Data Management and Governance Policy for the Vanuatu Meteorology and Geo-Hazard Department

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Table of Contents

List of Figures

List of Annex

Acronyms

CliDE	Climate data for the environment
DRR	Disaster risk reduction
GTS	Global Telecommunication systems
GDPFS	Global Data-Processing and Forecasting System
ICT	Information and Communication Technology
IPCC	Intergovernmental Panel on Climate Change
NAP	National Adaptation Plan
MGHCC	Meteorology, Geological Hazards and Climate Change
MOCC	Ministry of Climate change
QA/QC	quality assurance and quality control
RTI	Right to information
SPC	Secretariat of the Pacific Community
SPREP	Secretariat of the Pacific Environment Programme
UNDRR	United Nations Office of Disaster Risk Reduction
UNFCCC	United National Framework Convention on Climate change
VMGD	Vanuatu Meteorological and Geo-hazard Department
WMO	World Meteorological Organization
WIS	WMO Information System

Definition of terms

Data refers to an attribute or fact collected on an element of interest.

Database is an organised collection of data stored and accessible electronically. There are different types of databases such as cloud database, centralised database, object-oriented database, operational database, NoSQL database, distribution database, operational database, end user database.

Data accountability refers to the responsibilities of the controllers and processors to take responsibility for their processing activities and how they comply with data management and governance protocols.

Data automation is the process of using technical tools or machinery to handle and process data, as opposed to manual entry of the data.

Data breach refers to a security deficiency that results in accidental or unlawful and unauthorised access, destruction, loss, or alteration of stored institutional data.

Data governance is the exercise of decision-making and authority for data-related matters. The organisational bodies, rules, decision rights and accountability of people and information systems as they perform information-related processes.

Data handling is the process that encompasses data collection, organisation, analysis, and storage.

Data lifecycle, also called the information life cycle, defines the entire period that data exists in an organisation. It thus encompasses all stages of data, including data collection, processes storage and exchange.

Data management is collecting, organising, analysing, storing, using, and exchanging data securely to support decision-making and planning. It comprises architectural techniques and tools for accessing and exchanging data to meet the demand for all applications.

Data owner is an individual within an organisation who is tasked with the responsibility of management and protection of specific sets of data. Data ownership implies accountability and decision-making authority

over the data, including the authority to determine who has access to the data, how it is used, and what policies and procedures govern its management.

Data transparency is the process through which data handling and management practices are made available to stakeholders in order to examine data management processes. It is aimed that building trust with the data users.

Data steward is tasked with ensuring the quality, security, and use of the organisation's data assets and metadata.

Data stewardship refers to the management and oversight of institutional data assets. The main aim of data stewardship is to provide high-quality data that is accessible, trustworthy, useable, and secure to the stakeholders.

Data protection refers to the measures in place to protect data from unauthorised access, manipulation, theft and loss, misuse, or unlawful processing. By protecting data, individuals and organisations can safeguard their privacy, maintain the confidentiality of sensitive information, and prevent damage to their reputation and financial standing.

Data processing is collecting and manipulating data to produce informative and meaningful information that is usable to decision-makers and planners. It involves statistical analysis and methodologies.

Data security entails putting controls, standard procedures, and protocols to protect data from a range of breaches, such as unauthorised access, accidental losses, and data destruction. Data security can include certain technologies in administrative and logistical controls.

Electronic data is digital data or information stored and transmitted electronically using computers and electronic storage. It constitutes various digital information, spreadsheets, images, videos, audio files, databases, and software applications.

Metadata is data about data. It generally refers to providing information about a data element. It deals with aspects such as which database stores it and what data type it is.

Executive summary

Climate change is at an advanced stage in the Pacific region, as evident from the frequency and intensity of climatic events. Vanuatu is located on a highly active volcanic region known as the Ring of Fire. It is thus amid a combination of climatic and geo-hazards which can potentially cause irreversible destruction to infrastructure and loss of lives. Therefore, pragmatic climate change adaptation plans and disaster risk reduction plans and strategies must be developed and operationalised to minimise the impacts of climate change and geo-hazard events such as tsunamis, volcanic eruptions and landslides.

To develop robust and pragmatic climate change adaptation and Disaster Risk Reduction (DRR) plans, there is a need to continuously generate and produce good quality hydrometeorological and geoscience data. Furthermore, there is a need to promote hydrometeorological and geoscience data accessibility to stakeholders to be used in their planning. Finally, there is a need for a robust data governance structure and framework.

Consequently, this calls for developing a data management and governance policy for the Vanuatu Meteorological and Geo-hazards Department (VMGD) which will strengthen and improve data management and governance.

This hydrometeorological and geoscience data management and governance policy is developed to guide the Government of Vanuatu and enhance data-centric decision-making and planning amid climate change and geo-hazard adversities. The vision of the policy is a driven data-driven economy to protect its assets and citizenry from climate perils and geo-hazards. The development of this policy was guided by the data management and governance principles of defined data ownership, data stewardship, accessibility, data quality, accountability, auditability, data sharing and data as a strategic resource.

Seven policy statements were formulated based on the policy objectives, and a set of strategic activities were determined to achieve the policy objectives and statements. These policy statements are:

Policy statement No 1: The generation of good quality data will be promoted to ensure that accurate decisions and planning processes are implemented.

Policy statement No 2: To enable society to plan better and adapt to climate change, geological risk, and hazards, data accessibility will be promoted at all economic and community levels.

Policy statement No. 3: To sustain the generation of good quality data, measures will be implemented to improve adequate resource allocation for data generation.

Policy statement No. 4: To ensure proper data handling and management, data management systems will be promoted.

Policy statement No. 5: Robust data governance structures and protocols will be implemented to safeguard against data misuse and protect the department's intellectual property rights.

Policy Statement No. 6: Efforts will be continuously concentrated on building user confidence in the data by increasing transparency on the modalities of data generation.

Policy Statement No 7: data is a strategic asset with high economic value, and its value must be promoted at all levels.

This policy is aligned to various existing legal and policy frameworks such as the Meteorology, Geological Hazards and Climate Change (MGHCC) Act of 2016, the Vanuatu Climate Change and Disaster Risk Reduction Policy 2016-2030, The Right to Information Act of 2016, World Meteorological Organisation's (WMO) Unified Data Policy. Furthermore, this policy aligns with strategic documents such as the National Sustainable Development Plan 2016-2030 and the Vanuatu Framework for Climate Services.

This policy is developed for the VMGD and will be implemented by the Department, with the Director providing oversight in line with the MGHCC.

