COMPETENCY BASED FRAMEWORK

FOR

MAP PRODUCTION TECHNICIAN

National Land Commission Secretariat
2024

Published by: Department of Survey and Mapping, National Land Commission Secretariat, Thimphu. Post Box: 142

First Edition: March 2024

Task Force Members:

1. Tashi Peldon, Deputy Chief Survey Engineer
2. Chimi Dem, Deputy Chief Survey Engineer
3. Chencho Tshering, Survey Engineer
4. Tika Chhetri, Map Production Technician
5. Chencho Nedup, Map Production Technician
6. Dorji Phuntsho, Map Production Technician
7. Deki Tshomo, Asst. Human Resource Officer

Table of Contents

Abbreviation

CBF - Competency Based Framework
DoSAM - Department of Survey and Mapping
NLCS - National Land Commission Secretariat
GID - Geoinformatics Division
MPT - Map Production Technician
GIS - Geographical Information System
RS - Remote Sensing
GPS - Global Positioning System
NSDI - National Spatial Data Infrastructure
SDSS - Spatial Decision Support System
GI - Geospatial Information
GPS - Global Positioning System

1. Background

1.1 About the Department

The Department of Surveying and Mapping (DoSAM) was established in 2015. Besides surveying and mapping activity, the Department is also responsible for the development of geospatial data infrastructure of the country covering both soft and hard components such as data, technology, policy, people, collaboration, and improvement of processes.

Currently there are three Divisions in the Department, namely Topographical Survey Division, Cadastral Information Division and Geoinformatics Division. Topographical Survey Division is the main producer of national spatial data infrastructure. It also validates national horizontal and vertical datum. It ensures accuracy and strengthens surveying techniques and technologies, creates up to date and accurate fundamental geospatial data and topographical database. The Cadastral Information Division (CID) is one of the oldest divisions instituted sometime in early 1960s and is responsible for all the works related to cadastral surveying and mapping in the country and providing cadastral maps.

The **Geoinformatics Division (GID)** primarily deals with the geospatial science that involves data acquisition, management, spatial analysis, mapping, and visualization of geographic data through Geographic System (GIS), Remote Sensing (RS), and Surveying technology to support various functions and decision-making processes within and across agencies. The division is also responsible for development and maintenance of geospatial databases, integration with other systems, and developing Spatial Decision Support Systems (SDSS) including National Spatial Data Infrastructure (NSDI) Services.

The division strives to use cutting-edge technology in GIS, RS, Surveying and Machine Learning techniques, to uncover new insights and patterns in geographic data. The division is committed to continuous improvement and always looking for new and innovative solutions to keep abreast with the latest trends and technology in the field of geoinformatics.

In addition, the Centre for Geo-Information (CGI), responsible for implementation of Geographic Information (GI) Policy of Bhutan is functioning under the GID. Thus, the Geoinformatics division is also responsible for development and implementation of National Spatial Data Infrastructure (NSDI) for the country.

The National Land Commission today has achieved the excellent cadastral system which provides a more secure basis for land and property ownership using modern surveying equipment, strengthening ownership security and the tenure system.

1.2 Vision of the Agency

Geo-Enabled Nation with Par Excellence Land Governance

1.3 Missions of the Agency

1. Manage, regulate, and administer the ownership and use of land.
2. Guarantee the security of land tenure.
3. Ensure easy access to reliable geospatial information.

1.4 Core Values

1. Integrity
2. Teamwork
3. Professionalism
4. Innovation
5. Customer Driven

1.5 Core Functions

- Geospatial Data Collection and Acquisition
- Geospatial Data Management
- Cartography and Visualization
- Geocoding of fundamental geospatial data
- Printing and publication of fundamental and thematic maps.
- Management of geospatial data
- Geospatial Analysis and Modeling
- Integration of Geospatial Technologies
- Support National Land Use Zoning in GIS and Mapping Domain
- Conduct Land Use and Land Cover Mapping
- Development of web services
- Development and promotion of NSDI Services
- Conduct Research and Innovation in geoinformation.
- Provide technical support and training in GIS and Remote Sensing

2. Competency-Based Framework for Map Production Technician

2.1. Introduction

The Competency Based Framework of the Map Production Technician/GIS Technician has been developed to further enhance the capacity and capabilities of the Map Production Technician to support the goal of the Department of Survey and Mapping to be a professional and dynamic institution committed to excellence, courtesy and service delivery and to safeguard the country's national interest at all times.

2.2. Purpose

The CBF highlights the knowledge, skills, and abilities required for map production technicians to achieve a high level of professional competence and deliver the highest standard services. The framework is developed with the following aim and objectives.

2.3. Aim

Build a fraternity of Map Production Technicians who are highly knowledgeable, skillful, and competent in delivering efficient and effective services.

2.4. Objectives

The program is aimed at strengthening the capacity and capabilities of the civil servants based on their role specific competency to enhance professionalism, growth, and development to contribute optimally to nation building.

2.5. Framework Development Processes

The development of the framework involved identifying Role Profiles, Competency Areas, Key Competencies, Behavioral Indicators and Proficiency Levels through a rigorous, consultative, and inclusive process with key stakeholders.

The CBF is endorsed by the 184th Human Resource Committee meeting held on 26/01/2024.

2.6. Structure

Brief explanation and diagrammatic overview of the CBF

<table>
<tr><th colspan="10">Map Production Technician</th></tr>
<tr><th colspan="4">Cartographer</th><th colspan="3">Geospatial Analyst</th><th colspan="3">Geospatial Data Manager</th></tr>
<tr><th colspan="2">Cartography</th><th colspan="2">Production & Publication</th><th colspan="2">Geospatial Data Collection and Update</th><th>Spatial Data Analysis</th><th colspan="2">Geospatial Data Management</th><th>Sharing and Promotion of GI</th></tr>
<tr><td>Geo-Visualization</td><td>Web-Ma Service</td><td>Mapping Workflow</td><td>Graphic Design</td><td>Data Acquisition and Post Processing</td><td>GIS Software Proficiency, Coordinate System and Projections</td><td>Spatial Data Analysis and Research Assistance</td><td>Spatial Database Design, Management, and Administration</td><td>Metadata Management</td><td>Education, training, and technical support</td></tr>
</table>

Sl. No.	Structure	Numbers
1	Key Roles and Role Profile	3
2	Competency Area	6
3	Key Competencies	10
4	Behavioral Indicators	18
5	Number of Proficiency Levels	4

2.6.1. Identification of Key Role

The key role is an organized set of behaviors that are crucial to achieving the current and future goals of the Department of Survey and Mapping. Following are the key roles expected to be performed by the Map Production Technician/GIS Technician:

a. Cartographer
b. Geospatial Analyst
c. Geospatial Data Manager

2.6.1.1. Description of Role Profile

The role profile is the description of roles that Map Production Technicians are expected to demonstrate in achieving the outcomes of the Department of Survey and Mapping. It defines outcomes and competencies for an individual role. It concentrates on outcomes rather than duties, which provides better guidance than a job description on expectations. It does not constrain Map production Technicians to carry out a prescribed set of tasks.

