4.11 Budget Estimation

Refer to *APPENDIX 2: BUDGET ESTIMATES*

4.12 Funding Status

Single allocation budgets below $5,000 are to be provided for by key stakeholders (members of the TWG). An organisation that commits to establish a GIS service is to obtain resources as in-kind from donors or other key stakeholders. Help support are provided at the cost of the Ministry of Lands & Natural Resources budget.

SP5. INNOVATION

Evaluate current and emerging technologies and processes with a view to applying innovative methods to bridge the digital divide.

5.1 Agencies Involved

Lead Ministry: Information & Communication – MEIDECC, Marketing & Innovation - Ministry of Trade & Commerce, LGIS & CSD Division - MLNR.

Implementation Agency: MEIDECC with guidance from the LGIS Division, MLNR, PMU, TWG and the Ministry of Trade & Commerce, MAFF, and Ministry of Fisheries.

Stakeholder Community: Organisations responsible for generating data, such as the Survey & LGIS MLNR, Forestry Department, Statistics Department; HMAF and Government departments who are significant users of geospatial information in term so data acquisition.

5.2 Contact Persons

The CEO or person(s) to be assigned/authorized by the CEO, to oversee and provide result orientation of this Strategic Pathway.

MINISTRY OF LANDS & NATURAL RESOURCES

- HoS - Information Tech. Section
- HoS – Lands Geospatial Information Services

MEIDECC

- HoD: Information & Communication

MINISTRY OF LABOUR & COMMERCE

HoD – Marketing & Innovation

5.3 Background and Rationale

Currently, it is not possible to access accurate and integrated geospatial information across the whole of Tonga with reliability. Questionnaires answered by relevant stakeholders suggest that while organisations spend more time collating and managing information than analysing data and generating benefits from it, others do not readily collect or manage their data. Relying on certain projects to collate and analyse data.

The problem stems from the inability to readily share information, as information is either incomplete or fragmented within the department in various formats or computers. Technology and business processes (required to manage existing disconnected data sets) are well entrenched and therefore difficult to change - both culturally and financially. For example; services are done 'over the counter' and circulation of hard-documents.

Governmental process regarding handling of data and computerized information relies heavily on the Technological Information from IT confidants, and basics of handling excel, Microsoft and other computerized skills are mostly ignored. Geography is performed on hard paper locality, computer studies are not mandatory even in the 21st Century where all datasets and working environment is computerized, and collating information is not wholesome to the maximum level it should be.

Nonetheless, there are a number of technologies-driven trends that are having a positive impact in the geospatial industry, creating previously-unimaginable amounts of location-referenced information and the ability to share this information easily. These developments offer significant opportunities for Tonga to escalate integrated geospatial information management capabilities.

In Tonga the following technologies, methods and processes are considered to be out-dated and are to be explored under the Tonga Geospatial Innovation Framework:

- Storage and Processing Technologies.
- Data Sharing methods.
- Data Acquisition Methods.
- National geospatial reference system.
- Community Crowdsourcing.
- Website/Portal.
- Research Programs/agenda.

5.4 Proposed Approach

The proposed Innovation model (*Figure 17*) considers all aspects of the geospatial data management life cycle: from creation and initial storage; its dissemination and use as an information product; to the time when it becomes obsolete and is archived. The innovation life-cycle management approach involves establishment of technological based innovation to enhance norm work procedures and practices.

The Proposed Innovation Model approach is designed to address the concerns of government agencies through an integrated approach that:

- Address and reduce digital divide, promoting innovation and creativity in this era of advance technological instruments, advance and more efficient performances using technology & industrial advances, and software friendly environment for easier understanding and grasping of the programmes.
- Explain the role of leading organisations or leadership committee within the broader context of geospatial information management gathering of an IT inventory in hardware, software, human skills, graduates and storage capacity to assess how the Action Plan can be successfully carried out given the amount of IT resources available and needed.
- Address the demand to establish a GIS System and trained staff in organisations that generates data and the establishment of an Innovative Research Centre to drive and sustain geospatial

information use in work related research, and academic research increasing reliable scientific studies in Tonga.

- Address the issue of inaccessible datasets by providing a portal for uploading and downloading or requesting of datasets.

All of these are attained and convey using various methods of the communication channels, oversee by the four underpinning principles.

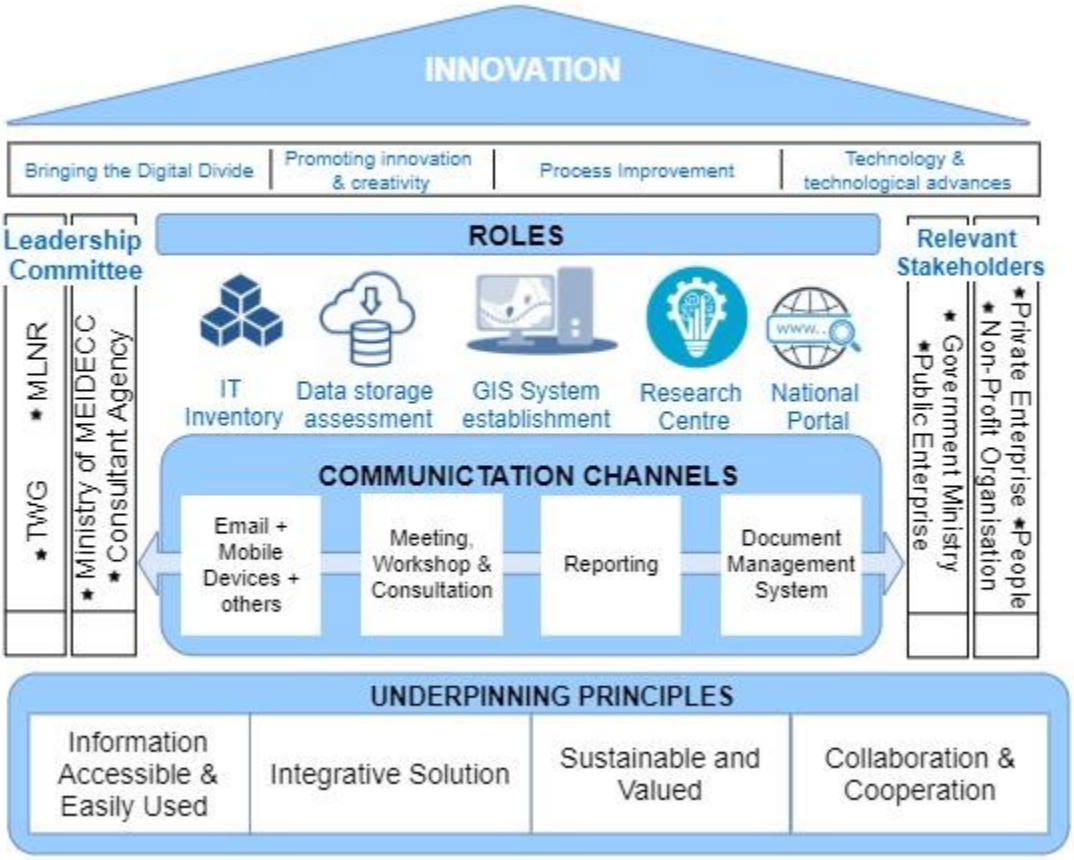


Figure 17: Proposed Innovation Framework.

5.5 Objectives

- Modern methods for data sharing and exchange between government departments and with private sector, academia and the community.
- Modern and efficient methods for collecting geospatial information.
- Sufficient back up repository in place in case of a disaster hazards.
- Functional data and asset management program in place.

5.6 Actions

The actions to stimulate the use of the latest technologies, process improvements and innovations have been identified to enable Tonga to adopt state-of-the-art geospatial information management systems and practices and in doing so quickly bridge the geospatial digital divide.

Action 23. Conduct an Inventory of existing IT and GIS resources and capacity e.g.: human, computers etc.

a23.1. Assess existing IT and GIS resources based on a 'Complete Functional System' Criteria –, hardware, software, storage capacity, staff with experience, staff with qualification, application etc.

a23.2. Document the Inventory and Develop a Guideline for Data Inventory.

Action 24. Assess Data & Information Storage

a24.1. Document the requirements for a storage solution including storage capacity needs, scalability, cost, performance, reliability and manageability.

a24.2. Expand the Data Hub (host by MEIDECC) storage capacity according to assessment as a National Geospatial Data Warehouse or repository.

a24.3. To create a National SDG Data Hub to which will be co-managed by the Ministry and the SDG Data Hub Working group.

Action 25. Encourage Innovation for GIS users across all government sectors.

a25.1. Formulate Programs to annually commemorate World Computer Literacy Day.

Action 26. Establish an Innovation and Creative Hub and its members – accessible for all public to incentivise the use of spatial data.

a26.1. Promote New Application & Technology Awareness Program Set-up staff and roles.

a26.2. Prepare practical demonstration of application and technologies.

- Use and purpose.
- Laws and safety operation rules.
- Pros and Cons of applications/technology devices.

Action 27. Implement a Bilingual National Map Portal to Share Geospatial Data.

a27.1. Develop high-level National Map Portal.

a27.2. Populating & tendering maps and open data to the portal.

a27.3. Develop a Business Operations Management Plan.

5.7 Implementation Schedule

The Innovation pathway implementation timeframe shown in *Table 13* is intended to start on the 1st Quarter of the 2nd year overlapping into the third year, and these actions focused on assessing, organising and producing virtual data storage methods, data sharing and services to maximise access and data sharing advancing Tonga's technological status and services.

This pathway is interdependent on pathway 1 and 2, and partial interdepended on pathway 3 and 4.

Table 13: Implementation scheduled for Strategic Pathway – Innovation.

SP5	**Innovation** - ACTION	PLAN START	PLAN DURATION
Action 23	Conduct an Inventory of existing IT and GIS resources and capacity eg: human, computers etc.	15	3
Action 24	Assess Contemporary Storage	15	3
Action 25	Encourage Innovation for GIS users across all government sectors.	17	5 (Tech-aid at ad-hoc basis)
Action 26	Promote New Application & Technology Awareness Program (follow-up of action 22)	17	1 (perform once per yearly quarter)
Action 27	Implement a Bilingual National Map Portal to Share Geospatial Data.	17	7

5.8 Deliverables

- An operational National Map Portal that delivers online access to layers of all forms of integrated geospatial information for viewing and download.
- A mechanism for government organisations to easily upload data for access by other government agencies, private sector, academia and the broader community.
- A National Geospatial Data Catalogue (i.e., XML document).
- A 'virtual' data warehouse environment that is a combination of centralized and decentralized data stores.
- Inventory List of IT & GIS resource, and storage capabilities.
- An Innovation, Creative Research Centre to support on-going technological and application support of IGIM.
- GIS System & Help support to strengthen geospatial information in organisation.

5.9 Outcomes

- Government programs and systems that enable state-of-the-art geospatial information management and facilitate innovation.
- Inclusive support and cooperation across multi-sector organization.

- An integrated inventory program to enable prioritization and reducing costly duplication and mismanagement of resources.
- Digital benefits are widely shared/access thus reduce digital gap.
- National Map Portal for visualization and accessing geospatial information.

5.10 Risk Mitigation

The ability to deliver actions associated with the Innovation Strategic Pathway has the following associated risks:

Table 14:Risk & Mitigation Strategy for pathway –Innovation

Risk	Likelihood (1 low-5 high)	Severity (1 low-5 high)	Mitigation Strategy
Funding for development of the National Map Portal is not available.	1	5	Implement essential components in first year and progressively fund new functionality overtime.
The human resources for National Map Portal development are not available.	1	5	Go out to market for development by external company.
Unstable internet network and portal kept crashing.	4	4	• Keep portal UI, simple and clean • Assess the fibre optic distribution plans • Identify problem whether its line network or poor computer infrastructure and improve it.
Limited skills in online technologies.	1	2	Provide training and skills development by an expert company.
Cost of data storage is too high and not a priority for some agencies.	3	1	Implement a whole-of-government warehouse where economies of scale are likely to produce a better return on investment and assist small agencies to come on board.
Centered data storage is insufficient to hold large datasets.	3	5	Perform a Storage capacity assessment Invest in a large-scale capacity that is sufficient in the long run.

Data custodians do not make data available in an accessible storage environment.	3	1	Familiarize agencies with data storage principles and benefits.
Stakeholders prefer to host individual Research Hub Centre in each organization.	2	3	Ensure they have the means to fund and provide training to host the Centre. Provide necessary training to allow for independent operation.
Lack of human resources skills to set of GIS system.	1	3	• Provide training and resources knowledge to allow for independent operation. • Introduce open-source software programs and other free applications.
Stakeholders are reluctant to provide information on IT and GIS resources due to sensitive information or policies.	2	4	• Conduct a stakeholder workshop to buy-in stakeholders. • Agree on the standard criteria to gather information.

5.11 Budget Estimation

Refer to APPENDIX 2: BUDGET ESTIMATES

5.12 Funding Status

- **Action 23 and 26:** Funds provided by the hosting or responsible organization
- **Action 25:** Funding is to be provided by stakeholder whom is requesting to establish a GIS system; using existing computer hardware would reduce costs.

SP6. STANDARDS

Adopt best practice standards and compliance mechanisms that enable legal, data, semantic and technical interoperability.

6.1 Agencies Involved

Lead Ministry: LGIS & Surveying & National Spatial Planning Division – MLNR & Tonga Statistics Department

Implementation Agency: LGIS & Surveying & National Spatial Planning Division – MLNR, NEMO – MEIDECC, MOI and TSDF.

Stakeholder Community: All organisation responsible for data acquisition or data curators, such as the MLNR, MAFF, Fishery, Public Enterprises, non-profit organisation, government and non-government organisations who are significant users of geospatial information.

6.2 Contact Persons

The CEO or person(s) to be assigned/authorized by the CEO, to oversee and provide result orientation of this Strategic Pathway.

