

Perspectives on Organisational Planning for the Sustainability of GNSS CORS and Geospatial Infrastructure

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Asia Pacific Capacity Development Network



UNITED NATIONS
Office for Outer Space Affairs



**Workshop on the Applications of Global Navigation Satellite Systems
Suva, Fiji, 24-28 June 2019**

Presentation Content

The purpose of this presentation is to provide perspectives on –

- Capacity development
- Organisational “planning”
- Establishing "long term" capability

with respect to sustainable GNSS CORS;
geospatial / geodetic Infrastructure or systems;
and related activities.

What is capacity development?

It is about understanding the challenges or obstacles that hinder an individual / organisation / community from accomplishing their objectives

And then developing the necessary knowledge / skills / abilities / competencies / frameworks to achieve them.

What is capacity development?

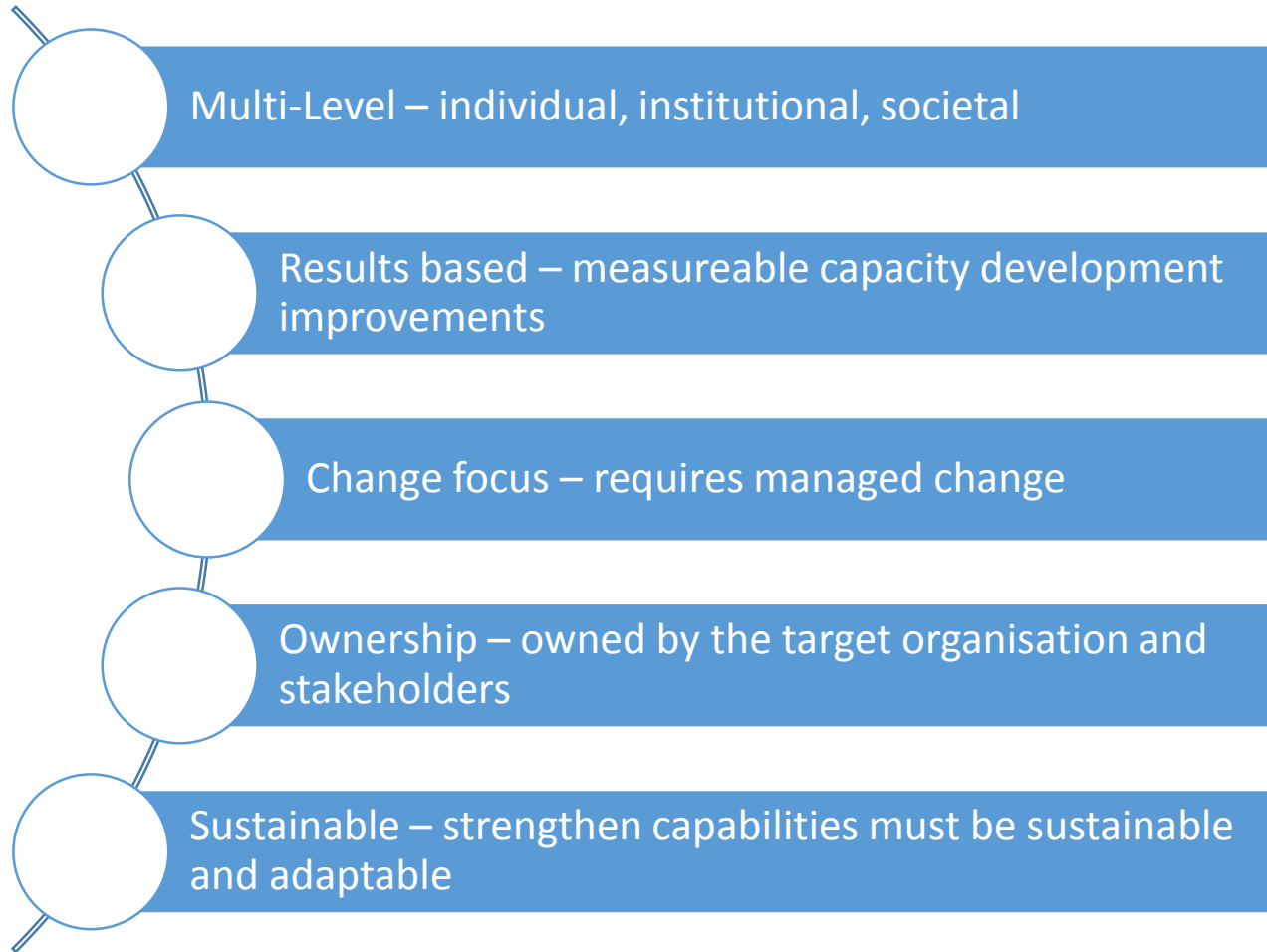
It is also about

The process of learning to adapt to change ...
(or shifting the paradigms of practice)

Who and how and where the decisions are made ...

Being supported by a sustained resource and political
commitment to yield longer term results ...

Fundamental Concepts of Capacity Development



Organisational Sustainable Capacity Development

Organisations own, design, direct, implement and maintain the activity themselves

Organisations achieve this through empowerment, and development or strengthening of its capabilities

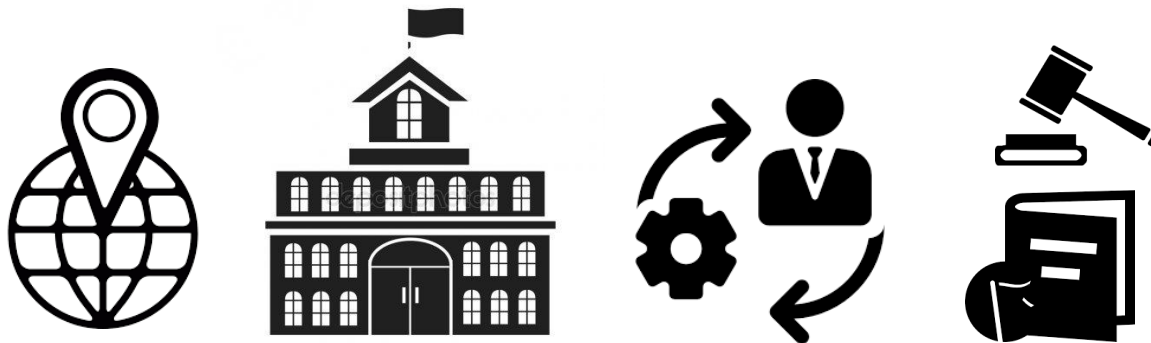
Organisations utilise local resources – people, skills, technologies, institutions

Organisations build these so they are agile, flexible, adaptable to change, inclusive of a diverse community / industry, founded on policies, standards / guidelines; and fit for purpose

***Organisational components that
influence “long term” or “sustainable”
capacity development***

1. Governance and Institutional Arrangements

- Clarity of roles (functionality), responsibilities and internal structure of geodetic / geospatial work units
- Impact - geodetic / geospatial information cycle and data management
- Interaction between agencies in the geodetic / geospatial information industry (national, regional, international)
- Community and / or social engagement and responsibility
- Legislation, regulations, policies, standards, code of practices, guidelines, MoUs, agreements, licences (can include also social “norms / expectations”)
- Financial and resourcing framework
- Configuration of accountability and delegation
- Performance monitoring and evaluation systems
- Human resource management and employment conditions



2. Leadership (Management)

- Provision of clear vision and direction
- Influencing, inspiring and motivating others to achieve organisational and personal objectives
- Supervising and implementing change and risk strategies
- Ensuring organisational capacity and personal development
- Employing different management styles for a diverse range of audiences
- Recognising, understanding and engaging with “traditional” or “customary” stakeholders and related “cultural” communities
- Accommodating and working with political authorities or public / community groups