Role Profile of Map production Technician

SN	Key Role	Role Description
1	Cartographer	1. Data pre-processing and manipulation 2. Cartography and visualization (Geo-visualization) 3. Design and creation of maps. 4. Thematic mapping and publication 5. GIS software operation 6. Education and training
2	Geospatial Analyst	1. Spatial Data acquisition (Field survey, GIS & RS method) 2. Data post-processing and quality control 3. GIS Software operation 4. Spatial data analysis and Interpretation 5. Integration of RS data 6. Web map services 7. Support NSDI services. 8. GIS Project assistance 9. Collaboration with GIS professionals
3	Geospatial Data Manager	1. Data acquisition and integration 2. Spatial database management and administration 3. Support sharing, access, and discovery of spatial data through NSDI services. 4. Coordination and collaboration with stakeholders 5. Management and sales of hardcopy maps 6. Management of GIS proprietary software and facilitation

		7. Metadata management 8. Data standards and quality control 9. Data security and privacy

2.6.2. Identification of Competency Areas

The competency area is the clustering of key competencies by related behavior and functions of each role. It comprises a set of Knowledge, Skills, and Abilities (KSA) that result in essential behaviors expected from the Map Production technician framework has identified seven competency areas as follows:

Role #	Key Role	Competency Area
1	Cartographer	Cartography
		Production and Publication
2	Geospatial Analyst	Geospatial Data Collection and Update
		Spatial Data Analysis
3	Geospatial Data Manager	Geospatial Data Management
		Sharing and Promotion of GI

2.6.3. Identification of Key Competencies

The key competency is an observable behavior that indicates the presence of a particular competency. Generally, it is broadly divided into core competency, leadership competency and technical or functional competency. The framework has identified eleven key competencies as presented below.

SN	Key Role	Competency Area	Key Competencies
1	Cartographer	Cartography	Geo-visualization
			Web map service
		Production and Publication	Mapping workflow
			Graphic design
2	Geospatial Analyst	Geospatial Data Collection and Update	Data acquisition and post processing
			GIS software proficiency, Coordinate systems and projections
		Spatial Data Analysis	Spatial data analysis and research assistance
3	Geospatial data manager	Geospatial Data Management	Spatial database design, management, and administration
			Metadata Management
		Sharing and Promotion of GI	Education, training, and technical support

2.6.4. Identification of Behavioral Indicators

Behavioral Indicators is the description of competencies based on various proficiency levels. It outlines a collection of desired and observable motives, traits and behaviors when executing or carrying out the assigned task. It serves as a tool to guide evaluations of employee performance. The framework has identified twenty behavioral indicators.

Key Role 1: Cartographer		
Competency Area	**Key Competency**	**Behavior Indicators**
1.1 Cartography	1.1.1 Geo-visualization	1.1.1.1 Able to use GIS Software such as ArcMap, ArcGIS Pro, and QGIS for the cartography.
		1.1.1.2 Proficient in generating maps according to specified requirements, design principles, layout guidelines, and analysis outcomes.
		1.1.1.3 Skilled in designing maps with expertise in cartographic grammar, symbol design, typography, color usage, and overall map design and layout.
	1.1.2 Web Map Service	1.1.2.1 Capable of leveraging GIS software like ArcMap, ArcGIS Pro, ArcGIS Enterprise, and QGIS to develop web applications.
		1.1.2.2 Dissemination of information as static (paper and screen) and dynamic (web applications, map applications, and web services).
1.2 Production and Publication	1.2.1 Mapping Workflow	1.2.1.1 Understand USE, CLIENT, and USER.
		1.2.1.2

		Capable to define all the possible inputs, actions, and results involved in a procedure or process.
	1.2.2 Graphic Design	1.2.2.1 Able to design and publish maps and reports as per the USE and USER
Key Role 2: Geospatial Analyst		
Competency Area	**Key Competency**	**Behavior Indicators**
2.1. Geospatial Data Collection and Update	2.1.1 Data acquisition and post processing	2.1.1.1 Demonstrates a thorough understanding of spatial data acquisition methods using survey equipment (field survey), and using GIS and RS technology
		2.1.1.2 Demonstrate excellent knowledge in post processing of data acquired
	2.1.2 GIS software proficiency, Coordinate systems and projections	2.1.2.1 Proficient in GIS and RS software operation (both proprietary and open-source SWs)
		2.1.2.2 Demonstrate knowledge in different coordinate systems and their significance in spatial data representation.
2.2 Spatial Data Analysis	2.2.1. Spatial data analysis and research assistance	2.2.1.1 Knowledge on Geo-processing techniques and tools including basic spatial queries
		2.2.1.2 Ensure accuracy and precision, solve problems with innovative approach
Key Role 3: Geospatial Data Manager		
Competency Area	**Key Competency**	**Behavior Indicators**

3.1 Geospatial data management	3.1.1 1 Spatial database design, management, and administration	3.1.1.1 Proficient in using existing ICT-based digital record management of spatial data and maps, data storing, Data Integration, analyzing spatial data. Data loading and Import/Export of Spatial Data.
		3.1.1.2 Ensures that data is secure with easy accessibility to extract the required spatial data and information.
	3.1.2. Metadata Management	3.1.2.1 Documentation of information about the source, accuracy, and completeness of geospatial data.
3.2 Sharing and promotion of GI	3.2.1. Education, training, and technical support	3.2.1.1 Demonstrate capability to train, educate and provide technical support to the users of GIS and RS technology

2.6.5. Classification of Proficiency Levels

The proficiency level is categorized based on the level of expertise. It describes the levels of competency required to perform a specific job successfully. There is a progression of proficiencies at each level. The proficiency level of a Map Production Technician is categorized into four levels as i) Entry (S2), ii) Intermediate (S1) iii) Experienced (SS4-SS3) and iv) Advanced (SS3-SS1). The framework has identified fifteen behavioral indicators across four levels of proficiency.