MINISTRY OF LANDS & NATURAL RESOURCES

- HoD & HoSs– LGIS Division
- HoD & HoS – Surveying & Geodesy Division
- HoD & HoS – Land Administration Division
- Senior Technical Officer – Natural Resources Division
- Senior Technical Officer – National Spatial Planning Office

MINISTRY OF INFRASTRUCTURE

- HoD – Lands Transport Division
- HoD – Marine Division
- HoD – Building Inspection Division

MINISTRY OF AGRICULTURE, FOOD & FORESTRY

- HoD – Agricultural Census Division
- HoD – Forestry Division

TONGA STATISTICS OFFICE

- Chief Executive Officer

6.3 Background and Rationale

In Tonga, data are managed in information silos across government with several versions of geospatial data being created. This is primarily from a lack of awareness that data already exists, but also because data formats are not always compatible across organizations and data structures do not suit multiple government business needs. Data reuse and sharing is therefore problematic. Cross-agency data sets are currently inconsistent in terms of completeness and accuracy. Updates to data need to be manually reworked causing time delays and increased overheads.

Technical personnel find that having no standards on legal, data, semantic and technical interoperability for efficient data sharing, access and interpretation makes technical operation difficult. The absence of a formal standard to guide collection, format, language, metadata and exporting of geospatial information and data is evident and requires appropriate actions to achieve the target goals.

There is a significant opportunity to derive benefits from the removal of functional impediments which give rise to duplication in data collection, access limitations and costly inefficiencies. This can be achieved through interoperability and agreements to share data using standards that support information exchange between cooperating organisations.

6.4 Proposed Approach

The proposed Standards model (*Figure 18*) considers all aspects of the geospatial data management life cycle: from creation and initial storage; its dissemination and use as an information product; to the time when it becomes obsolete and is archived. The standard life-cycle management approach involves establishment of interoperability standards to be adopted into normal work procedures to provide efficiency and effective work practices.

Identifying standard data practices and structures will aid in compiling, analysing and concluding on integrated geospatial information management throughout Tonga. Engaging stakeholders and data users are ways to formulate, produce and improve on appropriate standards throughout time. Through this the leading team together with the stakeholders can agree on a layout and structure which then can be infiltrated by data providers and users, dissemination and technological update can be managed by the LGIS Team.

The Proposed Standard Model approach is designed to address the concerns of government agencies through an integrated approach that:

- Address issues of technical, data, semantic and legal interoperability in terms of reusing, sharing and updating of geospatial information/ datasets. The processes use to acquire data, the instrument used, language and vocabulary, data format/type, and compliance factor that enforce these standards to be effective.
- Explain the role and the reason of nominated organisations that have high potential of joining the International Standard Organisation (example OGC or IHO) & UN – Global Geospatial Information Management realm in voicing Tonga's and that of Oceania's concern in an international platform.

- Explain the need of a Standard guideline to guide and provide assistant to relevant stakeholders in management their geospatial information in relation to recognise and rationale standards.

All of these are attained and convey using various methods of the communication channels, oversee by the four underpinning principles to provide geospatial information as; accessible and easily used, strategically enable an integrative solution of GI and serve as valued and sustainable information for planning.

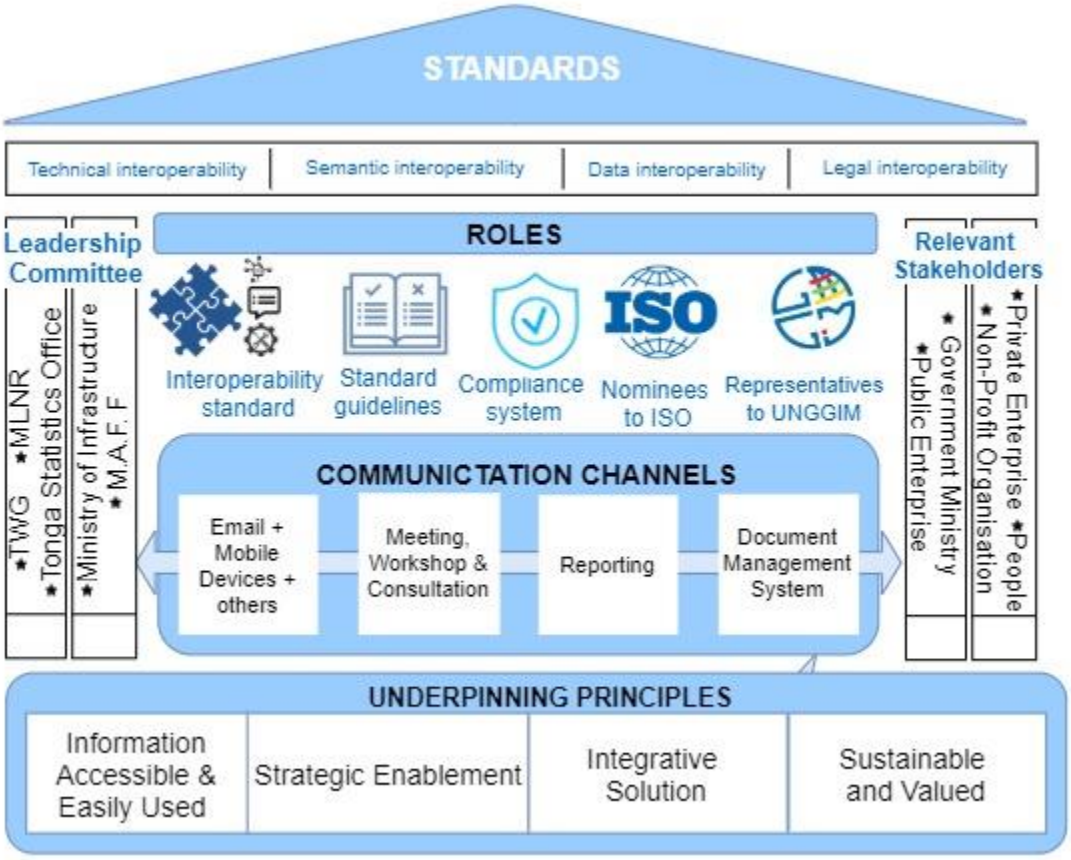


Figure 18: Proposed Standards Framework

6.5 Objectives

The overarching aim is to enable different information systems to communicate and exchange data, enable knowledge discovery and differencing between systems using unambiguous meaning, and provide users with lawful access to and reuse of geospatial information.

Specific objectives for implementing the Standards Framework are to:

- Have consistent use of data standards across the government sector.
- Data standards are adoptable and easy to follow based on Guidelines and is widely used to improve work operations.
- Use international standards where available and applicable.

- Enhance the integration of individual and disparate data sets using appropriate standards for the collection, maintenance and transfer of data.
- MLNR to improve work operations and solve outstanding land administration issues.
- Tonga is more aware of international standards and support.
- Organisations standards are compatible and aligns to international standards.

6.6 Actions

The actions for establishing best practice standards and compliance have been identified to enable different information systems to communicate and exchange data, enable knowledge discovery and differencing between systems using unambiguous meaning, and provide users with lawful access to and reuse of geospatial information. Certain government organizations follow certain international standards or Organisational standards

Action 28. Conduct a Need Assessment of Standards & Develop a Standard (Metadata, Acquisition, Technicality, Interoperability and Semantic).

a28.1. Develop an in-house expertise.

a28.2. Identify specialized standards for each dataset.

a28.3. Government to mandate the define standards as part of organisational policy.

Action 29. Develop practical SOPs for each Sections/Divisions of the MLNR to adhere to.

a29.1. HoS and HoD are to develop a Standard of Procedure manual for each section based on their expertise.

Action 30. Develop a Data Standards Guidelines (in line with Policy and Data pathway).

a30.1. Develop a Guidelines for the Data Standards.

Action 31. Develop a Compliance Coordination Standards/System - on data acquisition, custodianship and data sharing.

a31.1. Develop and Document compliance strategies.

a31.2. Incorporate compliance system into the National Geospatial Portal, Data Hub and Research Centre.

Action 32. Nominate a national representative to the International Standard Organisation.

a32.1. Nominate a representative per theme standards and seek endorsement of the ISO.

a32.2. Prioritise a national standard that needs international reinforcing and adoption of the international standards eg: Disaster, Statistics, Hydrological, and Environmental etc.

Action 33. Nominate a national representative to all relevant UNGGIM Working Group

a33.1. Conduct a meeting with the TWG discussing the UNGGIM realm.

a33.2. Encourage participation and provision of Working Group contact details.

a33.3. Organisation are to make necessary arrangements.

6.7 Implementation Schedule

The Standard pathway implementation timeframe shown in *Table 15* is intended to start on the 2nd Quarter of the 2nd year. These actions focused on assessing, organising and producing data standards Standard Operational Procedures and guidelines toward good practising of geospatial information and data.

This pathway is interdependent on pathway 1 and 2, and is intended to be implemented together with pathway 4 to reduce cost and inefficiencies.

Table 15: Implementation scheduled for Strategic Pathway – Standards

SP6	Standards - ACTION	PLAN START	PLAN DURATION (Number of month)
Action 28	Conduct a Need Assessment of Standards & Develop a Standard (Metadata, Acquisition, Technicality, Interoperability and Semantic).	16	8
Action 29	Develop practical SOPs for each Sections/Divisions of the MLNR to adhere to.	17	5
Action 30	Develop a Data Standards Guidelines.	21	2
Action 31	Develop a Compliance Coordination Standards/System - on data acquisition, custodianship and data sharing.	20	4
Action 32	Nominate a national representative to the International Standard Organisation.	5	3
Action 33	Nominate a national representative to all relevant UNGGIM Working Group.	5	1

6.8 Deliverables

- A published list of nationally agreed data standards for various data requirements.
- A published SOPs for the MLNR and other line ministries.
- A Compliance Standard Strategy.
- Guidelines for the adoption of standards.
- Introduction to a wider network of international organisation.

6.9 Outcomes

- All government geospatial information is in a format that can be easily reused, shareable, align and integrated with other information.
- Right and good management of geospatial information is widely accepted and known in Government and non-government organization.
- The MLNR's work procedures are more efficient, faster and digitally productive as a result in vast reduction in outstanding land information works.
- Tonga's adoption and adapting of the International Standards increase Tonga's professional network, global recognition and commitment to global targets.

6.10 Risk Mitigation

The ability to deliver actions associated with the Financial Strategic Pathway has the following associated risks:

Table 16:Risk & Mitigation Strategy for pathway –Standards

Risk	Likelihood (1 low-5 high)	Severity (1 low-5 high)	Mitigation Strategy
Departments fail to adopt metadata standards or other relevant standards.	3	3	• Conduct training in how to create metadata. • Frequent training to be conducted. • Provide Standard Guidelines. • Explain/Provide benefits of metadata adoption and compliance to using standards.
Compliance strategy is ignored by supervisors and staff.	3	4	A compliance Unit is established to check that standards are adhered to by supervisors and staff.
Lack of in-house expertise.	3	4	• Seek work attachment opportunities (short/long term) regionally or internationally. • Provide internship opportunities for other ministries within LGIS Division.
Registering to the ISO is complicated and un-relatable to Tonga.	3	2	• Willing and relevant organisation are encouraged for the ISO. • Seek UN and multilateral international/regional support.

Government do not accept the change in Standards.	2	5	• Present to decision maker the socio-economic benefit of geospatial information and how Data Standards help to achieve it. • Present evidence of the effect of Data Standards.
Non-government organization requires consistent support.	3	1	Support is provided at appropriate time given that fund is secured.

6.11 Budget Estimation

Refer to APPENDIX 2: BUDGET ESTIMATES

6.12 Funding Status

- **Action 28 & 30:** Secure funding from UN for the initial set Data Standards & Guidelines
- **Action 29:** Funding provided by the MLNR through other projects (SOLA).
- **Action 31:** Funding is provided by the hosting/ responsible organisation as part of their contribution to the project.
- **Action 32 & 33**: Funding is provided by UN, participating organisations are to secure funding for after the single allocated funds are used.

SP7. PARTNERSHIPS

Establish effective cross-sector and interdisciplinary cooperation, industry and private sector partnerships, and international cooperation to sustain integrated geospatial information management.

7.1 Agencies Involved

Lead Ministry: Ministry of Lands & Natural Resources

Implementation Agency: MLNR, Ministry of Public Enterprises, Ministry of Internal Affairs & Civil Society Organisation & MEIDECC, Ministry of Foreign Affairs, Tonga Water Board,

Stakeholder Community: UNGGIM, SOPAC, SPREP, LINZ, Earth observation data providers e.g. GEO, Copernicus Program. Development Aid agencies (AusAid, NZAid), NGOs and government departments who are significant users of geospatial information.

7.2 Contact Persons

The CEO or person(s) to be assigned/authorized by the CEO, to oversee and provide result orientation of this Strategic Pathway.

MINISTRY OF LANDS & NATURAL RESOURCES	MINISTRY OF PUBLIC ENTERPRISES
✸ Chief Executive Officer ✸ HoD – LGIS Division	✸ Chief Executive Officer
MINISTRY OF INTERNAL AFFAIRS	CIVIL SOCIETY ORGANISTION
✸ Chief Executive Officer	✸ Chief Executive Officer

7.3 Background and Rationale

There is strong informal collaboration and cooperation of line public and government organisation with the local community or public and international donors and agencies. Although these international donors focused on disaster and climate initiative projects some organisations have indirectly benefit from these such as in-kinds. At some extent of geospatial information is required in some aspects hence the LGIS Division is fortunate to contribute to their activities. However, there is minimal formal partnership and joint ventures between government and public and private agencies. Though the demand for capacity building programs joint ventures is high from the public and private agencies.

In Tonga, partnerships are often avoided in favour of the traditional siloed approach to geospatial information management. Common problems include a lack of commitment and unwilling participants,

differences in philosophies or work styles and inadequate understanding of roles and responsibilities, fear of hidden agendas, and financial and time commitments that are perceived as outweighing potential benefits.

Often, due to the lack of commitment and awareness, localized data are rarely shared or discussed amongst co-related agencies and ministries. Overall, a foundation of partnership is close to none, however, there is identification and acknowledgement of inter-related activities and similar responsibilities. There is lacking in joint ventures and cross-sector discussions on data formalities and formulations. The current technologies are mostly requested, installed and individually tasked, without further investigation on platforms or opportunities to combine and develop a centralized integrated geospatial system.