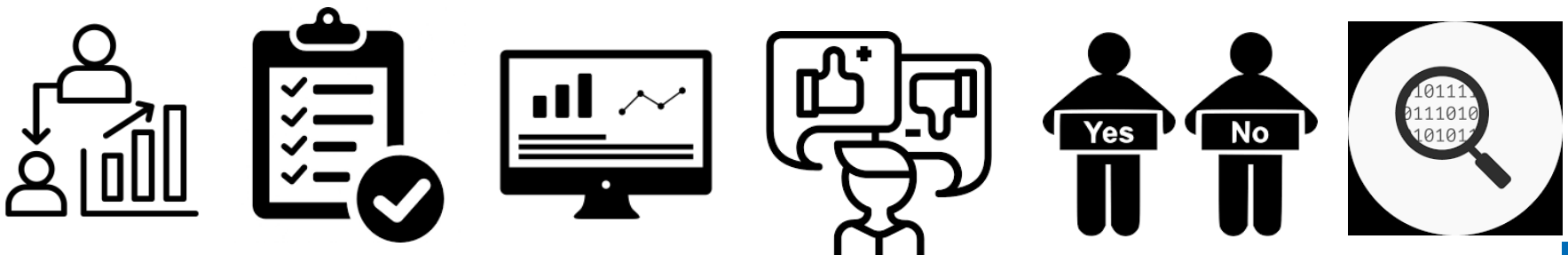
3. Knowledge

- Discovering the capabilities (existing and future) of the people – their knowledge, experiences, skills, qualifications, competencies
- Includes technical, administrative, people management capabilities
- Recognising and understanding existing capability of the individual will influence / determine capability development
- Acknowledging the organisation’s environment (policies etc) and the external environment (educational community / social system) will also impact the scope of capacity development
- Understanding the role of professional, international, scientific, academic institutions / networks and the leveraging opportunities that they can offer
- Recognising alternative means or non-traditional methods of learning
- Creating a “local” knowledge base