Proficiency will enable individual officials to distinguish the type of competencies expected in their career path, which will allow them to enhance competency in achieving current as well as future career goals. Further, the proficiency level will set a benchmark for recruitment and deployment. The proficiency levels of each key competency are detailed below:

Key Role 1: Cartographer

Competency Area: 1.1 Cartography			
Key Competency: 1.1.1 Geo-visualization			
Behavior Indicator: Able to use GIS Software such as ArcMap, ArcGIS Pro, and QGIS for the cartography.			
Entry	Intermediate	Experienced	Advanced
Proficient in utilizing GIS software and applying symbolization for simple map creation.	Able to use GIS software and design static & dynamic maps.	Proficient in automating fundamental mapping tasks using scripting languages within GIS software.	Proficient in exploring new technologies and enhancing existing methodologies and symbolization for improved map quality.
Behavior Indicator: Proficient in generating maps according to specified requirements, design principles, layout guidelines, and analysis outcomes.			
Entry	Intermediate	Experienced	Advanced
Can understand and follow user requirements for creating maps.	Can create maps that meet specific needs, understands design principles and layout guidelines, and can integrate basic analysis results into visualizations effectively.	Exceptional at creating detailed maps as needed, mastering advanced design principles, and seamlessly incorporating complex analysis outcomes for visually appealing results.	Exceptional at creating detailed maps as needed, mastering advanced design principles, and seamlessly incorporating complex analysis outcomes for visually appealing results.
Behavior Indicator: Skilled in designing maps with expertise in cartographic grammar, symbol design, typography, color usage, and overall map design and layout.			
Entry	Intermediate	Experienced	Advanced
Able to use the defined cartographic	Able to define and standardize the	Able to integrate and work on the	Capable of defining

grammar, symbol designs, typography, use of color, and map design/layout.	cartographic grammar, symbol designs, typography, use of color, and map design/layout.	symbolization for Web Map Applications.	cartographic grammar, symbol design, typography, color usage, and overall map design and layout.
Key Competency: 1.1.2 Web Map Service			
Behavior Indicator: Capable of leveraging GIS software like ArcMap, ArcGIS Pro, ArcGIS Enterprise, and QGIS to develop web applications.			
Entry	Intermediate	Experienced	Advanced
Capable of navigating and grasping the principles of web applications.	Capable of constructing basic web applications utilizing GIS software like ArcMap, ArcGIS Pro, ArcGIS Enterprise, and QGIS.	Proficient in comprehending and resolving real-world issues through the utilization of WMS (Web Map Service).	Capable of exploring new technologies and algorithms to develop Web Map Applications.
Behavior Indicator: Dissemination of information as static (paper and screen) and dynamic (web applications, map applications, and web services).			
Entry	Intermediate	Experienced	Advanced
Able to disseminate information as static maps for paper and screen.	Able to disseminate information as static (paper and screen) and dynamic (web applications, map applications, and web services).	Able to automate the dissemination of information as static (paper and screen) and dynamic (web applications, map applications, and web services).	Able to automate the dissemination of information as static (paper and screen) and dynamic (web applications, map applications, and web services).
Competency Area: 1.2 Production and Publication			
Key Competency: 1.2.1 Mapping Workflow			
Behavior Indicator: Understand USE, CLIENT, and USER.			

Entry	Intermediate	Experienced	Advanced
Demonstrates basic understanding of USE, CLIENT, and USER concepts.	Understands USE, CLIENT, and USER concepts well, applies them in mapping workflows with some guidance, and acknowledges the significance of user needs and system requirements.	Proficiently applies USE, CLIENT, and USER considerations in mapping workflows, independently analyzes and integrates these factors to improve map production and recognizes the influence of system and environmental factors on map design.	Proficiently applies USE, CLIENT, and USER considerations in mapping workflows, independently analyzes and integrates these factors to improve map production and recognizes the influence of system and environmental factors on map design.
Behavior Indicator: Capable to define all the possible inputs, actions, and results involved in a procedure or process.			
Entry	Intermediate	Experienced	Advanced
Able to understand and follow the instructions for the map production and publication.	Demonstrates the ability to outline a majority of inputs, actions, and results in a mapping process.	Can effectively describe all the things needed, done, and achieved in different mapping processes and is capable of handling complex aspects independently.	Exhibits exceptional expertise in defining inputs, actions, and outcomes for intricate mapping procedures, proactively addressing issues, and recognized as an authority in optimizing efficiency and effectiveness.

Key Competency: 1.2.2 Graphic Design			
Behavior Indicator: Able to design and publish maps and reports as per the USE and USER.			
Entry	Intermediate	Experienced	Advanced
Able to use graphic designing softwares for the production and publication of maps and reports.	Able to use graphic designing softwares for the production and publication of maps and reports.	Able to use graphic designing softwares for the production and publication of maps and reports.	Able to use graphic designing softwares for the production and publication of maps and reports.
Key Role 2: Geospatial Analyst			
Competency Area: 2.1 Geospatial Data Collection and Update			
Key Competency: 2.1.1 Data Acquisition and Post Processing			
Behavior Indicator: Demonstrates a thorough understanding of spatial data acquisition methods using survey equipment (field survey), and using GIS and RS technology			
Entry	Intermediate	Experienced	Advanced
Has a basic understanding of spatial data acquisition methods and tools.	Demonstrates a solid understanding of spatial data acquisition methods and tools, with the ability to work in diverse field conditions.	Possesses an advanced understanding of spatial data acquisition, excelling in both field surveys and technology-driven methodologies.	Recognized as an expert in spatial data acquisition, with a deep knowledge of the latest advancements and Advanced skills in processing and interpreting satellite imagery.
Behavior Indicator: Demonstrate excellent knowledge in post processing of data acquired			
Entry	Intermediate	Experienced	Advanced