1.0. Introduction

Climate change is at an advanced stage in Vanuatu, as evidenced by the frequency and intensity of climatic events. Recently, the country experienced tropical storms, depressions, hurricanes, flooding, and drought episodes at an unprecedented level (SPREP, 2016; MOCC, 2020). Furthermore, the island is vulnerable to sea level rise, which is projected to continue to increase over this century (MOCC, 2020). In addition to the climate and hydrometeorological hazards and risks, the Vanuatu Islands are highly vulnerable to geological threats (MOCC, 2020). In a seismic and volcanic-active region known as the Ring of Fire, or the Circum-Pacific Belt, Vanuatu is highly exposed to geologic hazards, mainly volcanic eruptions, earthquakes, tsunamis, and landslides (MOCC, 2020). Vanuatu is thus exposed to a variety of climatic, hydrometeorological and geological hazards which can potentially cause irreversible destruction to infrastructure and loss of lives. According to Vanuatu's Third National Communication to The United Nations Framework Convention on Climate Change (UNFCCC), to effectively deal with the climatic and geological hazards and risks, the government has prioritised the establishment of institutional frameworks and structures, which include the generation of climate and geoscience data to support and optimise planning and decision-making.

Unequivocally, climate and geoscience data should be one of the areas of prioritisation in developing institutional frameworks and structures in dealing with climate and geological hazards. Climate and geoscience data is critical for managing the climate and geological hazards as it informs all the Disaster Risk Reduction (DRR) processes consistent with early warning systems and preparedness. This is equally acknowledged in the Vanuatu National Geospatial Data Policy of 2020-2030 (MoL, 2020). Data play a central role in understanding climate risks and hazards, developing early warning systems, and developing national and sectoral adaptation and evacuation plans. National Adaptation Plans (NAP) and sectoral ones are highly prioritised by the UNFCCC, as evident in all the UNFCCC agreements, from Cancun in 2010 to the Paris Agreement in 2015. Furthermore,

hydrometeorological and geoscience data inform the impact and vulnerability assessments which in turn are used to develop the NAPs.

Consequently, with the insurgency of catastrophic events predicted by the IPCC, the demand for hydrometeorological and geoscience data will increase significantly. This pattern has been observed by VMGD (2014), which stressed that the need for climate services in Vanuatu has grown considerably as the benefits of climate science-based information to decision-making and planning is being realised. The unprecedented demand for climate and geoscience data could pose a risk to the quality of data produced, the use of uncensored data, and the misuse of data. Furthermore, the increase in demand for hydrometeorological and geoscience data will have cost implications for the Vanuatu Meteorology and Geo-hazards Department (VMGD), which could negatively impact the generation of good quality data over time if the budget is not increased.

These potential challenges call for developing a data policy that will regulate, guide, and govern hydrometeorological and geoscience data management. Furthermore, the legal framework must strengthen the cost recovery measures to optimise VMGD operations.

With an enhanced legal framework in the form of a policy, VMGD will be able to meet the growing demands of the Government of the Republic of Vanuatu and Ni-Vanuatu for improved meteorological and geo-hazards services (VMGD, 2014).

1.1. Background on hydrometeorological and geoscience data management, utilisation, and governance

VMGD is a government department within the Ministry of Climate Change, Meteorology, Geo-hazards, Energy, Environment and Disaster Management. The Department was established under the Vanuatu Meteorological Service Act of 1989. The Meteorology, Geological Hazards and Climate Change Act of 2016 superseded this Act. The new Act gives direction to the operations of VMGD. Specifically, it directs the Department to collect, collate and make available meteorological, climate, climate change, and geo-hazards data and information, including archiving of such data or information, amongst other duties (Republic of Vanuatu, 2017). Furthermore, the Act allows the

Department to achieve its mandate by installing and maintaining a national network of meteorological observation stations and all other necessary technical installations and equipment (Republic of Vanuatu, 2017).

Effectively, the Climate Change Act of 2016 gives responsibility to VMGD to collect and manage hydrometeorological and geoscience data and undertake seasonal forecasting, technical analyses and climate change predictions for Vanuatu. To carry out its mandate effectively, VMGD has six (6) Divisions being:

- **Administration Division** provides leadership and management structures for the operation of the VMGD.
- **Observations Division** maintains observational networks for collecting weather and climate information.
- **Weather Forecasting and Services Division** generates data and information on weather, forecasts and provides warnings on tropical cyclones, storm surges, and high tides for air and maritime navigation. This is achieved using state-of-the-art weather forecasting systems.
- **Climate Division** offers long-term country climate services, long-term forecasts, and warnings. Some of the envisaged critical outcomes of this division include improved management of historical meteorology, hydrological and other related environmental data, and ensuring that climate databases such as CLiDE and CLiDEdesk are maintained and operationalised (VMGD, 2014).
- **Geo-Hazards Division** offers services and products on Geo-hazards risk. The division uses modern science and technology to monitor and map geological hazards such as earthquakes, tsunamis and volcanic eruptions for the early warning system, among others. The division has operationalised a geo-hazards database for the country.
- **ICT and Engineering Division** is the heart of the VMGD database system. It monitors the networks and the automated sensors and ensures that all observation data are automatically captured from all divisions. Furthermore, it ensures that the divisions' database is operational and that the on-line request systems for VMGD divisional data are functioning. The division thus supports the other divisions in ensuring that the ICT equipment is functional to support data

processing and storage. This division has an engineering section that deals with instrumentation and data collection.

The divisions within VMGD collect, analyse and store hydrometeorological and geoscience data on a wide range of parameters. These include temperature, rainfall, humidity, hurricanes, depressions, storms, tidal waves, and seismic activities. As guided by the Meteorology, Geological Hazards and Climate Change Act of 2016, the Department has installed state-of-the-art equipment for the observation stations, which are automated and connected to the database storage platform. Gibson (2017) noted that the observation stations have adequate coverage for the country. Vanuatu Rainfall Network (VRN) coverage, on the other hand, is classified as excellent coverage and well-managed. There are a total of 12 seismic stations that are fully automated and feed real-time data to the database server for Tsunami Warnings (Gibson, 2017).

The divisions within the VMGD have established and operationalised seven database platforms for data storing and management:

- MARUM was named after a volcanic event.
- KUWAE was named after a volcanic event.
- CLiDE developed by the Bureau of Meteorology in Australia.
- CLiDEdesk developed by NIWA in New Zealand.
- Traditional Knowledge (TK) database based on Excel by Bureau of Meteorology in Australia.
- Instrumentation database managed under ICT and Engineering Division
- Asset database managed under ICT and Engineering Division
- METEOfactory

For all the automated observation stations, the hydrometeorological and geoscience data is automatically deposited into the database platform for storage and later analysis and sharing.

The MGHCC Act guides VMGD on matters incidental to data sharing and information exchange. The Act stresses the need for data sharing with national and international stakeholders for improved decision-making and

planning to build resilient communities that are responsive to climate and geo-hazards. The MGHCC Act directs the Department to promote the principle of free and unrestricted exchange of meteorological information with stakeholders in line with the Right to Information Act.

VMGD has put in place modalities to share its data and information with the community, individuals and international partners. The Department has developed an online data request form which can be completed online (electronic) or printed and completed manually. Upon approval of the data request form by the VMGD Director, the requested data is shared. The data request form covers all the hydrometeorological and geoscience parameters collected by the VMGD.

Additionally, VMGD, through international obligations and agreements, shares its hydrometeorological data with regional and international agencies (VMGD, 2014). Consequently, the Department shares climate data from selected stations with the World Meteorological Organisation (WMO) through the Global Telecommunication System (GTS) server.