Nonetheless Tonga recognises the value in building partnerships is being and to draw on a wider pool of technical expertise, experience, skills, labour and networks when working towards geospatial information management gaols, as well as reducing costs through shared resources and avoiding duplication.

Tonga's geospatial Information management goals cannot be achieved by any one organisation alone and therefore the Country-level Action Plan includes the investigation into partnerships to bring about positive change.

7.4 Proposed Approach

The proposed Partnership model (*Figure 19*) considers all aspects of the geospatial data management life cycle: from creation and initial storage; its dissemination and use as an information product; to the time when it becomes obsolete and is deleted. The standard life-cycle management approach involves establishment of partnership and joint ventures program to be accepted and practise by organisations; increasing geospatial information usability, and access for multi-sectoral benefits.

Cross-sector and inter/intra-regional to international collaboration are essential to the impact and effectiveness of the integrated geospatial management. Formal and informal settings are key foundations to the partnership to be formed. The relating ministries, organizations, private businesses to the community, are fundamental for the inclusive inflow and outflow of data.

The Proposed Partnership Model approach is designed to address the concerns of government agencies through an integrated approach that:

- Identify the different levels of participation that evolves through data collaboration and management; ministerial, organizational, interested foundations; locally, nationally, regional and international. To which all will have similar to various priority areas and focus, depending on the scale of dataset and integrated geospatial information they provide and access.
- Explain the role and the reason of having an international collaboration program in place, this increases the benefit Tonga will gain toward technology, capacity building and access to a global agenda of geospatial information management and expanding Tonga's insight of international trade, recognition and sustainable developments.
- Explain the role and responsibility of relevant non-profit organisation especially community participation and how they can impact the ease of implementation of the Action Plan.

- Explain the role and responsibility that private and public enterprises given that a proposal of a joint venture partnership could elevate their planning and asset management strategies, for instance; utility companies (Tonga Power, Tonga Water, Telecommunication etc).

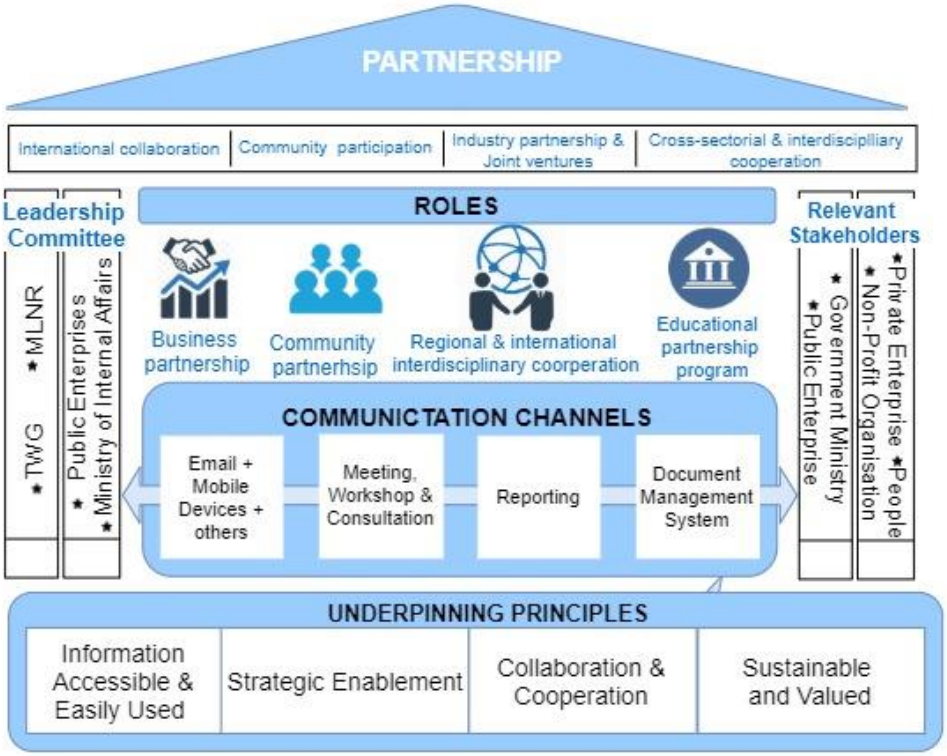


Figure 19: Proposed Partnership Framework

7.5 Objectives

The overarching aim is to create and sustain the value of geospatial information through a culture based on trusted partnerships and strategic alliances that recognize common needs and aspirations, and national priorities. Specific objectives for implementing the Partnership Framework are:

- Through partnership, acquiring the best available data from the best source;
    - Maximise the net benefits of spatial information to the community.
- Developing important collaborative relationships with different levels of government and across the various national agencies.
- Formally engaging through partnerships with users to validate the usefulness of products and services offered as well as learning new needs and potential applications of the geospatial information.
- Planning, recording and acquiring geospatial information through a least cost and coordinated approach.
- Clear oversight of nationally/internationally funded projects that acquire geospatial information.
- Acquiring multi-user (shared) licenses for imagery to enable reuse by many organisations.

- Build cooperative working relations between organisations that contribute different skills, ideas, financial and technical support.
- Leveraging greater value through economies of scale and consolidated spend.
- Establish an annual program of work where organisations can register their requirements annually.
- Identify opportunities for sharing knowledge and resources.
- Open up funding and in-kind opportunities for government.

7.6 Actions

The actions for establishing a Partnership Framework that will create and sustain the value of geospatial information in Tonga have been identified to deliver effective cross-sector and interdisciplinary cooperation, industry partnerships, community participation and international cooperation.

Action 34. Enforce Data Acquisition Collaborative Program – aim to acquire data, collate, and disseminate data, (outsource data collection) e.g: Business partnership ventures.

a34.1. Establish norms and a communication structure for the program.

a34.2. Implement a Technology Platform to manage data acquisition requests, prioritisation, and schedule notifications.

a34.3. Secure funding and resources to support the Program.

Action 35. Identify, formalize and frequently maintain local and national partnership or cooperation on Crowdsourcing and Volunteering program.

a35.1. Categorise stakeholders into groups (Local community, non-profit organization, media, private enterprises etc).

a35.2. Establish norms and a communication structure program for each stakeholder Category.

a35.3. Initiate a Collaborative Agreement with non-government organisation to support crowdsourcing and volunteering program.

Action 36. Strengthen Regional and International interdisciplinary cooperation through multilateral sector knowledge sharing for skills and program development on Geospatial information.

a36.1. Establish norms and a communication structure for the program.

a36.2. Initiate a Collaborative Agreement based on:

- Sharing imagery datasets.
- Sharing software and application licenses.
- Provision of training in using specialised equipment (Drone, GPS, GNSS etc.).
- Geospatial datasets etc.

a36.3. Develop the Reporting Framework and timeframes.

Action 37. Develop and secure (formalize) partnership and with Government key Institutions

a37.1. Establish norms with key institutions (supply chain, frequent users etc.).

- the Ministry of Education and non-government Head of Board.
    - Initiate a Partnership Agreement (limited timeframe) to encourage students to pursue studies in STEM areas especially Surveying, GIS, Geodetic, Civil Engineering etc.
    - Publicize agreement to encourage students of the opportunity.
- The Universities and Tertiary Institutes.

a37.2. Secure funding to support partnership agreement.

Action 38. Review partnership operational and financial implications.

a38.1. Gather operational and financial assessment of the Agreements in place.

a38.2. Identify issues and benefits presented by the already established agreements.

a38.3. Provide support or solution to strengthen the Agreement.

7.7 Implementation Schedule

The Partnership pathway implementation timeframe shown in *Table 17* is intended to start on the 1st Quarter of the 3rd year. These actions focused on assessing key and potential stakeholders and securing partnership or joint ventures with them. Partnership programme requires signing of agreements for mutual benefits.

This pathway is interdependent on pathway 1 and 2, and is intended to be implemented after pathway 4 and 7.

Table 17: Implementation scheduled for Strategic Pathway – Partnership

SP7	Partnership - ACTION	PLAN START	PLAN DURATION
Action 34	Enforce Data Acquisition Collaborative Program – aim to outsource data collection, e.g.: Business partnership ventures.	24	5
Action 35	Identify, formalize and frequently maintain local and national partnership or cooperation on Crowdsourcing and Volunteering program.	26	5
Action 36	Regional and international interdisciplinary cooperation across multilateral sectors.	28	3
Action 37	Develop and secure (formalize) partnership and relationship with Key Government Institutions.	24	2
Action 38	Review partnership operational and financial implications.	30	2

7.8 Deliverables

- A National Geospatial Data Acquisition Program Governance Model.
- Annual National Geospatial Data Acquisition Program made available online.
- A crowdsourcing and Volunteering program.
- Regional and International Partnership Program.
- Multi-disciplinary partnership program.
- Community Outreach Program.
- A partnership agreement with academic and educational institutions.
- Designated space for geospatial information baseline location. Emergency and ad-hoc situations will not cause any disruption to the flow of data collection and dissemination.

7.9 Outcomes

- Effective cooperation across disciplines and sectors, private sector and academia, communities and stakeholders, levels of governments, regional and international cooperation;
- Enhance efficiency of development efforts through the exploitation of complementary advantages of those involved in a partnership;
- The diversity that partnerships bring to organizational knowledge, expertise and proficiencies;
- Complementary skills, experiences, knowledge and resources; and
- Strategic and synergistic endeavours, and trusted partnerships that recognize common needs, aspirations, and goals, and national priorities.
- Inclusive awareness and distribution of knowledge and skills to all – leaving no on behind.
- Cost reduction and faster method in respond to disaster or national data collection using crowd-sourcing and volunteering.
- Promote the importance of Integrated Geospatial Information to general public.

Table 18: Risk & Mitigation Strategy for pathway – Governance & Institutional Arrangements

Risk	Likelihood (1 low-5 high)	Severity (1 low-5 high)	Mitigation Strategy
Lack of awareness and understanding for Geospatial Management and Operations.	3	3	Ensure all parties in the relationship have at least one goal on which they are jointly focused for the purpose of the work being undertaken. Revisit official documentation and agreement of partnership and enforce the layout.
Inconsistency in data collection and quality.	2	3	Include quarterly review to cater for agency changing priorities. Develop the annual program and seek early clarification from agencies on scheduled activities and specifications. Set in place an evaluation process and designated champions.
Crowdsourcing and Volunteering programs are not supported by government organization because of data reliability.	3	2	Set criteria to screen volunteers based on age, work and academic background and ability to conduct volunteering work.

7.11 Budget Estimation

Refer to APPENDIX 2: BUDGET ESTIMATES

7.12 Funding Status

Action 34 & 35: Initial funding is to be secured from the DAP. Long term, funding is to be acquired over investment return of value-add to geospatial information and is used to cover for data acquisition and updates, crowdsourcing and volunteering.

SP8. CAPACITY AND EDUCATION

Establish enduring capacity building programs and education systems so that geospatial information management and entrepreneurship can be sustained in the longer term.

8.1 Agencies Involved

Lead Ministry: LGIS & Survey Division – MLNR, Ministry of Education

Implementation Agency: LGIS & Survey Division – MLNR, Tonga Statistics Department, Ministry of Education & Training

Stakeholder Community: Organisations responsible for generating data, such as the Ministry of Lands & Natural Resources departments, His Majesty's Armed Force, Civil Society Organisation, Public enterprises, private enterprises, non-profit organisations and Government departments who are significant users of geospatial information.

8.2 Contact Persons

The CEO or person(s) to be assigned/authorized by the CEO, to oversee and provide result orientation of this Strategic Pathway.

MINISTRY OF LANDS & NATURAL RESOURCES

- HoS – LGIS Section
- HoS – Geodetic Section

TONGA STATISTICS DEPARTMENT

- Senior Training Officer

TONGA NATIONAL QUALIFICATION ACCREDITION BOARD

To be confirmed

MINISTRY OF EDUCATION & TRAINING

- HoD – Training & Development Division

8.3 Background and Rationale

The 'geospatial information' concept is a whole new level of knowledge to most organisations and the general population. The lack of awareness and outreach program, minimal education in related fields such as geology, surveying, GIS and geodetic and areas related to science and technology limits the expansion of geospatial concept in Tonga. This also results in less entrepreneurship activities using geospatial information. There is heavy demand for professional training in capacity development for staff and organisations.

Having the technology to share data is only one aspect of strengthening integrated geospatial information management. It is just as important to have a high level of computer literacy skills within the community to ensure its use; and the professional skills in the workforce, to use it innovatively.

In Tonga there is a need to actively promote geospatial information and advertise the National Map Portal to the broader community. Whilst internet and web-based products are becoming increasingly popular, the majority of the community are not aware of how geospatial information can be used or have access to it. Yet it is the community that can provide valuable local spatial information. Limited computerisation and low computer literacy among the user population, means that a large component of the intended user group will not realise the full benefits of being able to access integrated spatial information online.

Making innovation work requires a workforce with a range of sophisticated skills. Building this capacity is crucial for economic development and growth. This calls for the active promotion of the spatial sciences and increased government partnerships with universities and training providers to ensure the profession has the necessary skills.

8.4 Proposed Approach

Building a foundation from basics, such as geography, social science and computer studies is very important for skill development. Integration of Geospatial Information would be more prominent by building on existing curriculums and systems. Producing new methods to encompass current educational and ministry/organization systems can broaden the scope for interested users and participants.

The current systematic knowledge and functions regarding geospatial information are lacking, yet the basis of the digital and geographical knowledge is present in the current educational curriculum and every day uses of the public as a whole. Broadening of these existing ideas and encompassing the pathway to which leads to Geospatial Information can ingrain the skill and required capacity development for Integrated Geospatial Information.

Training and workshops can develop skills and capacity levels. Users can be more aware and informed by personally getting involved either through daily use or knowledge training, which can enhance their interest and skills on geospatial information. All these can be very effective as well, if the foundation of geospatial information is being strengthened.