Performs basic post processing of data	Can perform fundamental data cleaning tasks, basic data transformations, routine analysis using standard statistical methods and visualizations.	Proficient in addressing complex data quality issues, Proficient in writing custom scripts or code snippets to automate repetitive data processing tasks.	Proficient in real-time data processing and streaming analytics, ensuring timely insights for critical decision-making and be creativity in designing innovative solutions for complex data processing challenges
Key Competency: 2.1.2 GIS Software Proficiency, Coordinate Systems and Projections			
Behavior Indicator: Proficient in GIS and RS software operation (both proprietary and open-source SWs)			
Entry	Intermediate	Experienced	Advanced
Understand the fundamentals and be familiar with the concept of GIS and RS software operation.	Proficiency in data editing, attribute management and conduct more complex spatial analyses and modeling.	Good command of a wide range of tools and functionalities and Basic scripting skills for automation (e.g., Python for GIS).	Ability to customize GIS workflows and tools. Advanced scripting and use of model builder for automation.
Behavior Indicator: Demonstrate knowledge in different coordinate systems and their significance in spatial data representation.			
Entry	Intermediate	Experienced	Advanced
Understand the fundamentals of coordinate systems and projections,	Understand the map projections and their impact on spatial data representation.	Demonstrate the ability to transform coordinates between different systems. And	Be able to Analyze challenges and solutions related to coordinate

		understand the mathematical transformations involved in coordinate conversions.	system interoperability and Contribute to the development of standards for coordinate system usage.
Competency Area: 2.2 Spatial Data Analysis			
Key Competency: 2.2.1 Geospatial Data Analysis and Research Assistance			
Behavior Indicator: Knowledge on Geo-processing techniques and tools including basic spatial queries			
Entry	Intermediate	Experienced	Advanced
Has a basic Knowledge on Geo-processing techniques and tools including basic spatial queries.	Understanding and applying basic spatial analysis techniques and Proficiency in data editing and manipulation within GIS software.	Proficiency in advanced spatial analysis techniques (spatial statistics, network analysis) and Ability to create custom tools and workflows.	Expertise in incorporating remote sensing data into geospatial analyses.
Behavior Indicator: Ensure accuracy and precision, solve problems with innovative approach			
Entry	Intermediate	Experienced	Advanced
Demonstrates basic understanding of the task and follows established procedures to ensure accuracy.	Shows proficiency in problem-solving within familiar scenarios and begins to identify areas for improvement in existing processes.	Demonstrates a deeper understanding of the task and related processes and applies critical thinking to solve problems, combining established methods with some creativity.	Achieves a high level of accuracy and precision consistently. Utilizes advanced techniques to minimize errors and anticipates complex

			challenges and formulates strategic solutions.
Key Role 3: Geospatial Data Manager			
Competency Area:3.1 Geospatial Data Management			
Key Competency: 3.1.1 Spatial Database Design, Management and Administration			
Behavior Indicator: Proficient in using existing ICT-based digital record management of spatial data and maps, data storing, Data Integration, analyzing spatial data.Data loading and Import/Export of Spatial Data.			
Entry	Intermediate	Experienced	Advanced
Demonstrates the understanding of basic ICT skills and knowledge to keep record of spatial data in the database.	Have knowledge of Data security and data storage, be able to upload the Data and export spatial data.	Assists in maintaining the records in the Database to the utmost quality with the detailed attribute information. Able to query the data like update, delete, extract etc.	Fosters ICT performance and service utilization abilities in monitoring the colleagues in database management, data security and data sharing.
Behavior Indicator: Ensures that data is secure with easy accessibility to extract the required spatial data and information			
Entry	Intermediate	Experienced	Advanced
Have knowledge of Data security and sharing, be able to upload the Data and export spatial data.	Have knowledge of data standards, meta data and access control, data sharing platforms.	Assists colleagues in extracting information for dissemination to appropriate divisions and other agencies.	Monitors and ensures that the co-workers have appropriate knowledge on Data extraction, Data sharing, data security and management.

Key Competency: 3.1.2 Metadata Management			
Behavior Indicator: Documentation of information about the source, accuracy, and completeness of geospatial data.			
Entry	Intermediate	Experienced	Advanced
Knowledge of metadata information and Metadata documentation.	Data capture of spatial data along with accurate metadata information in the database, review metadata	Creates online advertisement, convinces, and persuades the user	Implements marketing strategies and policies and monitors coworkers on documentation modules.
Competency Area:3.2 Sharing and promotion of GI			
Key Competency: 3.2.1 Education, Training and Technical Support			
Behavior Indicator: Demonstrate capability to train, educate and provide technical support to the users of GIS and RS technology			
Entry	Intermediate	Experienced	Advanced
Basic knowledge of Cartography, GIS Software, remote sensing, Mapping. Familiarization of the GIS tools	Be able to train on GIS software like QGIS, ArcGIS Pro, and other mapping software. Able to guide within the co-workers.	Well-versed in GIS software like QGIS, ArcGIS Pro, and other mapping software. can guide co-workers, have capacity to train others stakeholders regarding the uses and implementation of GIS mapping softwares.	Well-versed in GIS software like QGIS, ArcGIS Pro, and other mapping software. can guide within the co-workers, have capacity for training regarding the uses and implementation of GIS mapping softwares.

2.7 Training Need Analysis

The Training Need is the difference between desired capability and current capability. It is the process of recognizing the skills gap and needs of training and the procedure to determine whether the training will bring out the solution to the problem. It ensures that the training is targeting the correct competencies, the right employees, and the needs of the Department. The training can reduce, if not eliminate, the gap by equipping the Map Production Technician with knowledge and skills. It should be the shared responsibility of the employees and Department to build and enhance their capability and competency. Additionally, the implementation of a continuous assessment and feedback mechanism serves as a pivotal measure to oversee the progress and engagement of trainees throughout the developmental process.

The training need analysis is carried out in consultation with the stakeholders through FGD. The discussion was based on 18 behavioral indicators of different proficiency levels and identified the performance gaps.