The information on earthquakes and tsunamis is documented and synthesised into bulletins shared with local communities, governmental departments and the international community for scientific research.

The Act regulates the use and handling of the VMGD data and information by giving the Director the following powers:

- To restrict the rights of any person or agency to undertake meteorological service for public use; and
- To restrict the publication or dissemination of any meteorological report or bulletin if the Director thinks that such information or document is false, misleading or not by the accepted science to which it relates.
- To assert the rights of the Department as the owner of all intellectual property rights about all information and data generated by or on behalf of the Department and with regard to all publications made by or on the authority of the Department.

In line with its parent ministry, the Ministry of Finance and Economic Development, VMGD has made some progress in recovering data generation costs, as guided by the MGHCC Act. Currently, there are three distinctive data fees: international meteorological fees, domestic meteorological fees, and fees for products and services. The prices for products and services are extensive and cover all the data generated by all the divisions.

Over the years, VMGD has experienced a surge in the demand for hydrometeorological and geological data and information. The increase in demand for data is a result of various factors, the primary one being an increase in climate-related events and the need to develop climate resilience and adaptation plans. Furthermore, Vanuatu is a party member of the UNFCCC and, as such, is required to report its climate change commitments. These include, among others, communicating its vulnerability, conducting impact assessments, and developing its adaptation and mitigation plans. Moreover, party members must develop NAPs, sectoral adaptation plans and Nationally Determined Contributions (NDCs). All these activities require extensive weather and climate data. These have thus given rise to the increase in demand for hydrometeorological and geoscience data.

Located in a highly seismic and volcanically active region, the Circum-Pacific Belt, more commonly known as the Ring of Fire, it is critical that the Government of the Republic of Vanuatu, through VMGD, generate as much real-life data as possible on seismic activities to monitor tsunamis, tidal waves and volcanic activities. This is critical for DRR as per the Sendai Framework for Disaster Risk Reduction 2015–2030, a framework designed by the United Nations Office for Disaster Risk Reduction (UNODRR) which the Republic of Vanuatu is a signatory to.

All these activities have increased demand for hydrometeorological and geoscience data. The rise in demand for hydrometeorological and geoscience calls for a legal framework to guide data management and governance.

2.0. Policy foci and scope

This policy is developed for VMGD and focuses exclusively on hydrometeorological and geoscience data management and governance. The policy has identified strategic activities to be implemented to enhance good data management and governance practices for the benefit of stakeholders and data owners. The approach is aligned with the Meteorology, Geological Hazards and Climate Change (MGHCC) Act of 2016, the Right to Information Act of 2016, and the WMO data policy to ensure ease of implementation and reduce conflict. The key aspects of focus for the data management and governance policy include:

- Generation of good-quality data to support decision-making and planning.
- Promoting data accessibility amongst stakeholders for data-centric decision-making and planning.
- Improved resource allocation to sustain the generation of good quality data.
- Establish comprehensive data governance structures to safeguard and protect data from unauthorised access, data breach and losses.
- Enhanced transparency on data management/handling to strengthen confidence amongst stakeholders.

3.0. Policy vision and mission

The vision of the policy is:

- A hydrometeorological and geoscience data-centric economy to protect its citizenry and assets from climate and geo-hazards events.

The mission of the policy is to:

Promote good data management and governance “best practices” that will safeguard the interests of all parties involved and contribute to data-driven decision-making and planning.

3.1. Policy objectives

The objectives of the policy are to:

- Ensure that the data generated is of good quality standards and that the quality is continuously maintained.
- promote good data management practices to improve data handling and archiving.
- Promote good data governance practices to safeguard the interests of all parties involved.
- Promote and facilitate seamless data and information sharing amongst the stakeholders for data-centric decision-making whilst safeguarding VMGD's interest.
- Enhance the sustainability of data generation services by improving resources allocated to VMGD.
- Safeguard against unauthorised use of climate and geoscience data and misuse.
- Build and strengthen users' confidence in data quality and accuracy through improved transparent processes.
- Mobilise resources for the implementation of the policy.

3.0. Legal and policy framework governing data use

This policy consistently aligns with the government's vision, Acts, policies and strategic documents. Some of the Acts and policies that this policy is consistent and in harmony with include:

- National Sustainable Development Plan 2016-2030,
- Vanuatu Framework for Climate Services
- Vanuatu Climate Change and Disaster Risk Reduction Policy 2016-2030
- Meteorology, Geological Hazards and Climate Change (MGHCC) Act of 2016
- The Right to Information Act of 2016
- WMO unified data policy

The National Sustainable Development Plan 2016-2030 has three pillars whose objectives strongly emphasise data sharing and information exchange for decision-making. The Society pillar refers "to strengthen research, data and statistics for accountability and decision-making" (Department of Strategic Policy, Planning and Aid Coordination, 2016). Under the Climate pillar, the plan emphasises enhancing environmental monitoring, evaluation and research with relevant, open and transparent data sharing among relevant agencies (Department of Strategic Policy, Planning and Aid Coordination, 2016).

The vision of the Vanuatu Climate Change and Disaster Risk Reduction Policy 2016-2030 is a resilient community, environment and economy. The policy emphasises improved data management on climate change and risk as pivotal to decision-making and planning to build adaptive and resilient communities. One of the policy's strategic activities is establishing and operationalising a central database to collect, store and enhance access to relevant data for planning and decision-making (SPC, 2015).

Likewise, this data management and governance policy is harmonised with the Vanuatu National Geospatial Data Policy of 2020-2030. The National Geospatial Data Policy is based on ensuring that spatial data is reliable for use, sharing or distribution (Vanuatu National Geospatial Data Committee, 2020). It emphatically calls for establishing and operationalising secure data-sharing mechanisms. Furthermore, it calls for the protection of intellectual property rights (Vanuatu National Geospatial Data Committee, 2020).

The MGHCC Act was formulated and endorsed by Parliament to guide the operations of VMGD. It is another legal instrument that this policy is aligned to. The objectives of the Act, which are in alignment with this policy, include:

- Ensure that high-quality services are provided to about weather, climate, flood forecasting and geological hazards in Vanuatu.
- Facilitate the use and application within Vanuatu of relevant information, forecasts, bulletins and warnings generated and disseminated to and by local, regional and international bodies.

The Act empowers the Director to guide the Department on matters incidental to climate services. This includes data collection, management and ensuring accessibility to third parties. The Act enables the Department to install weather and geological observation state-of-the-art equipment for data collection.

The Right to Information (RIT) Act was passed in Parliament in 2016 and gazetted in February 2017. It is an "Act to guarantee the right to information of all persons and to establish practical, effective mechanisms supportive of that right and for related matters" (Republic of Vanuatu, 2016). The purposes of the Act that this policy is hinged on are to:

- Provide access to information held by Government agencies, relevant private entities and private entities, subject to exceptions provided under Part 5 of this Act.
- Promote transparency, accountability, and national development by empowering and educating the public to understand and act upon their rights to information (Republic of Vanuatu, 2016).

The RTI Act provides exemptions where the right to information may be denied to a third party.