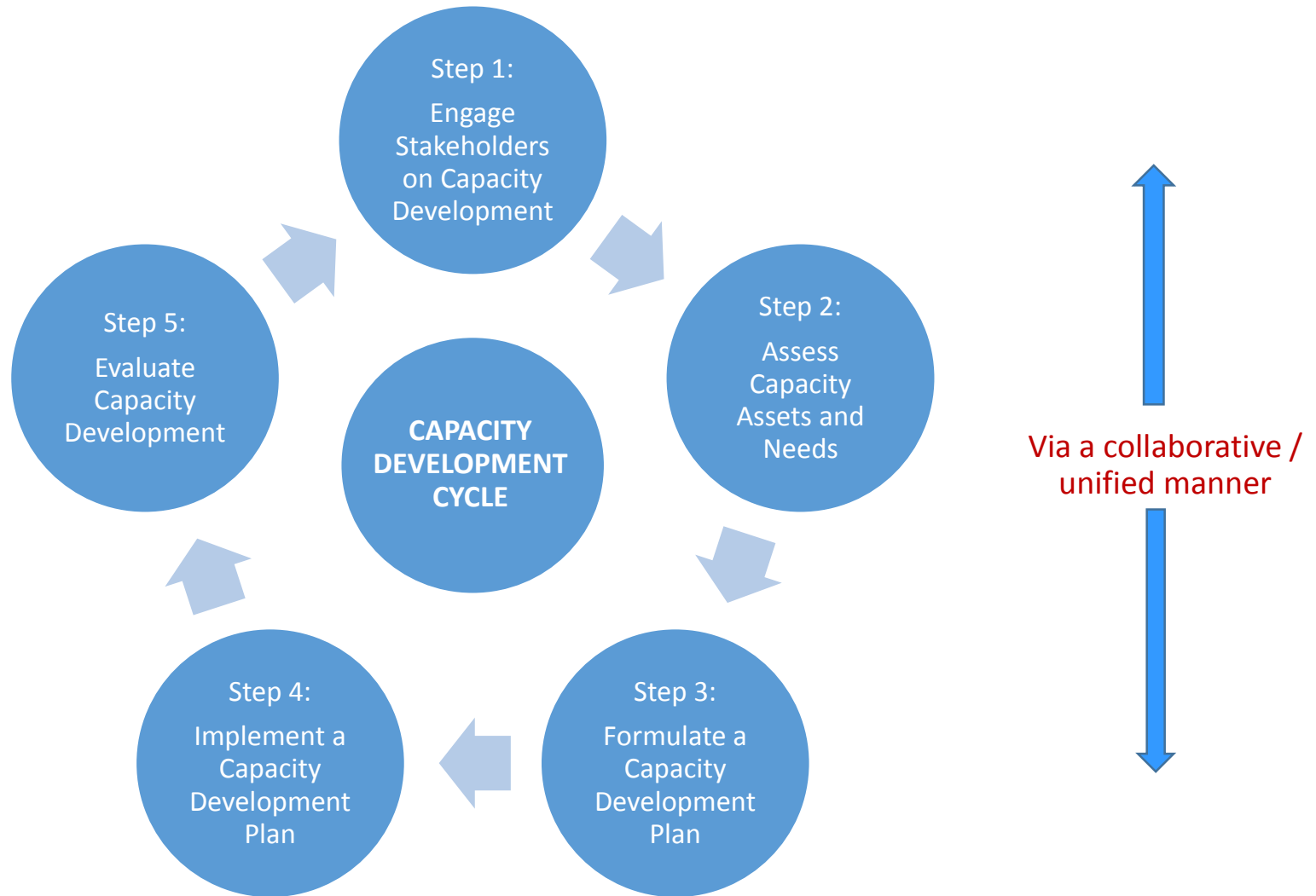


4. Accountability

- Obligation of the organisation to account for its' activities
- Assists organisations to manage the deliver of their obligations – vision, mission, objectives, goals, outcomes
- Through systems that enable analysis, evaluation, monitoring, measurement and reporting of “inputs / outputs”, performance indicators.
- Facilities interaction, engagement and feedback between the organisation, its stakeholders, users, service providers and the community / public
- Provides legitimacy to decision making, and improves transparency
- Supports ethical organisational and individual behaviour (reduces the influence of conflicting interests, corruption etc)
- Augments an organisations responsiveness to change
- Helps the management of self-regulating environment



5. Capacity Development Program



Step 1. Engage Stakeholders on Capacity Development