2.7.1 Training Needs Assessment at Entry Proficiency Level

Key Role 1: Cartographer				
Key Competencies	Description of Proficiency Level	Performance (C/NC)	Likely reason for performance gap	Capacity Development Intervention
1.1.1 Geo-visualization	1.1.1.1 Proficient in utilizing GIS software and applying symbolization for simple map creation.	C	NA	NA

	1.1.1.2 Can understand and follow user requirements for creating maps.	NC	The user requirement for maps is different with different agencies.	In-house Training
	1.1.1.3 Able to use the defined cartographic grammar, symbol designs, typography, use of color, and map design/layout.	C	NA	NA
1.1.2 Web Map Service	1.2.1 Capable of navigating and grasping the principles of web applications.	NC	WMS is usually not a lesson for diploma.	Short term training
	1.2.2 Able to disseminate information as static maps for paper and screen.	C	NA	NA
1.1.3 Mapping Workflow	1.3.1 Demonstrates basic understanding	NC	Not included in the syllabus	Inhouse Training

	of USE, CLIENT, and USER concepts.			
	1.3.2 Able to understand and follow the instructions for the map production and publication.	C	NA	NA
1.1.4 Graphic Design	1.4.1 Able to use graphic designing software for the production and publication of maps and reports.	NC	Not included in the syllabus for diploma	Short term training
Key Role: Geospatial Analyst				
Key Competencies	Description of Proficiency Level	Performance (C/NC)	Likely reason for performance gap	Capacity Development Intervention
Data Acquisition and Post Processing	Has a basic understanding of spatial data acquisition methods and tools.	NC	No field experience	● Field attachment with the senior colleague. ● Courses on Drone Survey and Aerial data acquisition. ● Training on relevant processing software.

	Performs basic post processing of data.	NC	Lack of domain experience	● System introduction
GIS software proficiency, Coordinate systems and projections	Understand the fundamentals and be familiar with the concept of GIS and RS software operation.	C	NA	NA
	Understand the fundamentals of coordinate systems and projections,	C	NA	NA
Spatial data analysis and research assistance	Has a basic Knowledge on Geo-processing techniques and tools including basic spatial queries.	NC	Lack of domain experience	● Field attachment with the senior colleague. ● Training on relevant processing software.
	Demonstrates basic understanding of the task and follows established procedures to	C	NA	NA

	ensure accuracy.			
Key Role: Geospatial Data Manager				
Key Competencies	Description of Proficiency Level	Performance (C/NC)	Likely reason for performance gap	Capacity Development Intervention
Spatial database design, management, and administration	Demonstrates an understanding of basic ICT skills and knowledge to keep a record of spatial data in the database.	Competent	NA	Training and Introduction to Database systems in an organization.
	Have knowledge of Data security and sharing, be able to upload the Data and export spatial data	Not Competent	Lack of domain knowledge and experience	Short term training on data security and sharing.
Metadata management	Knowledge of metadata information and Metadata documentation	Competent	NA	Inhouse introduction on the metadata management skills and provide guidance.
Education, training, and technical support	Basic knowledge of Cartography, GIS Software, remote sensing, Mapping.	Competent	NA	Attachment with co-workers for in-house learning.

	Familiarization of the GIS tools.			

2.7.2 Training Needs Assessment at Intermediate Level

Key Role 1: Cartographer				
Key Competencies	Description of Proficiency Level	Performance (C/NC)	Likely reason for performance gap	Capacity Development Intervention
1.1.1 Geo-visualization	1.1.1.1 Able to use GIS software and design static & dynamic maps.	NC	Dynamic Web Application Technologies	Short term training
	1.1.1.2 Can create maps that meet specific needs, understands design principles and layout guidelines, and can integrate basic analysis results into visualizations effectively.	C	NA	NA
	1.1.1.3 Able to define and standardize the cartographic grammar, symbol designs, typography, use of color, and map design/layout.	NC		

1.1.2 Web Map Service	1.1.2.1 Capable of constructing basic web applications utilizing GIS software like ArcMap, ArcGIS Pro, ArcGIS Enterprise, and QGIS.	NC		Short term training
	1.1.2.2 Able to disseminate information as static (paper and screen) and dynamic (web applications, map applications, and web services).	NC		Short term training
1.1.3 Mapping Workflow	1.1.3.1 Understands USE, CLIENT, and USER concepts well, applies them in mapping workflows with some guidance, and acknowledges the	C	NA	NA

	significance of user needs and system requirements.			
	1.1.3.2 Able to disseminate information as static (paper and screen) and dynamic (web applications, map applications, and web services).	NC		Short term training
1.1.4 Graphic Design	1.1.4.1 Able to use graphic designing software for the production and publication of maps and reports.	NC		Refreshers Course
Key Role: Geospatial Analyst				
Key Competencies	Description of Proficiency Level	Performance (C/NC)	Likely reason for performance gap	Capacity Development Intervention
Data acquisition and post processing	Demonstrates a solid understanding of spatial data	C	NA	NA

	acquisition methods and tools, with the ability to work in diverse field conditions.			
	Can perform fundamental data cleaning tasks, basic data transformation, routine analysis using standard statistical methods and visualizations.	NC		Short Term Training
GIS software proficiency, Coordinate systems and projections	Proficiency in data editing, attribute management and conduct more complex spatial analyses and modeling.	NC		Short Term Training
	Understand map projections and their impact on spatial data representation.	C	NA	NA
Spatial data	Understanding	C	NA	NA

analysis and research assistance	and applying basic spatial analysis techniques and Proficiency in data editing and manipulation within GIS software.			
	Shows proficiency in problem-solving within familiar scenarios and begins to identify areas for improvement in existing processes.	C	NA	NA
Key Role: Geospatial Data Manager				
Key Competencies	Description of Proficiency Level	Performance (C/NC)	Likely reason for performance gap	Capacity Development Intervention
Spatial database design, management, and administration	Have knowledge of Data security and data storage, and be able to upload the Data, and	Not Competent	Lack of experience	Short term training on Introduction to database design.

	export spatial data			
	Have knowledge of data standards, meta data and access control, data sharing platforms.	Competent	Lack of experience	Short term on Introduction on access control of the database.
Metadata management	Data capture of spatial data along with accurate metadata information in the database, review metadata	Competent	NA	NA
Education, training, and technical support	Be able to train on GIS software like QGIS, ArcGIS Pro, and other mapping software. Able to guide within the co-workers.	Competent	NA	NA