The WMO's Unified Data Policy is an instrument that guides the international exchange of weather, climate and related system data between the WHO's 193 member states. The policy reiterates the commitment of the member states to free access and exchange of weather, climate and earth system data. The policy lists the types of data to be shared and the platform for sharing the data. Some platforms on which members will share and have unlimited access to the data include WMO Information System (WIS), GTS, and Global Data-Processing and Forecasting System (GDPFS).

4.0. Guiding principles for data management and governance

The development of this policy was guided by the data management and governance guiding principles, which were formulated considering the

national circumstances and consistent with domestic legal frameworks, international obligations and commitments. Furthermore, these guiding principles are consistent with universal data management and governance. Essentially, the guiding principles are anchored on the operating guidelines of WMO policy, the 2030 Agenda for Sustainable Development, the Right to Information (RTI) Act, the Sendai Framework for Disaster Risk Reduction and Vision 2036, amongst others.

4.1. Data management principles

The principles that guided the development of this policy include:

1. data is a strategic asset: this policy recognises that data is a strategic asset for VMGD. As such, sufficient resources and efforts must be allocated to data management and governance. At the same time, as a strategic resource, unauthorised access and misuse must be minimised as much as possible.
2. Defined data ownership: defined ownership is important in data management and governance. The lack of clarity on data ownership could hinder its effective management and result in uncontrolled data transfer and access. Thus, defined data ownership must be prioritised. Clarity on ownership will facilitate organised data and information sharing in line with the RIT Act.
3. Data automation: as much as possible, data capture, validation and processing should be automated. Data automation is a process that involves capturing, handling, uploading, and processing data using automated technologies rather than manually. This aims to enhance data quality and provision of timely services. Furthermore, it is the most cost-effective way of data processing and storage.
4. Avoid data duplication: duplication in data must be minimised and avoided as much as possible. Replication of data occurs when information about an entity or variables is stored multiple times. This happens due to a lack of pre-planning, a lack of harmonisation of data systems, a lack of validation checks and integrity constraints.

Consequently, systems must be implemented to ensure that duplication is minimised as much as possible.

5. Specific purpose of data: each data should be collected for a specific purpose(s) and readily available for those purposes. This principle is critical as it will ensure that data collection and processing are specific for a purpose and will avoid the collection of unnecessary data which will not be used. Ultimately, this guiding principle is aimed at cost efficiency. Considering the specific purpose of the data to be collected will inform the data owners on the data to be collected.
6. Data management system: systems must be in place to ensure that the data is managed effectively through the data lifecycle management system. This will guarantee that the other principles are achieved.

4.2. Data governance principles

Data governance is a process that involves data management to enhance accountability, verification, consistency and quality, amongst others. It is defined as a framework for assigning decision-related rights and duties to enable the adequate handling of data as a company asset (Otto, 2011). Subsequently, the following guiding principles will inform and guide this policy:

1. Accountability: data governance aims to ensure a high level of accountability for the data personnel within the organisation. Responsibility will be emphasised at all levels by ensuring that all positions (data personnel, data owners, data stewards and custodians) are appointed with clearly defined roles and responsibilities. This will ensure that all persons responsible for data handling will be held accountable.
2. Transparency: transparency will be built into the data governance processes by documenting all the process and functions of data collection, analysis, storage, and data sharing. This will ensure that future audits can be undertaken on data management processes.

Transparency is critical as it builds confidence and trust in the integrity of the data. Thus, checks and balances will be designed to guide transparency.

3. Auditability: data-related decisions, processes, and controls should be well documented to enable them to be subject to audit by any party, both nationally and internationally. The policy will implement measures to promote audit processes for compliance-based and operational data auditing requirements.
4. Data quality standards: the data accessible to users must be of high-quality and reliable for precise decision-making and planning. Quality assurance/quality control (QA/QC) processes will be developed and implemented to ensure that the data is of appropriate quality.
5. Stewardship: data stewardship plays a pivotal and critical role in data governance. Data stewards' functions include the development of processes and procedures for data quality, compliance, data security, reliability, issues on data and metadata. The policy emphasises the appointment of data stewards and that their responsibilities are articulated.
6. Integrity: data governance participants will practice integrity in dealings with stakeholders. They will strive to implement data management and governance systems to ensure compliance.

5.0. Policy statements

The policy recognises climate change is at an advanced stage in Vanuatu, with impacts likely to reverse the developmental gains and economic strides achieved over the years. Furthermore, the policy resonates with the fact that Vanuatu is located in a highly seismic and volcanic region. These conditions require urgent pragmatic planning to avert potentially catastrophic hydrometeorological and geological events. Improved hydrometeorological and geoscience data management and governance will be vital to practical and proactive planning. Emphasis is thus placed on

the generation of accurate and reliable data to develop DRR and early warning systems to minimise economic and community vulnerabilities.

Subsequently, the policy has a set of statements aimed at facilitating and enhancing an environment of good data management and governance to promote data-driven decision-making and planning.

Policy statement No 1: Generating of good quality data will be promoted to ensure that accurate decisions and planning processes are implemented.

The policy takes a stern position that developing adaptation, recovery and resilience plans for both hydrometeorological and geo-hazards events depends on the generation of good-quality data. Thus, measures must be put in place to ensure that high-quality data is generated, which will be used as input in climate change impact assessments, adaptation plans, and DRR plans. This policy takes an unequivocal position that high-quality data brings more reliable results at a faster rate. Subsequently, the approach recognises that poor-quality data is as good as no data. Considering the multiple socio-economic benefits of the use of high-quality data, measures will continuously be put in place to improve the generation of high-quality data sets.

Policy statement No 2: To enable society to better plan and adapt to climate change, geological risks, and hazards, data accessibility will be promoted at all economic and community levels.

To enable effective climate change adaptation and develop pragmatic and proactive DRR programmes, hydrometeorological and geoscience data generated must be made accessible to all stakeholders at all levels (national, district and community levels) on a timely basis. Therefore, this policy will promote data and information accessibility to Ni-Vanuatu. Making data accessible and available to stakeholders will enable them to develop pre-emptive adaptation and DRR plans and aid in saving lives.

Policy statement No. 3: To sustain the generation of good quality hydrometeorological and geo-hazards data, measures will be implemented to improve adequate resource allocation for data generation.

The generation of quality data is an expensive venture. Both the fixed and operational costs are high. Therefore, to sustain the production of quality data covering the entire islands of Vanuatu, efforts will be concentrated on allocating sufficient resources to VMGD. Sustainable funding avenues will be implemented, such as affordable cost-recovery mechanisms, improved budgetary processes, and international funding.

Policy statement No 4: Data management systems will be promoted to ensure proper data handling.

Data management covers all the data handling processes from collection, and storage to sharing. It is critical that sound and robust data management processes are promoted to ensure properly handling of the data. This will be achieved by the development of data management plans and strategies.

Policy statement No. 5: Highly robust data governance structures and protocols will be implemented to safeguard against data misuse and protect the VMGD intellectual priority rights.