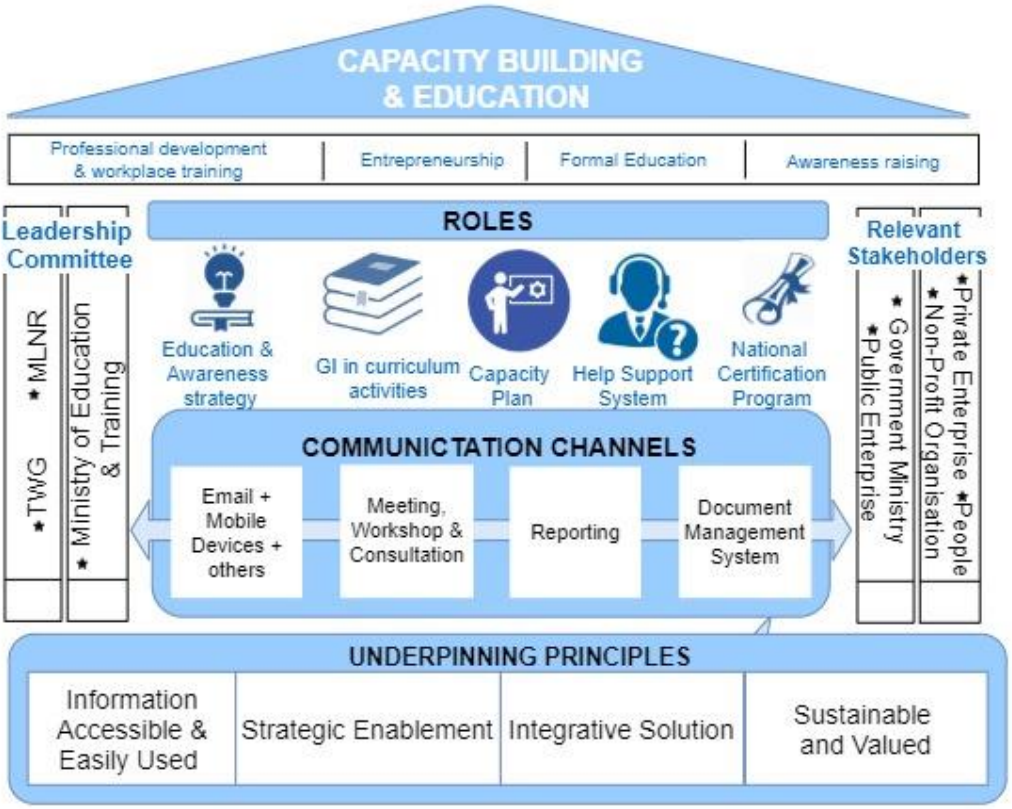
The proposed approach to the Capacity and Education Framework (

Figure 20) is to ensure the best use of spatial information within the professional and general community the proposed approach to education and awareness is as follows:

- Geo-Data Inclusiveness and Practicality: Familiarise Practices on Geospatial Information for government, non-government, private and business sectors. Include traits for geo-data management, such as data classification, data management, and localisation of data input.
- Communication and Awareness: Establish a proper understanding of geospatial information and the Country Geospatial Strategy among stakeholders and general public to increase their understanding of the use of spatial information technologies. Develop understanding within the

community about integrated geospatial information management and National Map Portal through various media platform (Communication Channel).

- Capacity development: Enhance the skills of individuals, organisation and social groups through participatory training in the use of the National Map Portal and/or establishment of a GIS system. Including the incorporation of geospatial information in academic curriculum and its relation to disaster and environmental management application. Also proposing that formal education is attained in STEM (Science Technology Engineering and Mathematic) fields related to geospatial such as Geodesy, Cadastral Surveying, Remote Sensing etc.



- Empowerment: Develop organizational competency, and in particular that of data custodianship, so that they can take responsibility for their role in strengthening integrated geospatial information management, by providing effective Help Support System and the establishment of a National Certification Program recognising skilful and experience technical personnel.
- Participation: Progressive empowerment from informing stakeholders, to consultation, to consensus building, to devolved decision-making, risk taking and partnerships.

Figure 20: Proposed Capacity and Education Framework

8.5 Objectives

The overarching objective is to increase the awareness and level of understanding of geospatial information science. This includes developing and strengthening the skills, instincts, abilities, processes and resources that organizations and communities require to utilize geospatial information for decision-making.

As systems vary in level of capacity and awareness infiltration, approaching through various developing schemes can be effective to some advantage. For the correct sectoral divisions, approaches can be made per; academia, government, private and public as a whole.

Specific objectives for implementing the Capacity and Education Framework are to:

- Capacity planning to identify the spatial core competencies and common skills sets required and incorporate these into existing training programs to increase the uptake of spatial technologies in the government sector.
- Actively raise awareness of geospatial information and promote the use of such knowledge in daily data collection and compiling. This also raises awareness on the National Map Portal to the community through various media.
- Support research, innovation and skills development through open access to spatial information.
- Change social norms, values, perceptions, and conversations about the value of spatial information through a communications program.
- Remove barriers and create incentives to use spatial information more broadly and as part of daily life.
- Increase job opportunities and add value to small businesses.
- Expand and grow digital literacy and knowledge to rural and isolated communities

8.6 Actions

The actions for establishing enduring capacity building programs and education systems have been identified to raise awareness and develop and strengthen the skills, instincts, abilities, processes and resources that departments require to manage and utilize geospatial information for decision-making. It is essential to extend all capacity and education learning and awareness of geospatial information to include vulnerable population or minorities for example, disable population, elderly etc.

Action 39. Develop a cross-sector Capacity Assessment to identify areas need for improvement

a39.1. Establish norms and a communication structure between leading, implementing organisations and relevant stakeholders.

a39.2. Develop a Capacity Building Need Assessment/Survey on Core Competencies.

a39.3. Secure funding to provide for trainers and office resources.

Action 40. Develop an Education and Awareness Program to promote an understanding of how integrated geospatial information supports economic, environmental and societal needs in workforce and academic arena.

a40.1. Seek approval for incorporation of GIS Curriculum activities in primary, secondary and tertiary school level.

- Seek endorsement of the School's Board, TNQB, Committees and Principals/Dean/ Head of School.
- Hire a contract academic expert into the Curriculum Development Unit.
- Develop the right level of curriculum per level at primary, secondary and tertiary (Student booklet).
- Develop a Work Plan, describing method use per target audience (language, examples, key speaker, demonstration tool etc.), resources and man-power.
    - Provide training on how to implement the Work Plan (if required).
- Check and approve by the Tonga National Qualification Board (TNQB).
- Launch, introduce into teacher's work plan, and school's curriculum.
- Monitor school's interest level and number of student intake of the new introduced curriculum.
- Review the curriculum every two years.

a40.2. Secure funding to support Action.

a40.3. Schedule a day/week dedicated to Geospatial Information (GIS Day/Week).

a40.4. Launch and implement A40.2

a40.5. Frequency of Feedback of education and awareness program.

Action 41. Develop a cross-sector Capacity Development Plan (Training Package) to target professional development in geospatial skills and technologies – short- and long-term knowledge and training.

a41.1 Identify Core Functions and Key Products for Geospatial Information Skills.

a41.2 Develop knowledge and training materials according to Core Functions and Key Products of Geospatial Information.

a41.3 Conduct a public or media cover targeting interested and vulnerable population with no or little knowledge of geospatial information.

a41.4 Establish norms and a communication structure with Ministry of Internal Affairs, Civil Society Organisation and local non-profit organisation.

a41.5 Develop a Capacity Building Work Plan.

a41.6 Secure funding to provide for trainers and office resources.

a41.7 Perform a 'Before and After' evaluation.

Action 42. The Leading Organisation provides Technical/Help Support System for users of government geospatial information.

a42.1 The TWG endorse a Help Support System to be established.
a42.2 Acquire requirements to set-up a support system (online and offline).
a42.3 Design system support – Eg: LAN Messenger, a developed app, Help Support Desk.
a42.4 Develop a standard method for providing Help Support and requesting for support.
a42.5 Allocate and train the 'Help Support' staff
a42.6 Build/Test/Deploy
a42.7 Release to stakeholders and public.
a42.8 Seek funding for system building and maintenance.

Action 43. Establish an Innovation & Research Centre - its members consist of public to incentivise the use of spatial data.

a43.1 Set-up of an Innovation & Research Centre.

- Conduct a stakeholder workshop to buy-in support from line stakeholders.
- Seek approval of Cabinet (if required) with support from TWG and leading/ implementing organisations.
- Identify hosting/responsible organisation to lead and partially provide for this centre
- Invite line stakeholder to be a member – research/intern staff.
- Identify funding to support the cause.
- Provide an annual report of the progress of the Centre and its contribution to producing scientific/academic findings using geospatial data and information.

a43.2 Develop and maintain an Online Capacity and Education Learning System in place.

(This can be incorporated into the National Geospatial Portal/Website or a separate Online Forum).

- Acquire relevant information requires
- Develop system design (considers):
    - Membership Log-in.
    - the history of Geospatial Information in Tonga.
    - List of Data/Standard Inventory with links to responsible organisations.
    - Existing curriculum related to geospatial information (link to TNQB).
- Develop an interactive map system in place (for learning purposes).

- Build/Test/Deploy
- Hire a Developer & System Design Analyst or build a Developer Team from existing IT staff
- Secure funding for building and maintenances

Action 44. Monitor and evaluate all training, help support activities carried out.

a44.1 All responsible implementing organisations to report to leading organisation.

a44.2 On-site validation is required to be conducted.

a44.3 Review all system development quarterly, training and workshops/seminars to be reviewed at end of trainings.

a44.4 Resolve issues or improve them.

Action 45. Establish a National Certification Program that verifies one's capabilities and values that is regionally and internationally recognised through partnership programs.

a45.1 Seek endorsement of Cabinet and relevant stakeholders.

a45.2 Establish a National Certification Board & Office (or use existing organisation – Ministry of Labour & Commerce).

a45.3 Seek partnership with regional and international organisations.

a45.4 Develop a National Certification Standard for technical themes: Surveying & Geodesy, Civil Engineering, GIS & Remote Sensing, Geologist, Hydrologist etc.

a45.5 Develop a method of management of applicants.

a45.6 Launch and release to public.

a45.7 Provide a National Licence Certificate to qualified technical expert.

a45.8 Seek funding to support Board, staff and office resource

8.7 Implementation Schedule

The Capacity Building and Education pathway implementation timeframe in Table 19 is intended to start on the 1st Quarter of the 4th year and slightly overlapping to the 5th year. These actions focused on providing capacity building resources, training and incorporating geospatial curriculum into the academic courses and increasing STEM graduate students to strengthen and support the goals toward the SDGs.

This pathway is interdependent on pathway 1 and 2, and 4. It can be implemented throughout any time period of the plan as desired by the MLNR and TWG.

Table 19: Implementation scheduled for Strategic Pathway – Capacity Building & Education

SP8	Capacity Building & Education - ACTION	PLAN START	PLAN DURATION (number of months)
Action 39	Develop a cross-sector Capacity Assessment to identify areas need for improvement.	38	5
Action 40	Develop an Education and Awareness Program to promote an understanding of how integrated geospatial information supports economic, environmental and societal needs in workforce and academic arena.	42	5
Action 41	Develop a cross-sector Capacity Development Plan (Training Package) to target professional development in geospatial skills and technologies – short- and long-term training.	22	5
Action 42	The Leading Organization provides Technical/Help Support System for users of government geospatial information.	25	5
Action 43	Establish an Innovation & Research Centre - its members consist of public to incentivize the use of spatial data.	45	7
Action 44	Monitor and evaluate all training, help support and activities modules carried out.	42	5
Action 45	Establish a National Certification Program that verifies one's capabilities and values that is regionally and internationally recognized through partnership programs.	40	5

8.8 Deliverables

- Education and Awareness Program
- Communications Plan
- Geospatial Information Curriculum
- Capacity Plan for Professional organisation
- Training Package for amateur population
- Help Support System
- Online Capacity/Educational System
- National Certification Program

8.9 Outcomes

- Broad scale awareness and capabilities in spatial information and technology use through capacity and education programs and awareness raising.
- An increase in the number of primary and secondary school children with knowledge and skills in geography and geospatial science.
- Accessible from anywhere at any time - capacity and educational materials and knowledge.
- An increase in the number of graduating professionals in geospatial information-related sciences.
- A heightened awareness and increased adoption of geospatial technologies by the government and private sector leading to the creation of innovative solutions that contribute to economic growth.
- Fast respond to issues, quality and less critical problems with operational activities.
- High standard experts and internationally recognize technical staff.

8.10 Risk Mitigation

The ability to deliver actions associated with the Capacity & Education Strategic Pathway has the following associated risks.

Table 20: Risk & Mitigation Strategy for pathway –Capacity Building & Education

Risk	Likelihood (1 low-5 high)	Severity (1 low-5 high)	Mitigation Strategy
Current education system does not support the capacity and education geospatial recommendations and needs of Tonga.	3	3	Revisit Ministry of Education and board of directors to clarify misunderstanding as well as give understanding on the importance of Geospatial Information to everyone in general.
Current users cannot comprehend the information and requirement for management of geospatial information.	2	3	Develop and distribute knowledge and awareness materials to related ministries and organizations
There is no increase in the use of spatial information via ministry visit and through media engagement (such as competitions for GIS Day OR request for existing data and the National Map Portal.	1	1	• Refine the Education and Awareness Strategy • Review design of system portal • Community Outreach and self-promotion
There is no evidence to indicate the increase of university applicants for Geospatial	3	3	• Review curriculum • Provide more training for teachers

Information intake students and graduates, such as STEM interests, Geography and IT Majors or Cartography students.			• Promote more awareness through High School and University visits
Graduate students with quality understanding on Geospatial Information migrates, such as those majoring in Geography and IT, Cartography, Geospatial Management and STEM.	3	4	• Enforce bonding agreements of 2-3 years of work in Tonga • Provide incentive to employees
An increase in community volunteered data is not evident.	2	1	Increase the number of community-based awareness programs
Help Support System is not effective and relies on internet network	3	1	• Identify specific issue, review system design. • A policy on the mandatory use of fibre optic lines. • Provide more training to Help Support staff.
No evidence to show that Qualified/Certified experts contributes to the development of Tonga.	3	2	• Review Certify Standards that applicants must have a significant contribution. • Renew certification at a time period (2/3 years' time).