- Have conversations, create opportunities for dialogue, tell each stories, ask questions and listen – why, what and how?
- Discover the shared benefits, the value, the opportunities, strengths, weakness, threats
- Engender ownership, investment and commitment
- Make the engagement on relevant local, national and regional matters and priorities
- Use consultation / communication methods that are familiar to your organisation or environment and are inclusive and attract diverse views.
- Establish **accountability** - that is who will do what, who will ensure that it gets done, and what will the consequences be if it doesn't?
Accountability should flow both upward and downward through clearly stated goals and responsibilities.



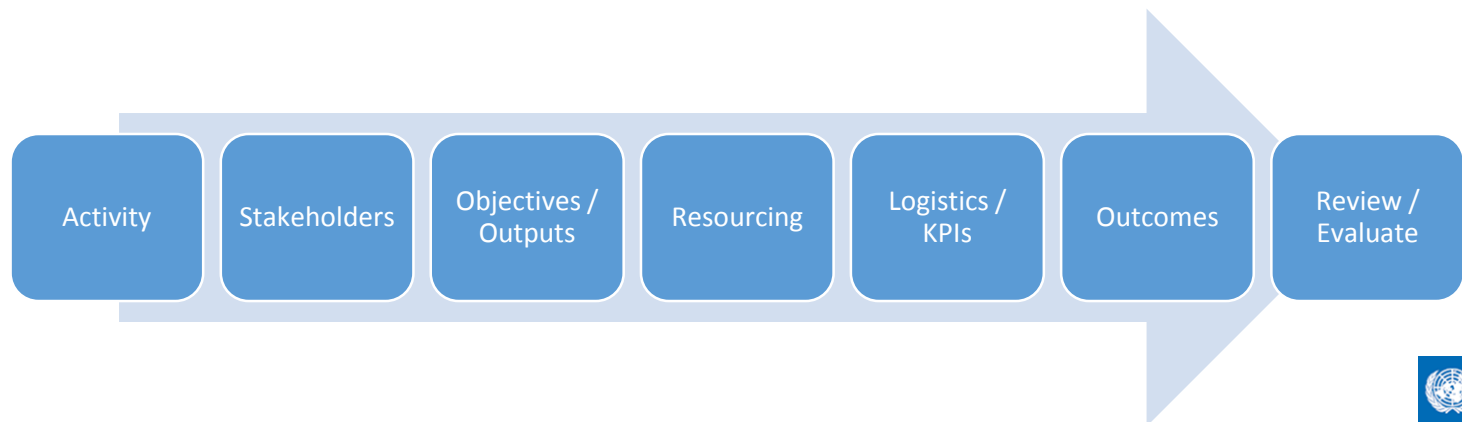
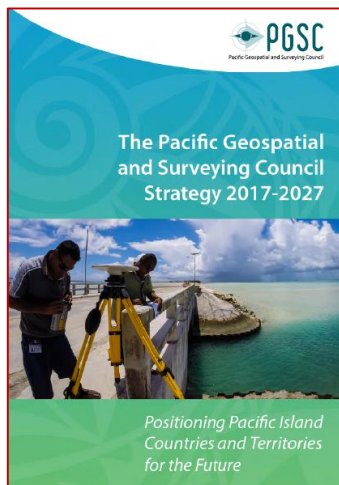
Step 2. Assess Capacity Assets and Needs