Data governance entails decision-making, management, and accountability on matters incidental to data in an institution or entity. Data governance involves a dedicated team of experts, data owners, data stewards, and quality assurancers. This will ensure the smooth execution of data handling such as processing, storage, sharing and protection from breaches.

Policy Statement No. 6: Efforts will be continuously concentrated on building confidence in the data users by increasing transparency of the modalities of data generation.

Data transparency is a critical element that builds confidence and promotes the use of data in planning and decision-making. Transparency entails providing the stakeholders with information on data management practices. The policy will implement clear measures to ensure stakeholders are informed and involved in the QA/QC processes. This process will foster greater confidence in stakeholders and data users, which will facilitate increased use of hydrometeorological and geo-hazards data in impact and

vulnerability assessments and the development of adaptation and DRR plans.

Policy Statement No 7: data is a strategic asset with high economic value and, at the same time, with associated high fixed and operational costs and must be allocated sufficient resources.

Data is a strategic asset with high economic value. At the same time, the cost of data management is significantly increased due to the high fixed costs and maintenance costs of instrumentation. If policymakers and decision-makers are unaware of the value and price of data, fewer resources will be allocated to data generation. Conversely, it is critical that information on the economic value of data in terms of saved lives and assets and minimised costs to gross domestic product (GDP) are relayed to the decision-makers and planners to ensure increased budget allocations to this strategic resource.

5.1. Strategic activities to achieve the policy statements and objectives

Achieving the above policy statements and objectives will involve combining multi-pronged strategic activities aimed at improved data management and governance. As guided by the guiding principles, strategic activities will be implemented within the VMGD divisions to achieve the policy objectives and statements. It is envisaged that these strategic activities will contribute to improved data handling, data quality, improved transparency, increased accessibility, enhanced understanding of the value of data, and overall enhanced data governance structures. These strategic activities are discussed below each policy statement:

Policy Statement 1: Generation of good quality data will be promoted to ensure that the data is used to develop unambiguous national adaptation and DRR plans.

This policy statement will be achieved through the following strategic activities:

- Development of the department data quality assurance and quality control (QA/QC) framework.
- Continuously train data personnel/generators on the QA/QC systems.
- Develop and implement a staff training programme for further education (Degree, Msc and Phd).
- Promote and enhance data automation systems for most variables to enhance quality and timely service.
- Establish and operationalise a QA/QC audit process with the stakeholders being part of the audit process.
- Increase the budget for instrumentation maintenance through lobbying and demonstrating the value of hydrometeorological and geo-hazard data.
- Develop built-in quality checks in the database platforms.

Policy Statement 2: To enable society to plan better and adapt to climate change, geological risks, and hazards, data accessibility will be promoted to all stakeholders.

Achieving this policy statement will involve the implementation of the following activities:

- Establish and operationalise comprehensive data access and information-sharing systems within VMGD.
- Promote and communicate the data and information-sharing systems to all the stakeholders by developing stakeholder engagement plans and strategies.
- Build the of stakeholders' capacity on using hydrometeorological and geoscience data in impact and vulnerability assessments, development of adaptation and resilience plans.

Policy Statement 3: To sustain the generation of good quality hydrometeorological and geo-hazards data, measures will be implemented to improve resource allocation for data generation.

This will be achieved through the following high level strategic activities:

- Review the existing cost recovery mechanism and recommend the appropriate cost recovery mechanism for the country based on existing cost recovery schemes.
- Negotiate with the relevance ministry on financing model that will allow quick access to resources for instrumentation maintenance e.g. revenue retainment scheme.
- Improve VMGD budgetary processes that reflect the actual financial needs of instrumentation maintenance.
- Sign the International Convention for the Safety of Lives at Sea to include the maritime in cost recovery scheme.

Policy statement No 4: Data management system will be promoted to ensure proper handling of data

This will be achieved through the following activity:

- Develop a data management plan and strategies.

Policy statement No. 5: Highly robust data governance structures and protocols will be implemented to safeguard data misuse and protect the VMGD intellectual property rights.

The following strategic activities will be implemented to ensure that sound data governance systems are in place to protect the data owners and the users:

- Appointment of a Data Governance team within the Divisions consisting of data stewards, data owners, and data custodians with clear roles and responsibilities to strengthen data governance protocols detailed in the terms of reference.
- Develop the terms of reference for the selected Data Governance team.
- develop the data accountability strategy for the Department to promote and enhance data accountability which is crucial for data governance.
- Establish a data governance framework to guide the data's lifecycle. The framework should include protocols, procedures, and guidelines

for managing data through its lifecycle. Importantly, it should entail elements of quality, privacy, security, access, and roles and responsibilities for implementing and enforcing these policies.

- Develop and implement data security controls.
- Develop and operationalise data backup systems.

Policy Statement No. 6: Efforts will be continuously concentrated on building confidence in the data users by increasing transparency on the modalities of data generation.

- Establish protocols and procedures for data auditing management systems.
- Strengthen the existing technical audit system (PASO) to undertaken the data audit process.

Policy Statement No 7: data is a strategic asset with high economic value, and its economic value must be promoted.

- Undertake economic valuation and produce position papers on the monetary value of hydrometeorological and geo-hazards data.
- Sensitise economic planners, decision-makers, and politicians on the monetary value of hydrometeorological and geo-hazards data.
- Document the operational costs of hydrometeorological and geo-hazards data considering the maintenance costs of instrumentation, wear and tear etc.

7.0. Institutional arrangements for data management and governance policy

This data management and governance policy is explicitly developed for the VMGD under the Ministry of Climate Change, Meteorology, Geo-hazards, Energy, Environment and Disaster Management. Consequently, it will be implemented by the VMGD under the guidance of the Ministry.

Compliance to this policy shall be ensured by the Director in line with the Meteorology, Geological Hazards and Climate Change (MGHCC) Act of 2016

which gives the Director authority to manage meteorological and related data collected in Vanuatu or for use by the Government of Vanuatu.

The policy will be implemented exclusively by VMGD, as depicted in Figure 1 below.