2.7.3 Training Needs Assessment at Experienced Proficiency Level

Key Role: Cartographer				
Key Competencies	Description of Proficiency Level	Performanc e (C/NC)	Likely reason for performance gap	Capacity Development Intervention
1.1.1 Geo-visualization	1.1.1.1 Proficient in automating	NC		Short term training

	fundamental mapping tasks using scripting languages within GIS software.			
	1.1.1.2 Exceptional at creating detailed maps as needed, mastering advanced design principles, and seamlessly incorporating complex analysis outcomes for visually appealing results.	C	NA	NA
	1.1.1.3 Able to integrate and work on the symbolization for Web Map Applications.	NC		Short term training projects
1.1.2 Web Map Service	2.1.1 Proficient in comprehending and resolving real-world issues through	NC		Study tour

	the utilization of WMS (Web Map Service).			
	2.1.2 Able to automate the dissemination of information as static (paper and screen) and dynamic (web applications, map applications, and web services).	NC		Short term training
1.1.3 Mapping Workflow	3.1.1 Proficiently applies USE, CLIENT, and USER considerations in mapping workflows, independently analyzes and integrates these factors to improve map production and recognizes the influence of system and environmental factors on map design.	C	NA	NA

	3.1.2 Can effectively describe all the things needed, done, and achieved in different mapping processes and is capable of handling complex aspects independently.	C	NA	NA
1.1.4 Graphic Design	4.1.2 Able to use graphic designing software for the production and publication of maps and reports.	C	NA	NA
Key Role: Geospatial Analyst				
Key Competencies	Description of Proficiency Level	Performance (C/NC)	Likely reason for performance gap	Capacity Development Intervention
Data acquisition and post processing	Possesses an advanced understanding of spatial data acquisition, excelling in both field surveys	NC	No advance knowledge on different mode of data acquisition	• Short-term training

	and technology-driven methodologies.			
	Proficient in addressing complex data quality issues, Proficient in writing custom scripts or code snippets to automate repetitive data processing tasks.	NC		• Short-term training
GIS software proficiency, Coordinate systems and projections	Mastery of a wide range of tools and functionalities and Basic scripting skills for automation (e.g., Python for GIS).	NC	Lack of knowledge and experience	• Training • eLearning • Attachments
	Demonstrate the ability to transform coordinates between different systems. And understand the mathematical transformations involved in coordinate conversions.	C	NA	NA

Spatial data analysis and research assistance	Proficiency in advanced spatial analysis techniques (spatial statistics, network analysis) and Ability to create custom tools and workflows.	C	NA	NA
	Demonstrates a deeper understanding of the task and related processes and applies critical thinking to solve problems, combining established methods with some creativity	C	NA	NA
Key Role: Geospatial Data Manager				
Key Competencies	Description of Proficiency Level	Performance (C/NC)	Likely reason for performance gap	Capacity Development Intervention
Spatial database design, management and administration	Assists in maintaining the records in the Database to the utmost quality with the detailed attribute	NC	Inadequate training on basic IT skills	• Certificate course on basic management of the database and design

	information. Able to query the data like update, delete, extract, etc			
	Assists colleagues in extracting information for dissemination to appropriate divisions and other agencies.	Competent	NA	NA
Metadata management	Creates online advertisement, convinces, and persuades the user	NC	Lack of knowledge on basic marketing skills	• STT on marketing strategies
Education, training, and technical support	Well-versed in GIS software like QGIS, ArcGiS Pro, and other mapping software. can guide within the co-workers, have capacity to train others stakeholders regarding the uses and implementation of GIS mapping software	NC	Lack of knowledge on basic archival activities	Training on relevant mapping GIS software to enhanced data security, storage, and connection.

2.7.4 Training Needs Assessment at Advanced Level

Key Role: Cartographer				
Key Competencies	Description of Proficiency Level	Performance (C/NC)	Likely reason for performance gap	Capacity Development Intervention
1.1.1 Geo-visualization	1.1.1.1 Proficient in exploring new technologies and enhancing existing methodologies and symbolization for improved map quality.	C	NA	NA
	1.1.1.2 Exceptional at creating detailed maps as needed, mastering advanced design principles, and seamlessly incorporating complex analysis outcomes for visually appealing results.	C	NA	NA
	1.1.1.3 Capable of defining cartographic grammar, symbol design, typography, color usage, and overall map design and layout.	C	NA	NA

1.1.2 Web Map Service	1.1.2.1 Capable of exploring new technologies and algorithms to develop Web Map Applications.	NC		SST
	1.1.2.2 Able to automate the dissemination of information as static (paper and screen) and dynamic (web applications, map applications, and web services).	NC		Short term training
1.1.3 Mapping Workflow	1.1.3.1 Proficiently applies USE, CLIENT, and USER considerations in mapping workflows, independently analyzes and integrates these factors to improve map production and recognizes the influence of system and environmental factors on map design.	C	NA	NA
	1.1.3.2 Exhibits exceptional expertise in defining	C	NA	NA

	inputs, actions, and outcomes for mapping procedures, addressing issues, and recognized as an authority in optimizing efficiency and effectiveness.			
1.1.4 Graphic Design	1.1.4.1 Able to use graphic designing software for the production and publication of maps and reports.	C	NA	NA
Key Role: Geospatial Analyst				
Key Competencies	Description of Proficiency Level	Performance (C/NC)	Likely reason for performance gap	Capacity Development Intervention
Data acquisition and post processing	Recognized as an expert in spatial data acquisition, with a deep knowledge of the latest advancements and Advanced skills in processing and interpreting satellite imagery.	Competent	NA	Courses on Drone Survey and Aerial data acquisition.
	Proficient in real-time data processing and	Competent	NA	NA

	streaming analytics, ensuring timely insights for critical decision-making and be creativity in designing innovative solutions for complex data processing challenges			
GIS software proficiency, Coordinate systems and projections	Ability to customize GIS workflows and tools. Advanced scripting and use of model builder for automation.	NC		● Certificate courses for the development ● Study Tour
	Be able to Analyze challenges and solutions related to coordinate system interoperability and Contribute to the development of standards for coordinate system usage.	C	NA	NA
Spatial data analysis and research assistance	Expertise in incorporating remote sensing data into geospatial analyses.	C	NA	NA
	Achieves a high level of accuracy	C	NA	NA