8.11 Budget Estimation

Refer to APPENDIX 2: BUDGET ESTIMATES

8.12 Funding Status

This strategic pathway is one of the prioritized them to advance Tonga's capabilities toward improving our current status of geospatial information management. Therefore, it is with uttermost desire to let the Development Account Project fund this entire pathway, given that existing staff and resources can be used in cases where they are interoperable/ compatible.

SP9. COMMUNICATION AND ENGAGMENT

Identifies and involves stakeholders (including the general community) as integral to integrated geospatial information management systems, and recognizes their buy-in is critical to success.

9.1 Agencies Involved

Lead Ministry: MLNR – LGIS Division & MEIDECC – Communication & Information Division

Implementation Agency: MLNR – LGIS Division, TWG, PMU

Stakeholder Community: All key stakeholders were identified (during workshop and meeting) and have developed similar interest and alliances including key and minor stakeholders such at government, private and public agencies, third parties and users. It is recommended to include the Tonga Broad Casting Commission, Radio Tonga and other media outlet like FM. 87.9 radio etc.

9.2 Contact Persons

The CEO or person(s) to be assigned/authorized by the CEO, to oversee and provide result orientation of this Strategic Pathway.

MINISTRY OF LANDS & NATURAL RESOURCES

- HoD – LGIS Division
- HoD – Surveying & Geodesy Division

CIVIL SOCIETY ORGANISATION

- Chief Executive Officer

TONGA BROADCASTING NETWORK

- Chief Executive Officer

MINISTRY OF EDUCATION & TRAINING

- HoD – Training & Development Division

MEIDECC

- HoD – Communication & Information

9.3 Background and Rationale

The importance of keeping engage and contact with stakeholders is vital to successfully implementing of the Action Plan. Nonetheless, there is no formal engagement strategy in place for except for the normal communication method of circulating engagement invitations. The major gap in this pathway, that there is no compliance system or strategy in place to ensure the commitment and participating of relevant stakeholder toward target goals and activities. Therefore, there is great uncertainty in the willingness of stakeholders to participate or join in the development and implementation of the integrated geospatial information management.

Stakeholders are integral to the development of the Tonga integrated geospatial information and therefore buy-in and commitment, particularly from Ministers and senior management, is critical to success. It is therefore important to develop a supportive governance environment that embraces stakeholders and acknowledges the importance of their role.

It is recognised that potential stakeholders will only become active participants if they see advantages for their organisations and if they do not feel threatened by the governance arrangements. The primary stakeholders for Tonga are:

- Government data suppliers and users. - their role in integrated geospatial information management is largely defined by government policies regarding data management, distribution and access, and as a consequence they need to be included in the development of the associated frameworks.
- Commercial entities (Public & Private enterprises) - they play a strong role as users of the National Map Portal; however, they may also be suppliers of primary and value-added data in the longer term, such as utility datasets and therefore need to be consulted and informed.
- The end-user community – they are concerned about data access, functionality of the infrastructure tools, the amount and quality of the content - its accessibility, fees for data access and usage policies. This includes researchers, students, third-party organisation etc.
- Key decision makers - they need to be kept informed about progress towards strengthening geospatial information management, and the benefits that are being progressively realised. This refers to Cabinet members, politicians, nobles etc.

9.4 Proposed Approach

The proposed approach to the Communication and Engagement Framework achieve a participative approach to cooperation and coordination in order to build on common interests and requirements. The approach will be documented as a Stakeholder Engagement Model and Plan (to be developed).

A stakeholder requirements matrix will be used to determine common, essential and aspirational needs. The following principles are adopted:

- Apply open and effective communication strategies.
- Use clear and agreed information and feedback processes.
- Work collaboratively to seek mutually beneficial outcomes where feasible.
- Be inclusive by recognising, understanding and involving stakeholders in the process.
- Conduct engagement in a manner that fosters mutual respect and trust.

Identifying stakeholders will require the creation of a geospatial information community profile and include groups who traditionally are underrepresented in planning efforts. These communication plans are monitored and evaluated over time.

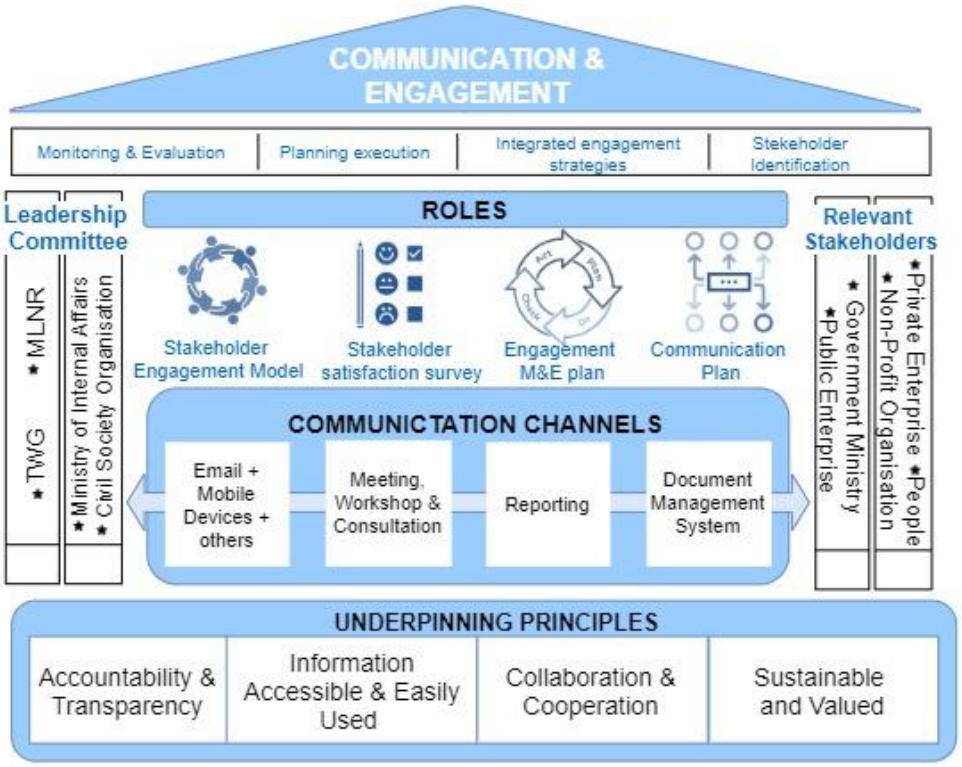


Figure 21: Proposed Communication and Engagement Framework

9.5 Objectives

The overarching objective is to deliver effective and efficient communication and engagement processes to encourage greater input from stakeholders in order to achieve transparent decision-making processes when implementing Tonga's Action Plan.

Specific objectives for implementing the Communication and Engagement Framework are to:

- Determine the stakeholders, organizations and public understand Integrated Geospatial Information and its core values.
- Understand stakeholder concerns, views, requirements and expectations.
- Better awareness of and ability to deal with issues of significance to stakeholders.
- Planning and Conducting Awareness Programs to increase the Geospatial interested parties.
- Respond coherently and appropriately to stakeholder needs.
- Enhance the understanding and acceptance of Tonga's Action Plan and the need to strengthen integrated geospatial information management.
- Early identification of potential problems leading to better risk management.
- Identify communication channels to which reaching the public and geospatial users would be impactful; a give and take situation to which interaction between the data providers and users are common.

- Create a cross parallel dimension between Geospatial Information providers and users; to which commonality is using location, geographic tactics and familiarize with reading computerization of environmental features, such as road maps, addresses and destination descriptions.
- Provide transparency, accountability and integrity in planning and implementation.
- Opportunities to develop long-term and trusted relationships.

9.6 Actions

Action 46. Develop the Stakeholder Engagement Model - PLAN, ENGAGE, RESPOND and MEASURE.

a46.1 Develop the Stakeholder Engagement Plan

- Geospatial Information Community Profile
- Stakeholder Engagement Matrix (Add F): Identification of stakeholders and their level of influence
- Design of the engagement process and methods including a checklist and communication plan (Add F)
- Consideration of logistics
- Set engagement frequency
- A Risk Management Model

Action 47. Perform Community/Organization Outreach Program and review outcome.

a47.1 Prepare a Work Plan on a community outreach program to raise awareness and educate local community on IGIM using easy language and scenarios.

a47.2 Conduct an Information Sessions and/or Workshops for staff.

a47.3 Train the Community Outreach team of their roles and responsibilities.

a47.4 Secure funding to provide resources (human and material) for the outreach program.

Action 48. Conduct a Stakeholder Satisfaction/ Feedback Survey (Evaluation Form)

a48.1 Develop a standard questionnaire to include:

- Engagement Process & methods issues and feedback.
- Communication method/plan issues and feedback.

a48.2 Document Stakeholder Evaluation.

a48.3 Present to TWG and disseminate report to relevant stakeholders.

Action 49. Develop a Stakeholder Engagement Monitoring & Evaluation Plan (with indicators).

a49.1 Acquire information needed to develop a Monitoring Plan (from engagement plan)

a49.2 M&E Plan should include:

- Task/Issue
- Performance Indicator
- Target

- Outcome

Action 50. Develop a Communications Plan to document behavioural change over-time by targeting various audiences with appropriate messages/themes.

a50.1 Document and Categories feedback, comment and discussion ideas into positive.

a50.2 Record the audience type, theme/ subject type, communication method uses and date.

a50.3 Compare results of the same audience group.

a50.4 Assess if there are any behavioral change based in the language use, feedback/comments.

a50.5 Report to TWG

9.7 Implementation Schedule

The Communication and Engagement pathway implementation timeframe in Table 21 is intended to start on the 1st Quarter of the 2nd year to stage effective engagement. It can be implemented at any given period in the plan but it is best to initiate after pathway 1 where Action 48 to Action 50 can be re-applied consistently throughout the duration of the plan for effectiveness.
This pathway is interdependent on pathway 1. It can be implemented throughout any time period of the plan as desired by the MLNR and TWG.

Table 21: Implementation scheduled for Strategic Pathway – Communication & Engagement pathway

SP9	Communication & Engagement - ACTION	PLAN START	PLAN DURATION (number of months)
Action 46	Develop the Stakeholder Engagement Model - PLAN, ENGAGE, RESPOND and MEASURE.	6, 14, 26, 38, 50	3
Action 47	Perform Community/Organization Outreach Program and review outcome.	June, July, August	2
Action 48	Conduct a Stakeholder Satisfaction/ Feedback Survey (Evaluation Form).	6, 14, 26, 38, 50	3
Action 49	Develop a Stakeholder Engagement Monitoring & Evaluation Plan (with indicators).	6, 14, 26, 38, 50	2
Action 50	Develop a Communications Plan to document behavioural change over-time by targeting various audiences with appropriate messages/themes.	6, 14, 26, 38, 50	3

9.8 Deliverables

- A high quality Stakeholder Engagement Model and Plan (Document).
- Geospatial Information Community Profile.
- A Stakeholder requirements matrix – describing common, essential and aspirational needs.
- Stakeholder Engagement Monitoring and Evaluation Plan and checklist.
- Satisfaction Survey Questionnaire.
- Stakeholder Communication Plan.
- Stakeholder Communication & Behavioural Change Plan.
- Newsletter of the Status of current and future data sets and data themes (From Data/Deliverables).

9.9 Outcomes

- Heightened awareness and actively engaged in the process of strengthening geospatial information management.
- Greater synergies and increased use of geospatial information within government, the private sector, academia and the broader community leading to innovations and major accomplishments.
- Strong sense of trust in government information and confidence in its use.
- Opportunities to enhance development and increase the benefits of geospatial information to communities and country.
- Geospatial agencies and their staff ready to meet national demands for digital data and services through increased awareness, and an ability to contribute and influence government policy.
- Stakeholder are updated and kept informed on governmental changes, plan and objectives.
- Stakeholders found a platform to voice concern and impact of geospatial information.
- Strengthened institutional mandates and political buy-in.

9.10 Risk Mitigation

The ability to deliver actions associated with Communication and Engagement Strategic Pathway has the following associated risks

Table 22: Risk & Mitigation Strategy for pathway – Communication & Engagement

Risk	Likelihood (1 low-5 high)	Severity (1 low-5 high)	Mitigation Strategy
Communication material is not understandable and standard for use.	1	5	Seek advice from experts and develop a more integrating material for consumable use.
Communications strategy is not effective.	3	5	Develop an early inclusive communication platform with stakeholders to identify key strategies for effective approach.
No clear communications channel for data distribution and collection.	2	4	Readdressing the key uses and users of network-based information. Identifying standard network uses and user research.
Available spatial data sets do not meet user requirements.	1	5	Seek further consultation and feedback to understand issues with adoption.
Funding not available to meet all user requirements.	4	2	Produce 5-year Plan showing future developments and disseminate to stakeholders. In this way stakeholders will know that their needs are being considered even though they are not a priority.
Event cancellation.	3	3	Careful planning and ongoing liaison with stakeholders.
Stakeholders are not committing to scheduled events.	3	5	• Consult stakeholder of their convenient time and re-scheduled. • Use new form of communication – online (Zoom), phone or email. • Provide incentive to attending stakeholders.

9.11 Budget Estimation

Refer to APPENDIX 2: BUDGET ESTIMATES

9.12 Funding Status

Funding can be secured through from co-sharing of costs by the leading agencies.