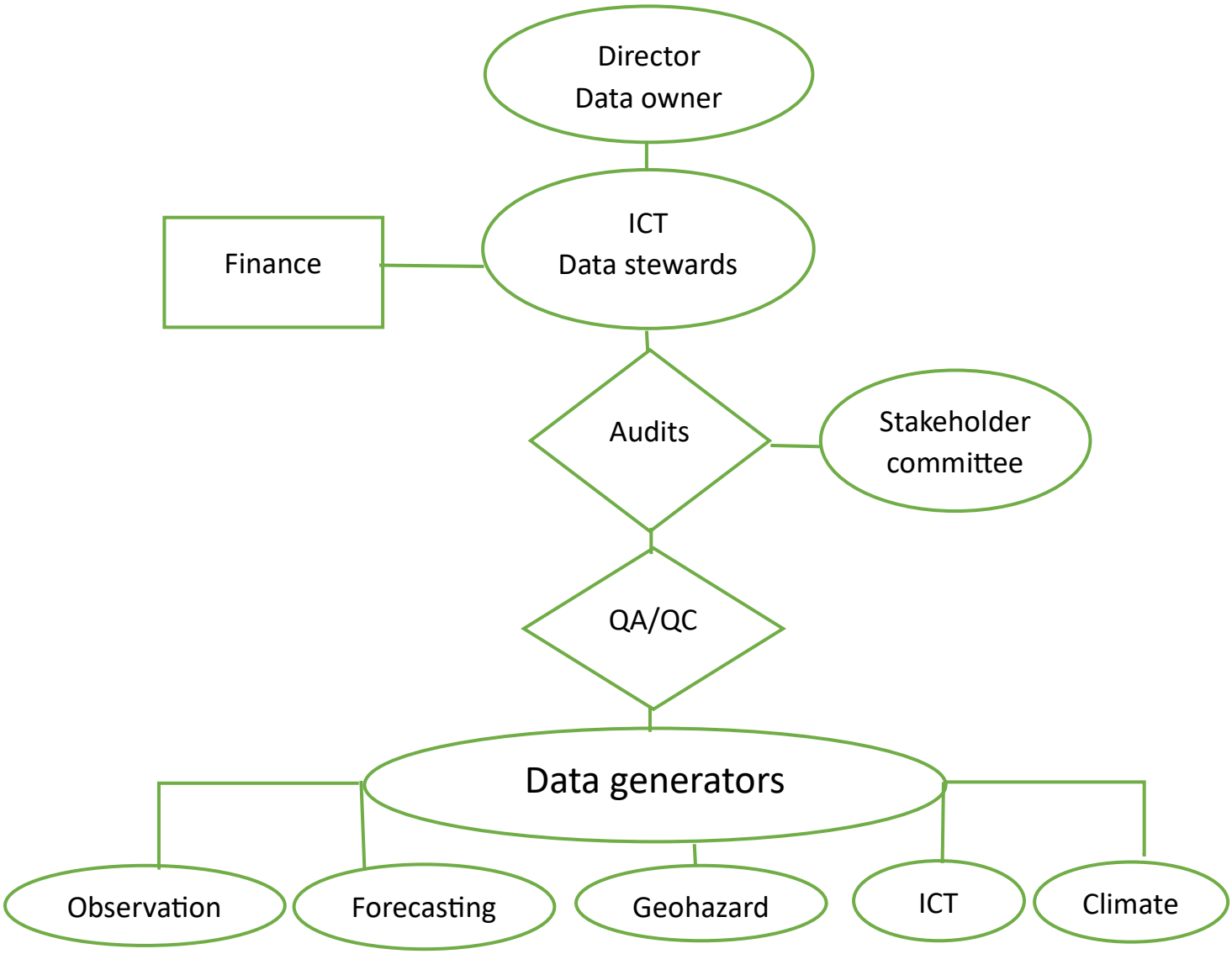

Figure 1: Institutional arrangements for the policy implementation

The Director

The Director will oversee the policy's implementation and, at the same time, be the data owner as stipulated in the Act. The Division Managers will report to the Director on the implementation progress.

ICT Division

The ICT Division will be the data steward and its tasks will entail the following:

- management of the databases,
- protection of the databases from unauthorised access,

- improved security of the databases,
- ensuring that there is sufficient data backup for the database systems for the Division.
- monitor and track all data-sharing processes.

The ICT Division will play a central role in data release through the Department of Finance. Moreover, the ICT will ensure the appropriate use of the VMGD data assets. Lastly, as a data steward, the ICT will play a vital role in data quality, particularly in providing in-built data quality checks and ensuring that the instrumentation is well maintained and records accurate data.

VMGD Divisions

The department Divisions will play a critical role in data generation. Furthermore, they will ensure the QA/QC process implementation within their divisions. The Division Managers will oversee this, will ensure that their divisions adhere to internal and overall QA/QC systems. Additionally, the Division Managers' roles will include receiving data requested and liaising with the ICT on the type of data to be released.

Stakeholder Committee

A Stakeholder Committee will be established whose overall responsibilities will be to ensure compliance with the based QA/QC system. The Stakeholder Committee will be involved in the periodic audits of the data quality management systems to ensure compliance and to build transparency and confidence in the data generated.

Finance Department

The Finance Department will receive the requested data from the ICT Division, release it to the client, and receive payment.

8.0. Data sharing processes and protocols

Data-sharing processes is another element of data management and governance. It is essential that data sharing is organised to track the data being shared, its quantity, the client types, and the ways the data is being

used (commercial, non-commercial, research and education). This will require a centralised data sharing system, as depicted in Figure 2.

Due to the high demand for hydrometeorological and geoscience data, all the data requests will be through the Division Managers, who will send requests to the Director for approval. Upon approval, the submissions will be sent to the ICT Division (Data Steward), who will liaise with the appropriate Division Manager on the specifics of the data to be released. Upon reaching a consensus between the ICT personnel and the relevant division Manager on the data to be removed, the ICT personnel will release the data to the Finance department with the invoice on the cost of the released data. The Finance department will release the data to the requester upon receipt of payment.