	and precision consistently. Utilizes advanced techniques to minimize errors and anticipates complex challenges and formulates strategic solutions.			
Key Role: Geospatial Data Manager				
Key Competencies	Description of Proficiency Level	Performance (C/NC)	Likely reason for performance gap	Capacity Development Intervention
Spatial database design, management, and administration	Fosters ICT performance and service utilization abilities in monitoring colleagues in database management, data security, and data sharing	NC	Inadequate training on database design and management.	• Study tour. • Short term training
	Monitors and ensures that the co-workers have appropriate knowledge on Data extraction, Data sharing, data security and managements	NC	No proper leadership training	• Leadership training
Metadata management	Implements marketing strategies and	NC	Lack of knowledge on basic	• Training on marketing

	policies and monitors coworkers on documentation modules		marketing skills	
Education, training, and technical support	Well-versed in GIS software like QGIS, ArcGIS Pro, and other mapping software. can guide within the co-workers, have capacity for training regarding the uses and implementation of GIS mapping software	NC	No specific training on a required mapping software and management system	● Online classes ● Self-learning ● Study tour/ Digital Archiving and archiving database management

2.7.5 Short-term Training and Learning Objectives

The framework has highlighted the likely reasons for the gaps and interventions proposed above. To provide a capacity building program, the following are the expected learning objectives. The respective proficiency level officials will be able to achieve the objectives mentioned against each of the training courses.

Entry Proficiency Level			
Sl. #	Training/ Intervention	Methods of Implementation	Learning Objectives
I	Orientation on functions of divisions	Institute and implement a standard in-house orientation to new recruits and recruits through lateral transfer	Familiarize and apply rules & regulations in performing the duties
II	GIS Fundamentals and Map Design	● Formal Training (In-country/ex-country/eLearning) ● Project-based learning	● Understand the basic principles of GIS and its applications.

		and case studies. ● Mentorship and peer collaboration.	● Identify and interpret user requirements for map creation. ● Demonstrate proficiency in using GIS software for map production. ● Apply cartographic principles to design visually appealing and informative maps. ● Create reports and presentations using graphic design software.
III	Spatial Data Acquisition and Processing	● Formal Training (In-country/ex-country/eLearning) ● Project-based learning and case studies. ● Mentorship and peer collaboration.	● Explain various spatial data acquisition methods and tools. ● Demonstrate proficiency in data collection techniques such as GPS, surveys, and remote sensing. ● Perform basic post-processing tasks including cleaning and manipulation of spatial data. ● Apply appropriate techniques for data conversion

			and format compatibility. ● Interpret and analyze spatial data for further processing.
IV	Geo-Processing and Spatial Analysis	● Formal Training (In-country/ex-country/eLearning) ● Project-based learning and case studies. ● Mentorship and peer collaboration.	● Understand the concepts of geo-processing and its significance in GIS. ● Utilize geo-processing tools for tasks such as buffering, overlay analysis, and spatial joins. ● Perform basic spatial queries to extract relevant information from spatial datasets. ● Apply spatial analysis techniques to solve real-world problems. ● Interpret and communicate the results of spatial analysis effectively.
V	Web Mapping and Data Management	● Formal Training (In-country/ex-country/eLearning) ● Project-based learning and case studies. ● Mentorship and peer collaboration.	● Demonstrate proficiency in creating web maps using various platforms. ● Understand the basics of web technologies such as HTML,

			CSS, and JavaScript. ● Utilize appropriate methods for data sharing and collaboration within a team or organization. ● Manage spatial datasets efficiently, including uploading, exporting, and organizing data.
Intermediate Proficiency Level			
Sl. #	Training/ Intervention	Methods of Implementation	Learning Objectives
I	Advanced GIS Software Utilization and Map Design	● Formal Training (In-country/ex-country/eLearning) ● Project-based learning and case studies. ● Mentorship and peer collaboration.	● Utilize advanced features of GIS software such as ArcGIS Pro and QGIS plugins effectively. ● Create dynamic and interactive maps incorporating spatial analysis results. ● Apply advanced cartographic principles to design visually appealing and informative maps. ● Standardize cartographic grammar,

			symbol designs, typography, color usage, and map design/layout. ● Demonstrate proficiency in adhering to cartographic standards and guidelines.
II	Advanced Web Application Development with GIS Integration	● Formal Training (In-country/ex-country/eLearning) ● Project-based learning and case studies. ● Mentorship and peer collaboration.	● Develop interactive web maps and applications using ArcGIS Online, ArcGIS Enterprise, or similar platforms. ● Customize web applications with advanced GIS functionalities like geocoding, routing, and real-time data integration. ● Utilize web services (e.g., REST APIs) to disseminate spatial information effectively. ● Optimize performance and user experience in web applications through efficient coding practices and design optimization.

III	Advanced Data Processing and Analysis	● Formal Training (In-country/ex-country/eLearning) ● Project-based learning and case studies. ● Mentorship and peer collaboration.	● Implement advanced data cleaning techniques to ensure data integrity and accuracy. ● Apply advanced data transformation methods such as spatial interpolation and rasterization. ● Utilize advanced statistical methods for spatial data analysis and interpretation. ● Explore spatial modeling techniques including network analysis and machine learning for solving complex spatial problems.
IV	Advanced Data Management and Security	● Formal Training (In-country/ex-country/eLearning) ● Project-based learning and case studies. ● Mentorship and peer collaboration.	● Implement advanced data editing workflows and best practices for efficient data management. ● Manage attributes effectively, ensuring data consistency and integrity. ● Conduct more

			complex spatial analyses and modeling tasks to derive meaningful insights from spatial data. ● Implement data security protocols and practices to safeguard sensitive spatial data. ● Utilize secure methods for data storage, backup, and sharing, considering data privacy and confidentiality.
Experienced Proficiency Level			
Sl. #	Training/ Intervention	Methods of Implementation	Learning Objectives
I	Automation and Scripting in GIS	● Formal Training (In-country/ex-country/eLearning) ● Project-based learning and case studies. ● Mentorship and peer collaboration.	● Proficiently automate mapping tasks using scripting languages within GIS software. ● Develop advanced scripting skills to address complex data processing challenges. ● Streamline workflows and enhance productivity through