APPENDIX 1: NGAP CHRONOLOGY

A brief chronology of the National Action Plan development

Components	Date	Activity/ Event
1: Project Execution Plan	▪ 8th July, 2019 ▪ 8th July, 2019 ▪ 10th July, 2019	1. Project Initiation Meeting 2. Pre-needs Assessment Sharing Meeting 3. Project Scoping & Schedule
2: Needs Assessment and Gap Analysis:	▪ 15th - 16th of July (internally within the Ministry) ▪ 23rd of July: National Stakeholder Workshop Part 1 (external stakeholder) ▪ 25th– 26th July: 1-1 Meeting (external stakeholder) ▪ 27th August External stakeholder Workshop Part 2 ▪ 5th - 6th of August NY Workshop (UN Consultants) ▪ 10th of September (internally within the Ministry) ▪ 19th of December	4. Current & Desired Performance 5. Baseline Survey 6. Environmental Scanning (PEST & SWOT) 7. Stakeholder Identification & Analysis 8. Stakeholder Engagement Workshop *(Repeat step 4 – step 8)* 9. Strategic Alignment (and Benefits) NY Workshop 10. Vision, Mission and Goals 11. Gap Analysis Matrix 12. Needs Assessment and Gap Analysis Report
3: Country Action Plan	▪ 10th of September (internally within the Ministry) ▪ 11th February (internally within the Ministry) ▪ 19th February – 2nd March 1-1 Meeting (external stakeholder)	13. Review Country Action Plan template 14. Strategic Pathway Activities 15. Populate Country Action Plan (with Activities) 16. Implementation Schedule 17. Budget Estimation 18. Develop Success Indicators
	▪ 2019 ▪ 25th - 26th June 2020 ▪ 3rd July, 2020 (internal meeting)	19. Finalize Country Action Plan Draft 1.0 20. Review Draft 1.0 and incorporate feedback from stakeholders 21. Review Draft 1.0 and incorporate amendments

APPENDIX 2: BUDGET ESTIMATES

Breakdown overview of the Budget Estimates for project activities identified in the Action Plan. The detailed and complete Budget Estimates is found in here or *refers* to the Attached Appendix 1: Budget Estimates.

*** Currency in TONGAN Pa'anga - TOP**

Reference	Project Description	Original Funding ($)		Balance Funding ($)		Consultant Fees	Data and Technology	Office Resources	Others	Total Capital Required
		Recurrent	Single Allocation	Recurrent	Single Allocation					
SP1: Governance	Leadership, governance model, institutional arrangements and a clear value proposition	100,000	960,000	50,000	783,000	300,000	377,000	100,000		2,670,000
SP2: Policy & Legal	Legal and policy framework to institute national geospatial legalization and policy.	10,000	130,000	7,500	56,000	40,000	50,000			193,500
SP3: Financial	Business model, financial partnerships and identify investment needs, funding sources, and benefits realization milestones		58,000	-	88,500	26,000	77,500			442,000
SP4: Data	Geospatial data framework and custodianship guidelines	513,000	13,000	405,000	671,000	40,000	360,000			2,002,000
SP5: Innovation	Current and emerging technologies and processes with a view to applying innovative methods	38,000	134,000	20,000	100,000	30,000	186,000			508,000
SP6: Standards	Best practice standards and compliance mechanisms	30,000	61,500	10,000	71,000	30,000	30,000			232,500

SP7: Partnership	Cross-sector and interdisciplinary cooperation, industry and private sector partnerships, and international cooperation	10,000	80,000	48,000	62,000	10,000	53,000			263,000
SP8: Capacity & Education	Capacity building programs and education systems	35,000	222,000	39,500	660,000	160,000	691,000			1,807,500
SP9: Communication & Engagement	Recognize stakeholder's (including the general community) buy-in is critical to success.	5,000	30,000	11,500	82,000	20,000	20,500			169,000
		Original Recurrent Budget	Original Single Allocation	Recurrent Budget - Balance	Single Allocation - Balance	Consultant Fees	Data and Technology			Total Capital Required
	TOTAL	**741,000**	**1,688,500**	**591,500**	**2,573,500**	**656,000**	**1,945,000**			**8,195,500**

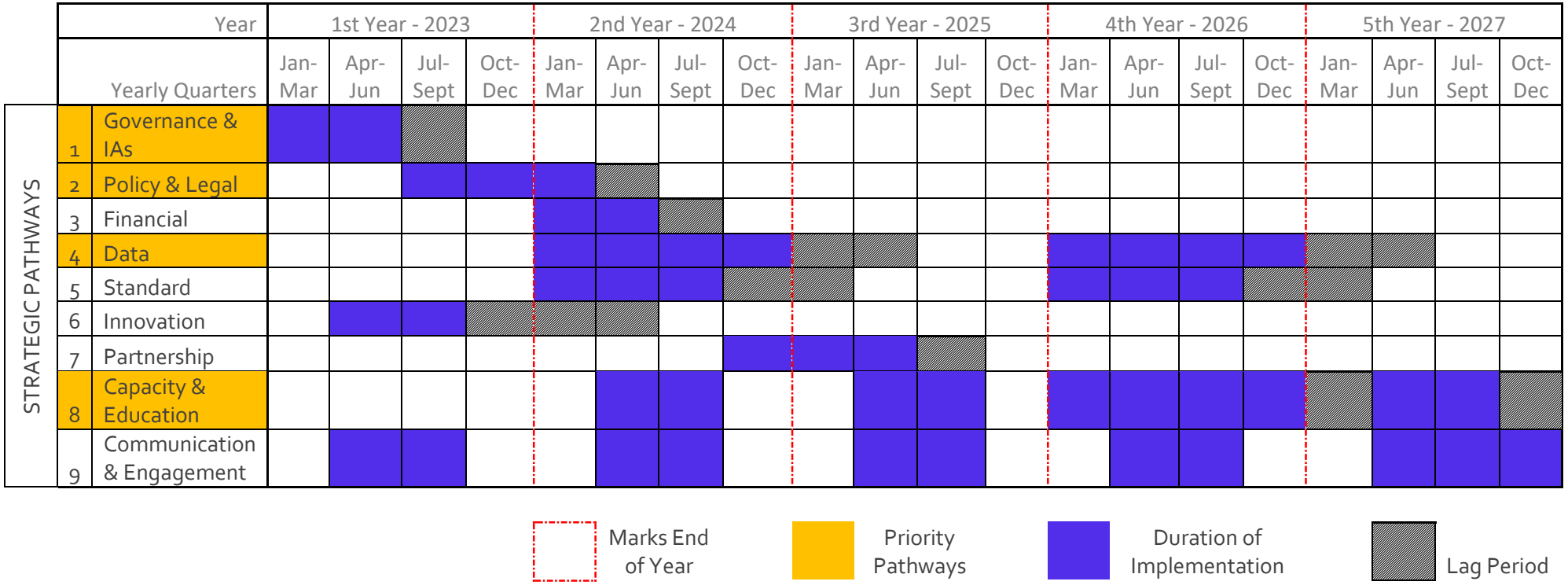
DEVELOPMENT ACCOUNT PROJECT - TONGA ACTION PLAN 'IGIM' : Activities, Budget, Schedule														
Reference	Project Description	Implementing Stakeholder	Original Funding ($TOP)		Balance Funding ($TOP)		Consultant Fees ($TOP)	Resources ($TOP)	Data and Technology ($TOP)	Office Resources	Miscellaneous	Total Capital Required ($TOP)	PLAN START	PLAN DURATION
			Recurrent	Single Allocation	Recurrent	Single Allocation							(month)	
SP1: Governance	Establish leadership, governance model, institutional arrangements and a clear value proposition to achieve multi-disciplinary and multi-sectoral participation and commitment.	*MLNR (CEO/LGIS/CSD) *PSC (Oversight Div.) *NATIONAL PLANNING (HOD)	-	-	50,000	783,000	300,000	100,000	277,000	100,000	-	1,610,000	Y1: Q1-Q2	15
Action 1	Official recognition of LGIS Division, MLNR as the central hub for coordination and accountability of IGI activities.				50,000				50,000			100,000	1	3
Action 2	Establish a Project Management Unit (PMU)					300,000	300,000	100,000	100,000	100,000		900,000	2	3
Action 3	Establish a Steering Committee					200,000			50,000			250,000	2	3
Action 4	Establish a Technical Working Group (TWG) for IGIM direction and endorsement					250,000			50,000			300,000	4	2
Action 5	Develop and implement a Governance Model					8,000			2,000			10,000	5	2
Action 6	Develop a Reporting Framework					25,000			25,000			50,000	4	2
SP2: Policy & Legal	Robust legal and policy framework to institute national geospatial legalization and policy to enable the availability, accessibility, exchange, application and management of geospatial information.	*MLNR (CEO/LGIS/CSD) *PSC (Oversight Div. *Min. JUSTIC (Legal Div.)	-	-	7,500	56,000	40,000	5,000	45,000	-	-	153,500	Y 1 : Q3 - Q4 & Y2: Q1	20
Action 7	Undertake a Policy and Legal Review and Needs Assessment					20,000	10,000		20,000			50,000	5	3
Action 8	Develop and Implement Policy/s					20,000	20,000		10,000			50,000	8	7
Action 9	Develop a Policy Management Plan				4,500	6,000	10,000		3,000			23,500	12	3
Action 10	Develop and conduct a Policy Impact Assessment study					5,000		5,000	5,000			15,000	37	3
Action 11	Establish and maintain a national policy repository				3,000	5,000			7,000			15,000	14	4

SP3: Financial	Establish a business model, financial partnerships and identify investment needs and funding sources, as well as the benefits realization milestones associated with activities for strengthening integrated geospatial information management.	*MLNR (CEO/LGIS/CSD) *Mins. FINANCE	-	-	0	88,500	26,000	0	77,500	-	-	192,000	Y2: Q1 -Q2	8
Action 12	Establish Financial Program Management and Leadership					10,000			10,000			20,000	12	1
Action 13	Conduct a Socio-Economic Value Assessment					50,000	10,000		50,000			110,000	13	2
Action 14	Review of current Business Models, Investment Programs and Government budget program					20,000	10,000		5,000			35,000	14	2
Action 15	Develop a dynamic and compatible Business & Pricing Model to sustain IGIM					8,000	6,000		12,000			26,000	16	2
Action 16	Develop a Funding Model (Benefit Request Form for requesting of funding, in-kinds, maintenance, procurement and services related to IGIM.					500			500			1,000	13	1
SP4: Data	Establish a geospatial data framework and custodianship guidelines for best practice collection and management of integrated geospatial information that is appropriate to cross sector and multidisciplinary collaboration.	*MLNR - (all HoDs/HoSs) *MAFF - (Agricultural/ Forestry Div.) *TONGS STATISTICS - (CEO), *MOI (HoD - Transport/ Building/ Marine)	-	-	405,000	671,000	40,000	0	360,000	-	-	1,476,000	Y2: Q1 -Q2	26
Action 17	Develop a Geodetic Network Strategy to modernize and standardize the National Geodetic Datum Reference and coordinate system				$50,000				150,000			200,000	13	5
Action 18	Document a Data Theme Framework				50,000	1,000	10,000		140,000			201,000	13	3
Action 19	Conduct data collection or Update the National Topographical maps and baseline layers –Map Edition.				5,000	500,000						505,000	18	6
Action 20	Create, Document and Share Metadata Standard and Checklist					30,000	10,000		50,000			90,000	14	2
Action 21	Document a Data Inventory of all baseline datasets currently collected by government					10,000	10,000		20,000			40,000	13	3
Action 22	Create a Geographical Names Inventory and update and maintain it. Eg: Road names				200,000	30,000	10,000					240,000	14	2
Action 23	Develop a Data Curator and Delivery Forum to build capacity of GIM.				100,000	100,000						200,000	15	2

SP5: Innovation	Evaluate current and emerging technologies and processes with a view to applying innovative methods to bridge the digital divide.	*MLNR - (HoS of IT/GIS), *Mins. LABOUR & COMMERCE (Marketing/Innovation), *MEIDECC - (HoD of Information/Communication)	-	-	20,000	100,000	30,000	40,000	116,000	30,000	-	336,000	Y2: Q1 -Q2	28
Action 24	Conduct an Inventory of existing IT and GIS resources and capacity eg: human, computers etc.					1,000			1,000			2,000	15	3
Action 25	Assess Contemporary Storage				5,000	50,000	10,000		20,000	30,000		115,000	15	3
Action 26	Establish a GIS System and provide tech-aid services.				2,000	14,000	10,000	30,000	10,000			66,000	17	5
Action 27	Establish an Innovation, Research & Creative Hub Centre and its members - accessible for all public to incentivise the use of spatial data				10,000	20,000			30,000			60,000		
Action 28	Implement a Bilingual National Map Portal to Share Geospatial Data.				3,000	15,000	10,000	10,000	55,000			93,000	17	7
SP6: Standards	Adopt best practice standards and compliance mechanisms that enable legal, data, semantic and technical interoperability.	*MLNR - (all HoDs/HoSs) *MAFF - (Agricultural/ Forestry Div.) *TONGS STATISTICS - (CEO), *MOI (HoD - Transport/ Building/ Marine)	-	-	10,000	71,000	30,000	0	30,000	-	-	141,000	Y1: Q2- Q3	23
Action 29	Conduct a Need Assessment of Standards & Develop a Standard (Metadata, Acquisition, Technicality, Interoperability and Semantic)					5,000	10,000		5,000			20,000	16	8
Action 30	Develop practical SOPs for each Sections/ Divisions of the MLNR to adhere to.					2,000	10,000		3,000			15,000	17	5
Action 31	Develop a Data Standards Guidelines (in line with Policy and Data Pathway)					4,000	10,000		2,000			16,000	21	2
Action 32	Develop a Compliance Coordination Standards/System - on data acquisition, custodianship and data sharing.				10,000	10,000			20,000			40,000	20	4
Action 33	Nominate a national representative to the International Standard Organisation					30,000						30,000	5	3
Action 34	Nominate a national representative to all relevant UNGGIM Working Group					20,000						20,000	5	1