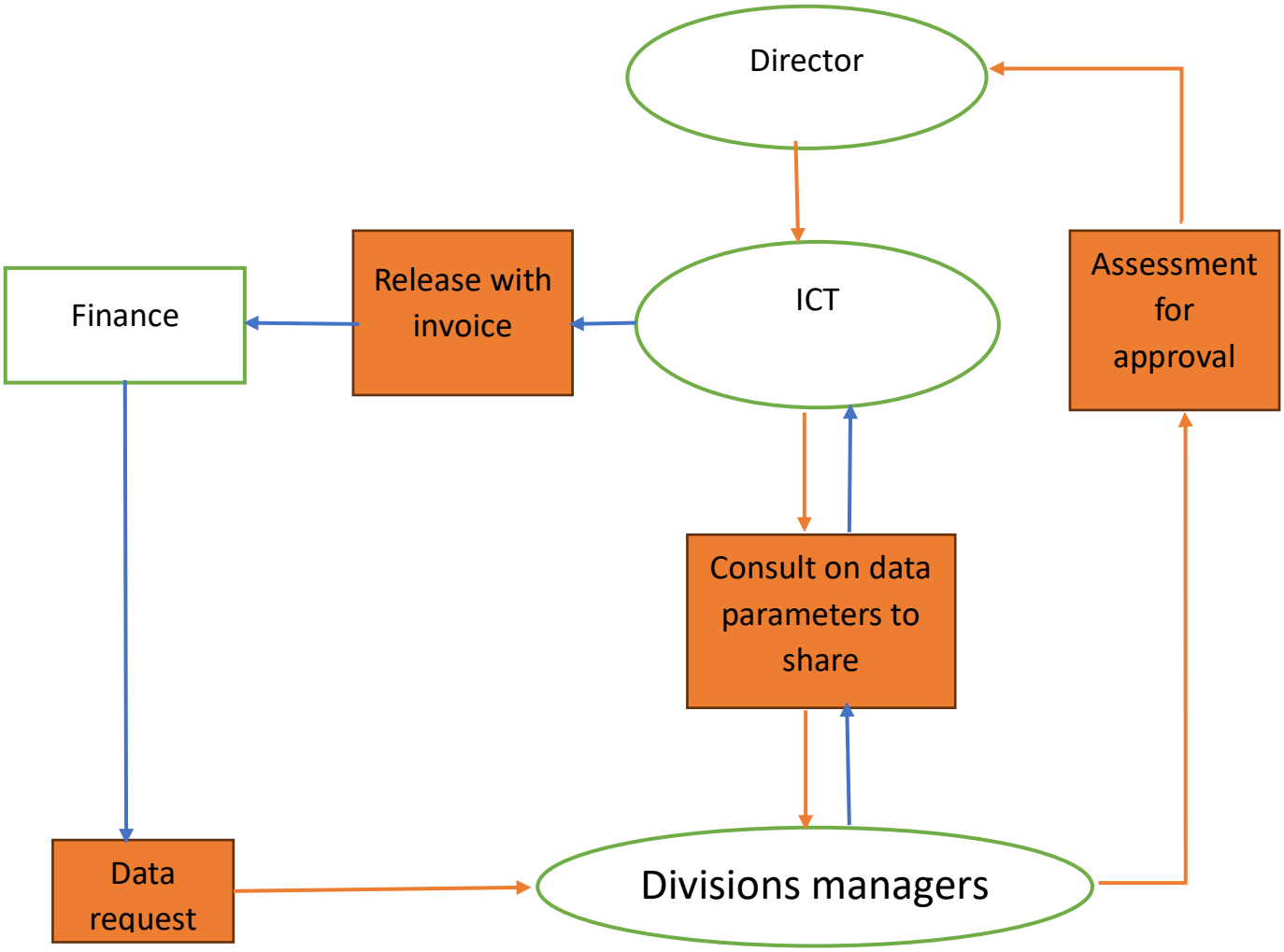

Figure 2: Data sharing system

Some stakeholders require real-time data and information on hydrometeorological and sea conditions daily. Such stakeholders must be provided the data and information on a timely basis. The proposed data-sharing process in Figure 2 will not be able to meet their requirements. Therefore, memorandum of agreement/understanding must be signed between VMGD and the concerned stakeholders to ensure that real-time data is released daily and on time.

In addition, in compliance with the RIT Act of 2016, the department will continue to provide the public relevant information on hydrometeorological and geo-hazards. This will be in the form of bulletins; weather updates; seismic, volcanic, and tsunami warnings.

9.0. Resource mobilisation for data management and governance policy implementation

As already alluded to, hydrometeorological and geoscience data are valuable and strategic resources that contribute to the function of the economy of Vanuatu, but this comes with high data management costs. Therefore, measures must be put in place to mobilise sufficient resources (finance, human resources, and equipment) to implement this policy which will facilitate data generation and flow to stakeholders.

All the strategic activities of this policy must be viewed as equally essential and be allocated sufficient resources. Funding shall therefore be made available for the entire data lifecycle; on QA/QC, capacity building, maintenance of instrumentation/observation stations, data storage and data sharing and dissemination.

The policy aims to increase resource allocation to the department by sustainably mobilising resources sustainably without disrupting development processes and financial planning cycles. The policy shall emphasise monetary and non-monetary (in-kind) resources to sustain hydrometeorological and geoscience data generation. The following shall

be undertaken to improve resource allocation and reallocation for data generation through its lifecycle:

Data cost recovery and quick access to finance for maintenance of instrumentation.

The Meteorology, Geological Hazards and Climate Change Act directs the VMGD to charge for climate services provided to the stakeholders. this involves the sale of data to stakeholders. As per the governmental financial instructions, all the revenue generated by the governmental departments is deposited to the Central Bank for redistribution. There is a need to review the existing data charge and ensure that they reflect the cost of data generation. For instance, aviation charges are based on litres of fuel used and hence not reflective of the price of data. Furthermore, some stakeholders, such as the maritime industry, must be included in the cost recovery scheme.

It is essential that the department has quick access to funds for instrumentation maintenance. Another way to quickly access funds to maintain instrumentation is to advocate for retaining a certain percentage of the revenue generated by the department in the sale of data. The retainment of a certain percentage of revenue generated will enable VMGD to quickly access the funds to fix instruments that provide vital data and information, such as at a seismic station. Therefore, there is a need to create a dialogue between the department and the relevant ministry to advocate for a change that will allow the department to retain a certain percentage or access funds quickly for maintenance of instrumentation.

National budget

The department receives an annual budget from the central government as a governmental department. There is a need for the Department to mainstream the data management and governance policy activities into its annual budget to implement the policy's activities. Furthermore, advocating for budget increases must be promoted based on the operational costs of

the observation stations and the economic value of hydrometeorological and geoscience data.

Donor funding

Over the years, the department has received donor funding to support the installation of weather and seismic observation stations as well as capacity building/training for its staff members on various aspects of the data lifecycle. Efforts must be continued on donor funding to mobilise resources for implementing the policy activities, particularly capacity building, data automation, development of guidelines and protocols, and instrumentation maintenance, among others.

Community Partnerships

Communities are strategic and essential partners in raising resources, particularly human capital for data collection, where the Department does not have an observation weather station, e.g., rainfall. Forging a solid relationship with the community through community-based approaches will provide labour which is a valuable resource for data collection. The community members must thus be trained in data handling to enhanced enhance data quality.

Non-government Organisations

NGOs have the potential to contribute immensely through in-kind contribution by providing training, information dissemination and community mobilisation. Therefore, they must be seen as strategic partners in mobilising resources through capacity building and information dissemination. NGOs participation will be motivated through the formation of partnerships with communities.

10.0. Policy implementation plans

The policy will be implemented by executing the strategic activities listed under the policy statements. The relevant division within the department will undertake the execution of the strategic activities. It is envisaged that the implementation of the activities will be continuous. The implementation of the policy will be through the strategic plans. It is thus critical that when the department's strategic plans are developed, this policy is thoroughly reviewed to ensure that the policy strategic activities are included in the strategic plans.

Annex 1 depicts the policy implementation plan. It shows the strategic activities, responsible agent for performance, duration, and budget for implementation.

11.0. Enforcement, Monitoring and Evaluation

11.1. Enforcement

This policy will be enforced by the Ministry of Climate Change, Meteorology, Geo-hazards, Energy, Environment and Disaster Management and partially enforced through existing Acts. Consequently, through the collaboration and strengthening of law enforcement, the judicial system, VMGD and stakeholders, the policy will be implemented to improve data management and governance, contributing to improved data access, streamlining data sharing, and reducing data loss and misuse.

11.2. Monitoring and evaluation

The policy shall be results-based and therefore results-driven. As such, the policy shall be evaluated and monitored on the set policy statements to ensure they are achieved at all levels. Thus, the Ministry of Climate Change, Meteorology, Geo-hazards, Energy, Environment and Disaster Management shall receive timely updates on all related activities undertaken by the VMGD concerning the development and operationalisation of the strategic activities contributing to achieving the policy statements. Monitoring and

evaluation (M&E) shall be undertaken at two levels basis annually. Annex 2 details the monitoring and evaluation framework of the policy.