			customized automation solutions. ● Utilize scripting to automate dissemination of spatial information across different platforms.
II	Advanced Web Mapping and Integration	● Formal Training (In-country/ex-country/eLearning) ● Project-based learning and case studies. ● Mentorship and peer collaboration.	● Integrate and customize symbolization for web map applications effectively. ● Comprehend and resolve real-world issues using Web Map Services (WMS). ● Create dynamic and interactive web maps with enhanced user experiences. ● Automate dissemination of spatial information in static and dynamic formats across various platforms.
III	Advanced Spatial Data Acquisition and Quality Assurance	● Formal Training (In-country/ex-country/eLearning) ● Project-based learning and case studies. ● Mentorship and peer collaboration.	● Excel in both field surveys and technology-driven spatial data acquisition methodologies. ● Address complex data quality

			issues through advanced analysis and validation techniques. ● Automate repetitive data processing tasks using custom scripts to ensure data integrity. ● Stay updated with industry trends and best practices in spatial data acquisition.
IV	Database Management and Stakeholder Engagement	● Formal Training (In-country/ex-country/eLearning) ● Project-based learning and case studies. ● Mentorship and peer collaboration.	● Maintain database records with detailed attribute information and perform data queries effectively. ● Ensure data quality and integrity through advanced database management techniques defined in NSDI framework. ● Engage users and stakeholders. ● Mentor and train colleagues and stakeholders on GIS mapping software usage and

			implementation.
Advanced Proficiency Level			
Sl. #	Training/ Intervention	Methods of Implementation	Learning Objectives
I	Advanced Web Map Application Development	● Formal Training (In-country/ex-country) ● Project-based learning and case studies. ● Mentorship and peer collaboration.	● Explore and implement new technologies and algorithms for developing cutting-edge Web Map Applications. ● Develop proficiency in optimizing Web Map Application performance and user experience. ● Automate dissemination of information across various platforms including web applications, map applications, and web services. ● Master techniques for dynamic data integration and visualization.
II	Advanced GIS Workflow Customization and Automation	● Formal Training (In-country/ex-country) ● Project-based learning and case studies. ● Mentorship and peer collaboration.	● Customize GIS workflows and tools to streamline processes and improve efficiency.

			• Master advanced scripting techniques and model builder for automating complex GIS tasks. • Integrate external APIs and services to enhance GIS functionality and interoperability. • Optimize GIS workflows for maximum productivity and resource utilization.

III	Database Management	● Formal Training (In-country/ex-country) ● Project-based learning and case studies. ● Mentorship and peer collaboration.	● Foster ICT performance and service utilization abilities among colleagues in database management, data security, and data sharing. ● Ensure colleagues possess appropriate knowledge of data extraction, sharing, security, and management. ● Monitor and enforce data security protocols and best practices within the organization.
IV	Advanced GIS Software Utilization and Training	● Formal Training (In-country/ex-country) ● Project-based learning and case studies. ● Mentorship and peer collaboration.	● Utilize advanced features of GIS software effectively for various mapping and analysis tasks. ● Guide colleagues in the effective use and implementation of GIS mapping software. ● Develop capacity for training others on GIS

			mapping software usage and implementation. ● Stay updated with the latest advancements in GIS software and technologies.

2.7.6 Proposed Long-term Program (Specialization)

Program
Advance/Diploma in GIS and RS or Geospatial Science
Advance/Diploma in Cartography
Advance/Diploma in Web-GIS & Programming
Advance/Diploma in Geospatial Data Management

3. Implementation of Competency Based Framework

The implementation of training and other intervention must be based on the mandatory program/interventions listed under section under the training needs analysis of this document. The mandatory list of training/intervention includes all the programs against the behavior indicators that are found to be “Not Competent” under the Training Needs Analysis. However, for implementation, it must be prioritized based on the following:

a. Annual prioritization
b. Most critical area of intervention
c. Rationalization of selection of participants
d. Availability of the resource allocation

Implementation must be initiated and spearheaded by the concerned department or parent agency in close coordination and collaboration with the respective HR Division.

4. Recommendations

The following recommendations were proposed:

a. Disseminate the Competency-Based Framework to all Map Production Technicians and create awareness of the importance of key competencies.
b. Implement the Competency-Based Framework concerning behavior indicators Based on an individual's responsibility.
c. Facilitate the acquisition of key competencies as per the CBF.
d. The management consider the training needs assessment positively and recommend staff as per their performance need for training, workshop, etc.
e. The management to prioritize and implement the proposed interventions to strengthen the competency.
f. To review the implementation of the CBF annually.
g. Conduct Training Needs Analysis (TNA) for the Map Production Technicians periodically.
h. Develop and implement structured orientation, coaching, mentoring, and e-learning programs focusing on priority needs to be learned.
i. Use CBF for evaluation of the performance of employees and promotion by incorporating the competencies required for a Map Production Technician.

5. Conclusion

The National Land Commission Secretariat strives towards achieving the vision of providing excellence in land governance services for the nation's well-being. The public needs advances along with technology. Hence it is imperative for the organization to keep abreast with the advancing technologies.

Royal Civil Service Commission's timely intervention by initiating Competency Based Framework for Map Production Technician will not only enhance the service delivery but will also help upskilling the competencies required to fulfill the vision and mission of the agency. The framework has identified three Key Roles, seven Competency Areas, eleven Key Competencies Areas, and fifteen Behavioral Indicators under 3 Proficiency Levels.

The Competency-Based Framework would greatly contribute to enhance and strengthen the capacity and capabilities of Map Production Technicians by providing the required training and professional development interventions as per the gaps identified. It was observed that no training needs assessment was conducted in the past. There have been limited capacity building opportunities due to lack of training institutes within the country as well as due to lack of resources. The framework will also help the supervisors/managers to make informed decisions about talent recruitment, retention, and succession strategies. And identifying the specific behaviors and skills needed for each role will help the organization in budgeting and plan for capacity building of the organization.

6. References

1. CBF for Survey Engineer
2. CBF for Land Registrars