SP7: Partnership	Establish effective cross-sector and interdisciplinary cooperation, industry and private sector partnerships, and international cooperation to sustain integrated geospatial information management.	*MLNR, *Mins. INTERNAL AFFAIRS, *CIVIL SOCIETY ORGANISATION, *Mins. PUBLIC ENTERPRISES	-	-	48,000	62,000	10,000	3,000	50,000	-	-	173,000	Y2: Q4 & Y3: Q1 - Q2	25
Action 35	Establish and Formalize a Data Acquisition Partnership Program – aim to outsource data collection, e.g. : Business partnership ventures.				10,000	30,000	10,000		30,000			80,000	24	5
Action 36	Identify, formalize and frequently maintain local and national partnership or cooperation on Crowdsourcing and Volunteering program				20,000	30,000			20,000			80,000	26	5
Action 37	Strenghten Regional and international interdisciplinary cooperation across multilateral sectors					NA						0	28	3
Action 38	Develop and secure (formalize) partnership and relationship with Ministry of Education and Academic Institutions.					NA						0	24	2
Action 39	Develop and secure (formalize) partnership and relationships with Community and NGO key Institutions				8,000	2,000		3,000				13,000		
Action 40	Review partnership operational and financial implications.					NA						0	30	2
SP8: Capacity & Education	Establish enduring capacity building programs and education systems so that geospatial information management and entrepreneurship can be sustained in the longer term.	*MLNR, *Mins. EDUCATION & TRAINING, *TONGA STATISTICS OFFICE, *TONGA NATIONAL ACCREDITATION QUALIFICATION BOARD	-	-	39,500	660,000	160,000	305,000	236,000	150,000	-	1,550,500	Y4: Q1 - Q3	48
Activity 41	Develop a cross-sector Capacity Assessment to identify areas need for improvement					50,000		30000	20,000			100,000	38	5
Activity 42	Develop an Education and Awareness Program to promote an understanding of how integrated geospatial information supports economic, environmental and societal needs in workforce and academic arena.				7,500	200,000	50,000	150,000	100,000	50,000		557,500	42	5
Action 43	Develop a cross-sector Capacity Development Plan (Training Package) to target professional development in geospatial skills and technologies – short and long term training.				10,000	300,000	100,000	100,000	50,000	100,000		660,000		
Activity 44	The Leading Organisation provides Help Support System for users of government geospatial information.				2,000	10,000			18,000			30,000	45	7
Activity 45	Establish an Innovation, Research & Creative Hub Centre and its members - accessible for all public to incentivise the use of spatial data				13,000	30,000	10,000	5000	30,000			88,000	17	10
Activity 46	Monitor and evaluate all training, help support and activity modules carried out.				7,000	20000		20000	3,000			50,000	42	5
Activity 47	Establish a National Certification Program					50,000			15,000			65,000	40	5
SP9: Communication & Engagement	Identifies and involves stakeholders (including the general community) as integral to integrated geospatial information management systems, and recognizes their buy-in is critical to success.	*MLNR, CIVIL SOCIETY ORGANISATION, Mins. EUDCATION & TRAINING, TONGA BROADCASTING NETWORK, MEIDECC - INFORMATION & COMMUNICATION	-	-	11,500	82,000	20,000	2,000	18,500	-	-	134,000	Y5: Q1 - Q3	11
Activity 50	Develop the Stakeholder Engagement Model - PLAN, ENGAGE, RESPOND and MEASURE.					15,000	20,000		15,000			50,000	52	3
Activity 51	Perform Community/Organization Outreach Program and review outcome.				8,000	10,000			2,000			20,000	30	8
Activity 52	Conduct a Stakeholder Satisfaction/ Feedback Survey (Evaluation Form)				500	5000		2000	500			8,000	55	3
Activity 53	Develop a Stakeholder Engagement Monitoring & Evaluation Plan (with indicators).				1,500	50,000			500			52,000	52	2
Activity 54	Develop a Communications Plan to document behavioral change over-time by targeting various audiences with appropriate messages /themes.				1,500	2,000			500			4,000	55	3

APPENDIX 3: IMPLEMENTATION SCHEDULE



APPENDIX 4: MONITORING AND EVALUATION

Use the traffic lights method (or similar) to indicate progress towards achieving your objectives. Delete the circles that do not apply. Quarterly reporting is recommended.

Traffic Light Reporting: *Green =* *Objective has been achieved*

Amber = *Objective is on track to be delivered*

Red = *Objective is delayed and requires review and action*

Strategic Pathway	Objective	Outcomes	Success Indicators	Means of Verification	Traffic Lights	Progress Comments
Governance and Institutions Establish leadership, governance model, institutional arrangements and a clear value proposition to achieve multi-disciplinary and multi-sectoral participation and commitment.	To attain government and political endorsement, strengthen institutional mandates and build a cooperative data sharing environment through a shared understanding of the value of an Integrated Geospatial Information Framework, and the roles and responsibilities to achieve the vision.	Achievement of Tonga's strategic geospatial information management goals through effective leadership and coordination	Government and political endorsement for the LGIS Division, MLNR and Technical Working Group has been attained. Roles and responsibilities to achieve the vision have been assigned at a high level	Evidence of government mandate issued Relevant Ministerial or departmental appointments identified.		

Policy and Legal Establish a robust legal and policy framework to institute national geospatial legalization and policy to enable the availability, accessibility, exchange, application and management of geospatial information.	To address current legal and policy issues by improving the laws and policies associated with, and have an impact on, geospatial information management, and by proactively monitoring the legal and policy environment, particularly with respect to emerging technologies and the evolving innovative and creative use of geospatial information.	All government and non-government agencies that collect and use geospatial information comply with laws and policies relating to geospatial information management	A Legal and Policy Framework for Geospatial Information established and enforced Laws and policies have been reviewed in the context of emerging technologies	Evidence that government agencies are complying with laws and policies relating to geospatial information management Eg: data sharing policy		
Financial Establish a business model, financial partnerships and identify investment needs and funding sources, as well as the benefits realization milestones associated with activities for strengthening integrated geospatial information management.	The objective is to achieve an understanding of the implementation costs and ongoing financial commitment necessary to deliver integrated geospatial information management that can be sustained and maintained in the longer term.	A Financial Model that sustains integrated geospatial information management in the longer term	Costing for the implementation and long-term sustainability of the Integrated Geospatial Information framework has been undertaken and is understood	• Government budget has allocated budget for geospatial information management. • Pricing model is identified and use.		
Data Establish a geospatial data framework and custodianship guidelines for best practice collection and management of integrated geospatial	To enable data custodians to meet their data management, sharing and reuse obligations to government and the user community through the execution of well-defined data supply chains for	High quality geospatial information is available to end users through well-defined supply	Organisation are actively participating in quality information management and data sharing.	Number of participating organizations The range and number of quality datasets available		

information that is appropriate to cross sector and multidisciplinary collaboration.	organizing, planning, acquiring, integrating, curating, publishing and archiving geospatial information.	chains and exchange/ release process.		Geospatial Metadata		
Innovation Evaluate current and emerging technologies and processes with a view to applying innovative methods and technological platform to bridge the digital divide.	To stimulate the use of the latest technologies, process improvements and innovations so that governments, no matter what their current situation is, may leapfrog to state-of-the-art geospatial information management systems and practices	Government programs and systems that enable state-of-the-art geospatial information management and facilitate innovation	Access to geospatial information has enabled the development of new services and apps. Eg: drone imagery mapping etc.	• Operational and modern national data portal • Evidence of new services and Apps		
Standards Adopt best practice standards and compliance mechanisms that enable legal, data, semantic and technical interoperability.	To enable different geospatial information and IT systems to communicate and exchange data, enable knowledge discovery and inference between systems using unambiguous meaning, and provide users with lawful access to and reuse of geospatial information.	All government geospatial information are interoperable and it can be easily reused and integrated with other information There is public confidence in the security of private information	An increase in the number of end users accessing and reusing government geospatial data	• The number of end user data downloads recorded • The number of complaints on sensitive/ private information is recorded.		
Partnerships Establish effective cross-sector and interdisciplinary cooperation, industry and private sector partnerships, and international cooperation to sustain integrated	To create and sustain the value of geospatial information through a culture based on trusted partnerships and strategic alliances that recognize common needs and	Data acquisition is characterised by cross-sector cooperation and collaboration Volunteering and crowdsourcing program are	Relevant government and NGO departments are participating in the geospatial data awareness program.	• The number of participating departments • The number of various		

geospatial information management.	aspirations, and national priorities.	supported by local community.		geospatial data users.		
Capacity and Education Establish enduring capacity building programs and education systems so that geospatial information management and entrepreneurship can be sustained in the longer term.	To conduct outreach training, awareness and educational workshop to develop and strengthen the skills, instincts, abilities, processes and resources that organizations and communities require to utilize geospatial information for decision-making.	A heightened awareness and adoption of geospatial technologies and GIS system and knowledge by organizations and the community.	Geospatial information is regularly used by organisations and the community.	The number of end user data views (website hits) recorded. The number of customers requesting geospatial datasets/information, maps and trainings recorded.		
Communication and Engagement Identifies and involves stakeholders (including the general community) as integral to integrated geospatial information management systems, and recognizes their buy-in is critical to success.	To deliver effective and efficient communication and engagement processes to encourage greater input from stakeholders in order to achieve transparent decision-making processes when implementing the Integrated Geospatial Information Framework.	Stakeholders are actively engaged in the process of strengthening integrated geospatial information management	Stakeholders have a sense of being valued contributors to the outcomes of decisions regarding integrated geospatial information management.	The results of a stakeholder survey Behavioral change is observed in the Behavioral assessment survey.		

APPENDIX 5: QUESTIONAIRE SHEET

This Activity Sheet can be incorporated into business cases or used to communicate information on individual activities to stakeholders. An example is provided.

Activity 1: Officially recognizing the LGIS Division – MLNR as the coordination and accountability department for IGIM.	
Lead Implementing Agency	LGIS Division - MLNR
Objective	What is the problem or opportunity that the activity will address? (NOTE: This is derived from the SWOT Analysis) **For example**: Lack of Leadership and coordination across agencies
Background and rationale	Describe the social, economic, political and or environmental problem to be addressed by the Activity. (NOTE: This is derived from the PEST Analysis and strategic Alignment Study) **For example**: A number of departments and research institutions collect and use spatial information. However, there is currently no clear accountability for the management and exchange of this information. This has led to a lack of ICT interoperability and limited data standards where spatial data is concerned. Cross-agency coordination of spatial information is inadequate and as a consequence planning and decision-making is made difficult because spatial data is not easily shared and reused. Current institutional coordination and collaboration needs to be strengthened. Institutional arrangements are based on hierarchical channels of information flows. This has created information silos and the approach it subject to a high degree of bureaucracy for data requests, preparation and signing of agreements, and data transfers. The implementation of new data access technologies is not enough to resolve data sharing issues. There is a need to develop a more enduring underpinning governance structure for spatial data access and use. The Geospatial Coordination Unit will deliver whole-of-government governance arrangements and the ability to balance public and private sector needs, and the mandate to encourage compliance with data sharing policies and standards. The Unit's overarching governance approach also recognizes the potential contribution that research institutions and the community can make as producers and users of data.
Description	This Activity will seek to endorse the recognition of the LGIS Division as Tonga's central hub for the coordination and accountability for all integrated geospatial information activities. This division is to be managed by the Head of Division and assistant from its co-Head of Sections and will be comprised of its existing staff. • 1 Deputy Secretary (Head of the LGIS Division) • 2 Head of Sections • 3 Senior GIS officers The Geospatial Information Coordination Unit will:

	• Provide a forum for the effective management and sharing of spatial information across the government and NGO sector. • Work collaboratively with spatial data suppliers, service providers and users to achieve the goals and support the strategic priorities of government. • Ensure that integrated geospatial information management is approached in a multi-disciplinary and multi-sectoral way. • Promote the use and innovation potential of geospatial information The LGIS Division is one of the primary divisions of the MLNR that generates geospatial data and supplying geospatial datasets to various government organisations. Though it does not responsible for the ongoing daily ICT operations.

Actions and Milestones	**Start Date**	**End Date**
Note: Refer to the Development Account Project – Component 1, Activity 11, which identifies the activities and subtasks (Addendum L)		
Seek Cabinet Approval		
Establish the organizational structure		
Create Position (job) Descriptions for permanent/part-time roles		
Identify funding required for resourcing the office		
Identify staff delegations and reporting structure		
Success Indicators	**2023**	**2027**
Refer to the next section to select the most appropriate success indicators		

Additional Information	
Estimated Budget	Refer to Budget Estimation Guide (Addendum P) for an explanation of how to estimate the budget
Alignment to government programs	Link to government plans e.g. National Development Plan Refer to the Development Account Project – Component 1, Activity 12, which identifies strategic alignment
Alignment to sustainable development goals	
Contact Information	

Name of responsible person from implementing agency	This will be the Project Leader
Title, Department	
Major Stakeholders to be consulted - CSOs, private sector, multilaterals, working groups	Refer to the Stakeholder list prepared using the Stakeholder Identification and Analysis Tool (Addendum G)

APPENDIX 6: PEST & SWOT Analysis

PEST ANALYSIS			
The PEST Analysis considers the external environment and focuses on the Political, Economic, Social and Technology issues that may have a positive or negative impact on the implementation of integrated geospatial information management.			
POLITICAL	**Economic**	**Social**	**Technology**
Open Government data /Data management policy and legal framework - Differences in policy, ACT, legal structures between organizations. Example: Government Ministry, Public Enterprises and Private organization. Difficult for these organizations to coordinate and integrate information. Some organization has an existing policy or statutory guideline in place while other organization doesn't.	**Hardware/Software/resources costs -** Lack of funding for training, resources, and facilities to house IGI. Very costly to maintain IGI infrastructure over long-term considering the rapid advancement of technologies.	**Human Resources** - Lack of HR to support, maintain and implement the IGIM h	**Rate of technology change vs policy change -** the current policy, ACT and legislations are out-of-date compare to the rapid changes of technology. Frequent review is needed. This includes the review and update of utilities guidelines to align with other changes. The current act/policies cannot cater for establishment of technological infrastructures.
Bureaucracy issues - Value and importance of IGIM to country. Various standardization of data (relate to policy) can create conflict on how IGM will implement. What are the appropriate standards to accommodate the needs? How realistic our desired IGIM performance will be?	**Funding opportunity & Prioritization** - Would the government support or prioritize the promotion or movement toward IGI for Tonga given it is very costly to be implemented and maintain.	**Community needs -** What about the community/grassroots that has no resources? Do they have the same privilege as the gov't ministries or public enterprises etc. to access and use IGI?	**Integrate laws** etc. to cater for tech. infrastructural development. A slow process and often are not enforce. Clash or overlap in policies etc. mean it would take some time to create a general policy to cover all loopholes.