The annual reports shall give an account of activities undertaken towards achieving the policy statements. Aptly, the following fundamental aspects of the Policy shall be monitored and evaluated on a yearly basis:

- Implementation of the sharing data-sharing framework
- Development of a national stakeholder usage data sharing and engagement strategy.
- Development of QA/QC framework.
- Engage with the relevant ministries to introduce a department revenue retainment scheme or scheme that will ensure quick access to funds for instrumentation maintenance.
- Development of a data governance team, including a data stewardship position.
- Establishment of a data governance framework.
- development and operationalisation of data management plan and strategies
- Development and implementation of data security controls.
- Establishment of highly secure data backups for all the Division database systems.
- Establishment of protocols and procedures for data auditing management systems.
- Strengthen the existing PASO technical audit team to verify the audit process.

11.3. Policy review

This policy will be reviewed every 2 years to allow for new development and changes within the departments and legal framework.

12.0. References

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Annex 1: policy implementation planStrategic area	Activities	Duration	Implementation agent	Resources US$
Promote the generation of good quality data	Develop and operationalise QA/QC system	3 months	ICT	25,000.00
	Train division personnel on QA/QC system	1 month	ICT	12,000.00
	Increased coverage of automated systems to capture data	2 years	ICT	TBD
	Improved maintenance of the observation station	Continuous	ICT	TBD
	In-built quality checks in the database systems	Continuous	ICT	TBD
	QA/QC audit system in place	2 months	ICT	N/A
	Develop an operational staff training programme for further education	6 months	Administration	TBB
Promote data access at all levels.	Establish data access and information platforms	2 months	ICT	N/B
	Develop stakeholder engagement strategy on data and information access and sharing	3 months	Administration	25,000.00
	Stakeholder workshops on data and information accessibility and data uses	2 months	Administration	N/A
	Capacity building on Division budgeting	2 months	Administration	20,000.00
Promote data management practises	Development of data management plans and strategies	2 months	Administration	25,000.00
	Capacity building on Division budgeting	2 months	Administration	25,000.00

Optimal resources allocation to VMGD	Revised cost recovery charges	2 months	Administration	25,000.00
	Engage with the relevant ministry to introduce a department financing model that will allow for emergence instrumentation maintenance e.g. revenue retainment scheme	3 months	Administration	N/A
Establish data governance structures to safeguard and protect data.	Appointment of data owner, data stewards and custodian	2 months	Administration	N/A
	Developed terms of reference for the appointed personnel	3 months	Administration	N/A
	Developed data governance framework	3 months	Administration	25,000.00
	Establish database security systems	Continuous	ICT	N/A
	Develop database backup systems	Continuous	ICT	N/A
Strengthen stakeholder confidence through enhanced transparency	Strengthen the technical audit team (PASO)	2 months	Administration	N/A
	Established procedures for audit data management systems	2 months	ICT	N/A
Promote the economic value of	Position and policy paper on the value of hydrometeorological and geoscience data	3 months	Administration	25,000.00

hydrometeorological and geoscience data	Workshops conducted on the economic value of hydrometeorological and geoscience data	2 months	Administration	N/A
	Detailed analysis study on operational costs of VMGD data processing	3 months	Administration	25,000.00

Annex 2: Monitoring and evaluation framework for the policy

Key performance area	Indicator(s)	Methodology	Reporting frequency	Person(s) responsible
Promote data management practices	• Developed data management plans	• Review the Department plans • Interview the division on the existence of the plans and strategies	• yearly	VMGD
Promote data access at all levels	• Established data access and information platforms • Developed stakeholder engagement strategy on data and information access and sharing • Number of workshops on data and information accessibility and data uses	• Interview the Divisions on data access and information platforms • Review the stakeholder engagement strategy to determine level of promotion of access to data • Interviews with the Department of Workshops conducted	• Yearly	VMGD
	• Established QA/QC system	• Review the QA/QC document		

Generation of high-quality data.	• Number of trained personnel on the QA/QC system • automated systems to capture data • Improved maintenance of the observation station • QA/QC audit system in place • In-built quality checks in the database systems • Number of staff graduated and on graduate programmes trained	• Interview the divisions on coverage of automation systems • Interview divisions on the maintenance of the instrumentation • Interview the divisions on trained staff on QA/QC • Interview the ICT on database quality checks	• Yearly	VMGD
Optimal resources allocation to VMGD for data management	• Increased budget for the VMGD • Revised cost recovery charges • An agreed funding model for access to financing instrumentation maintenance	• Analyse the budget for VMGD • Instrumentation maintenance funding model • Interview the Department financing model for emergence instrumentation maintenance	Yearly	VMGD
Establish data governance structures to safeguard and protect data	• Appointment of data owner, data stewards and custodian • Developed terms of reference for the appointed personnel • Data accountability strategy established • Established data governance framework	• Interview VMGD on the existence of the data owner, data steward and custodian position • Review the accountability strategy • Interview the ICT on data security	Yearly	VMGD

	• Established database security systems	• Review the data governance framework		
Strengthen the confidence of stakeholders through enhanced transparency	• Strengthen the PASO technical Audit team • Established procedures for audit data management systems	• Interview the VMGD on the existence of an audit team • Review the audit procedures	Yearly	VMGD
Promote the economic value of hydrometeorological and geoscience data	• Position and policy paper on the value of hydrometeorological and geoscience data • Workshops conducted on the economic value of hydrometeorological and geoscience data • Detailed analysis of operational costs of VMGD data processing	• Review the position and policy paper • Interview the Department on workshops conducted • Interview the Department on a detailed analysis ofthe operational costs of VMGD	Yearly	VMGD

Annex 3: rapid situational assessment matrix

Strategic area	Indicator	Status	Comment	Mitigation for improvement
Promote hydrometeorological and geoscience data access at all levels.	Established data access and information platforms			
	Developed stakeholder engagement strategy on data and information access and sharing			
	Number of workshops on data and information accessibility and data uses			
Promote the generation of high-quality hydrometeorological and geoscience data.	Established QA/QC system			
	Number of trained personnel on the QA/QC system			
	automated systems to capture data			
	Improved maintenance of the observation station			
	In-built quality checks in the database systems			
	QA/QC audit system in place			
Optimal resources allocation to VMGD	Increased budget for the VMGD			
	Revised cost recovery charges			

	An agreed funding model for emergence instrumentation maintenance			
Establish data governance structures to safeguard and protect data.	Appointment of data owner, data steward and custodian			
	Developed terms of reference for the appointed personnel			
	Data accountability strategy established.			
	Established data governance framework			
	Established database security systems			
Strengthen the confidence of stakeholders through enhanced transparency	Strengthen technical audit (PASO)			
	Established procedures for the audit of data management systems			
Promote the economic value of hydrometeorological and geoscience data.	Position and policy paper on the value of hydrometeorological and geoscience data			
	Workshops conducted on the economic value of			

	hydrometeorological and geoscience data			
	Detailed analysis study on operational costs of VMGD data processing			

Annex 4: Status progress

Status	Completed
	Almost completed
	In progress
	Just started
	Not done but planned
	Still needs to be done and planned.