Copyright and Intellectual Property laws - Conflict of data provision – where the timeframe may be restraint based on the location of need. Each Organization has their own website, conflict in use or ownership of information sharing/release or access by people.	**Public-Private partnership -** Unlikely that public and private organization would have sufficient funding to co-fund with Government. Project or international donor dependent	**Cultural Change/ community culture -** Community people would experience cultural change, and behavioural change. Acceptance of such change would take time to accept by some people	**Internet & Broadband capacity.** - The need of funding for technological advancement. And poor broadband connection would be big issue. Storage to the cloud would be an issue if broadband capacity is poor. ISPs charges & fees
Country Information Security - Monitoring and management of confidential information. How to monitor these? Who will be able to access these confidential information/ or general data. The need to centralize/IGIM platform question who is accountable to managing and monitoring the GIS). Due to different priority and urgent requirements of different ministry. What is the level of Transparency for the IGI platform/system? Different organization would need to have different level of access privileges. Eg: Police – drug trafficking data vs. MET (disaster related data). Ownership and accessibility, how to acquire consent…? Who owns this IGM? Gov't or Private sector or Public? /Board.	**Investment Opportunities for revenue growth -** What kind of business model is appropriate using IGI? Can IGIM be able to promote and enhance revenue growth in private sector area?	**Community safety -** Safeguarding people's confidential information is a huge responsibility. Who is accountable if IGIM fails or become corrupt? Do the people or general public have consent/have a saying in instigating a policy or implementation in the IGIM? Confidentiality to be protected and with consent.	**Basic infrastructure level and capability** - Mainframe server is needed to manage all GI, reliability of back-up to the cloud is an issue in regards to leaking of information to the cloud hosting country. Eg: Server capacity
Sufficient government support and funding - Who's the main contribution to funding? All agency or donor? Is it enough to sustain and upgrade the IGIM for long-term? How to monitor/Who will be funded to monitor this centralized or aggregated system? Where/who and what would be the plan to budgeting of staff, resources and management of the IGIS.	**Pricing Framework -** Need for policy to give weight or legalize map sales, currently map sales are often shared in-kind or complimentary due to not having a fixed price for maps.	**Computer literacy -** Would be the community and general public, especially isolated communities aware or knowledgeable of how to use appropriate technologies, on how effective and efficient IGIM be? What would their benefit be from IGIM?	**Technological and geospatial data standards -** Increase capacity training to use technological equipment, software update, learn standards etc. and law/policy to use technological equipment.

Political Support - Lack of political support for implementation of IGIM. Also, the absent of national policy to set a standard/criterion for election candidates. Since national gov't election and ministerial portfolio change every 4 years there is no assurance the plan made in the previous government would be supported by those running the current government. Due to limit knowledge and understanding of GIM would heavily impact the accepting of GIM framework etc.	**Mis-management of financial support -** Miss-use of funding and savings can discourage donors of providing future funding.	**Consistency of information -** Information consistency is heavily required to share the right kind of data and consistency across ministry and all users. Centralized and archive the data. (Research/ shows lack of data in Tonga). MDG – no data on Tonga just Oceania data.	**Technology skills capacity**
Data Pricing Policy	**Business model/plan**	**Cost -** provide appropriate costing where public would afford	**Availability of technology** - Current status of technology level in industry
E-Government system - Supported by the e-government and would sustain IGIM long-term	**Employment trend -** Growth of employment status	**Awareness** - Encourage collaboration with community level/grass root. Not enough collaboration/ dissemination of data. Lack of awareness. Raise awareness of what they mean and how to use them wisely.	**Communication infrastructure**
Disaster Preparedness and Recovery - Enhance and improve disaster preparedness and recovery		**Private/Community/ Public partnership or forum -** Limited cooperation/forum of private and public sectors.	**Rate of research and development findings**
Emergency response and management		**Digital gap and geographical literacy level**	**Quality and capacity of technology infrastructure**
		Lifestyle and welfare	**Technological support system**
		Attitude toward wisely using of resources - reducing waste (paper-based products)	
		Attitude toward saving and investing	
		Education level - Knowledge is power	
		Minority's accessibility	

APPENDIX 7: GLOSSARY

(Arrange in alphabetical order)

WORD	DEFINITION
Accountability	Liable or answerable
Archived	a collection of information permanently stored on the internet (containing one or more compressed files).
Cadastral Survey	Discipline of land surveying that relates to the laws of land ownership and the definition of property boundaries.
Crowdsourcing	to utilize information contributed by the general public to a project, often via the internet and without compensation.
Curator	A person who takes organization of metadata to the next level and works with data dictionaries and data catalogues.
Custodianship	The person who has administrative and/or operational responsibility over data applications.
Data/Dataset	Data are observations or measurements (unprocessed or processed) represented as text, numbers or multimedia. A dataset is a structured collection of data generally associated with a unique body of work.
Data Ecosystem	A collection of infrastructure, analytics, and applications used to capture and analyze data.
Datum	A geodetic datum is an abstract coordinate system with a reference surface (such as sea level) that serves to provide known locations to begin survey and create maps.
Digital Divide	The gulf between those who have ready access to computers and the internet, and those who do not.
Geodetic/Geodesy	It is the science of accurately measuring ad understanding the Earth's geometric shape, orientation in space, and gravity field.
Geographic Information System	A computer system for capturing, storing, checking, and displaying data related to positions on Earth's surface.
Innovation	The creation, development and implementation of a new product, process or service, with the aim of improving efficiency, effectiveness or competitive advantage.

Integrated Geospatial Information Management	A reference guide for developing and strengthening arrangements in national geospatial information management.
Metadata	Data that describes other data, which us used to summarize basic information about data which can make finding and working with particular instances of data easier.
Multi-sectoral	Collaboration between organizations in different areas of policy and different sectors, as well as communities and people, working together to achieve policy outcomes.
Plate Tectonics	Theory explaining the structure of the Earth's crust and many associated phenomena as resulting from the interaction of rigid lithospheric plates which move slowly over the underlying mantle.
Topography	Arrangement of the natural and artificial physical features of an area.
Virtual	Not physically existing as such but made by software to appear to do so.

APPENDIX 8: UNGGIM Background

The United Nations Economic and Social Council (ECOSOC) established the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) in 2011 to take concrete action to strengthen international cooperation in global geospatial information management. UN-GGIM makes joint decision and sets directions on the production, application and use of geospatial information within national, regional and global policy frameworks, and provides a forum for Member States to develop and strengthen their national geospatial information management and systems capabilities and capacities.

In 2017, the United Nations and the World Bank agreed to collaborate on a joint vision to promote growth and prosperity through creating and strengthening geospatial information capacity and development. The objective being to develop an Integrated Geospatial Information Framework that countries can use to develop and enhance their own geospatial information management.

(IGIF 2018)

The United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) aims at playing a leading role in setting the agenda for the development of global geospatial information and to promote its use to address key global challenges. It provides a forum to liaise and coordinate among Member States, and between Member States and international organizations.

In 2009, the United Nations Statistics Division/DESA (UNSD) convened in New York, on the side of the 9th United Nations Regional Cartographic Conference for the Americas (UNRCC-A), an informal consultative meeting with geospatial information experts from different regions of the world, and discussed how to better coordinate the various regional and global activities on geospatial information and the related management issues. Subsequent to the consultative meeting, the UNSD, jointly with the United Nations Cartographic Section, convened three preparatory meetings on Global Geospatial Information Management (GGIM): the first in Bangkok in October 2009, prior to the 18th UNRCC-AP, the second in New York, in May 2010, and the third one also in New York, in April 2011.

In 2010, at the 18th United Nations Regional Cartographic Conference for Asia and the Pacific (UNRCC-AP), and the 41st session of the United Nations Statistical Commission, the issue of global geospatial information management was also discussed. The United Nations Secretariat was requested to initiate discussion and prepare a report for the approval of the Economic and Social Council (ECOSOC) on global coordination of geospatial information management, including the consideration of the possible creation of a United Nations Forum on GGIM. In July 2010, ECOSOC requested the Secretary-General to submit to the Council at its 2011 substantive session a report on global geospatial information management (see the full text E/2010/240). This decision paved the way for subsequent preparatory activities

The priorities and work programmes of the Committee of Experts are driven by Member States. The Committee of Experts is mandated, among other tasks, to provide a platform for the development of effective strategies on how to build and strengthen national capacity on geospatial information, as well as disseminating best practices and experiences of national, regional and international bodies on geospatial information related to legal instruments, management models and technical standards.

1. Development of the global geodetic reference frame

2. Development of a global map for sustainable development
3. Geospatial information supporting Sustainable Development and the post 2015 development agenda
4. Adoption and implementation of standards by the global geospatial information community
5. Development of a knowledge base for geospatial information
6. Identification of trends in national institutional arrangements in geospatial information management
7. Integrating geospatial statistics and other information
8. Legal and policy frameworks, including critical issues related to authoritative data
9. Development of shared statement of principles on the management of geospatial information.
10. Determining fundamental data sets

(https://ggim.un.org)

APPENDIX 9: IGIF (Integrated Geospatial Information Framework)

VISION

The efficient use of geospatial information by all countries to effectively measure, monitor and achieve sustainable social, economic and environmental development – leaving no one behind

MISSION

To promote and support innovation and provide the leadership, coordination and standards necessary to deliver integrated geospatial information that can be leveraged to find sustainable solutions for social, economic and environmental development.

STRATEGIC DRIVERS

National Development Agenda ● National Strategic Priorities ● National Transformation Programme ● Community Expectations ● Multilateral trade agreements ● Transforming our World: 2030 Agenda for Sustainable Development ● New Urban Agenda ● Sendai Framework on Disaster Risk Reduction 2015 – 2030 ● Addis Ababa Action Agenda ● Small Island Developing States Accelerated Modalities of Action (SAMOA Pathway) ● United Nations Framework Convention on Climate Change (Paris Agreement) ● United Nations Ocean Conference: Call for Action

UNDERPINNING PRINCIPLES

Transparent and Accountable	Information Accessible and Easily Used	Strategic Enablement	Collaboration and Cooperation	Integrative Solution	Sustainable and valued	Leadership and Commitment

GOALS

Effective Geospatial Information Management	Increased Capacity, Capability, and Knowledge Transfer	Integrated Geospatial Information Systems and Services	Enhanced Stakeholder Engagement and Communication
International Cooperation and Partnerships Leveraged	Sustained Education and Training Programs	Economic Return on Investment	Enriched Societal Value and Benefits

STRATEGIC PATHWAYS

Governance and Institutions	Legal and Policy	Financial	Data	Innovation	Standards	Partnerships	Capacity and Education	Communication and Engagement
Value proposition	Data protection and licensing	Benefits realization	Data curation and delivery	Bridging the digital divide	Technical interoperability	International collaboration	Professional development and workplace training	Monitoring and evaluation
Institutional arrangements	Implementation and accountability	Investment	Data supply chain interlinkages	Promoting innovation and creativity	Semantic interoperability	Community participation	Entrepreneurship	Planning and execution
Leadership	Norms, policies and guides	Partnerships and opportunities	Custodianship, acquisition and management	Process improvement	Data interoperability	Industry partnerships and joint ventures	Formal education	Integrated engagement strategies
Governance model	Legislation	Business model	Fundamental geospatial data themes	Technology and technological advances	Legal interoperability	Cross-sectoral and interdisciplinary cooperation	Awareness raising	Stakeholder identification

APPENDIX 10: Participating MDAs

STAKEHOLDER IDENTIFICATION AND ANALYSIS

Stakeholders List with their Roles and Responsibilities				
Strategic Pathway	**Implementing Agency**	**Stakeholder**	**Leading Agency**	**Co-Lead**
SP1: Governance and Institutions	MLNR	MLNR		
	Public Service Commission	MEIDECC		
	Prime Minister's Office	MOI	MLNR – LGIS	PMO
		MAFF		Department of Statistics
		Tonga Statistics Department		
SP2: Policy and Legal	MOJ		MLNR – LGIS & CSD	Attorney General's Office
	Policy/Legal Consultant from TWG, LGIS and PMU	Compliance/Policy Officers of organizations that generate and are curator of data		MEIDECC – Comm & Info Division
SP3: Finance	TWG, PMU and LGIS	MOF		
		Cabinet		
		World Bank and other international organizations	MLNR – LGIS	Ministry of Finance
		Partner key organizations		
		UN (donors)		
SP4: Data	MLNR	MLNR		
	MOI	His Majesty's Armed Forces		
	MEIDECC	Civil Aviation		
	MAFF	Marine and Ports		
	Tonga Statistics	Civil Society Organizations	MLNR – LGIS	Department of Statistics
	Fisheries	Public Enterprises		
	Public Enterprises	Private Enterprises		
	PMO/Local Government	Non-Profit Organizations		
		MIA		
		Government Departments who are significant users of geospatial information		
SP5: Innovation	MLNR	MLNR		
	MEIDECC	Forestry Dept		
	Trade and Commerce	HMAF		MEIDECC – Comm & Info Division
	MAFF	Civil Society Organizations	MLNR – LGIS & CSD	Trade and Commerce – Marketing & Innovation
	Fisheries	Government Departments who are significant users of geospatial information		
	Public Enterprises	Ministry of Tourism		
		MIA		
SP6: Standards	MLNR	MLNR		
	NEMO-MEIDECC	MAFF		
	MOI	Fisheries		
	TSD	Public Enterprises	MLNR – LGIS	Department of Statistics
		Non-Profit Organizations		
		Government and non-government organizations who are significant users of geospatial information		
SP7: Partnership	MLNR	UNGGIM		
	Public Enterprises	SOPAC		
	MIA	SPREP		
	Civil Society Organizations	LINZ	MLNR	UNGGIM
	MEIDECC	Earth Observations		
	Foreign Affairs	Government and non-government organizations who are significant users of geospatial information		
	TWB			
SP8: Capacity and Education	MLNR	MLNR		
	Tonga Statistics	HMAF		
	Ministry of Education and Training	CSO		
		MPE	MLNR – LGIS	Ministry of Education
		Private Enterprises		
		NGO and GOVT dept who are significant users of geospatial information		
SP9: Communication and Engagement	MLNR	All Stakeholders		
	TWG, PMU and LGIS	TBC		
	All media outlets	Private and Public agencies		
		Ministry of Tourism	MLNR – LGIS	MEIDECC – Comm & Info Division
		Radio Tonga		
		Other media outlets		