- Methodology to analyse existing capacity and future capabilities will depend on the environment and culture of the organisation
- Identifying, assessing and prioritising capacity assets and needs should be done collaboratively and in a unified manner
- The analysis should provide capacity development action that is achievable, and have measureable outcomes
- Capacity outcomes should connect both organisational and personal development objectives
- “Baseline capabilities” must be established so progress can be measured
- If possible be strategically linked or aligned to national objectives



Step 3. Formulate a Capacity Development Plan

- The plan should build on existing capabilities and use capacity assets / strengths to fill identified gaps
- Capacity development plan should not be an “after thought”
- Plans will be more effective if they address multiple issues and levels; align with existing strategies, plans, initiatives; manage change
- To gain immediate and ongoing support, it is prudent to formulate capacity development activities or initiatives that will provide quick wins or demonstrate effectiveness
- A realistic plan – incl. resourcing, budget and time schedule, along with performance indicators that relate to the organisation’s and stakeholder objectives ; output / outcome ; SMART
- Prioritise the list of initiatives, and alternatives or contingencies



Source : Capacity Development - UNDP

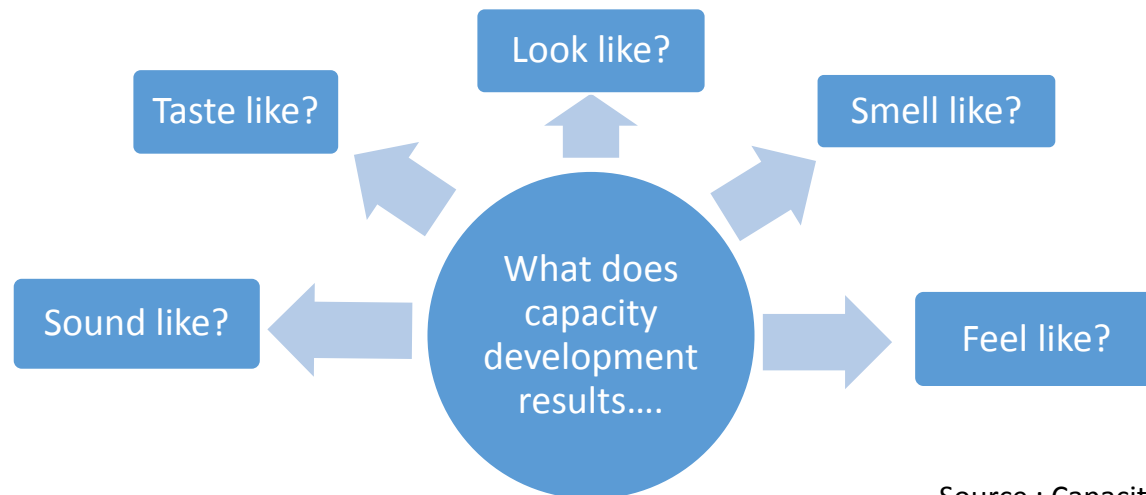
Step 4. Implement a Capacity Development Plan

- Challenging part of the capacity development cycle
- Highly recommended that capacity development actions need to be incorporated or be part of the organisations existing process, systems and structure; be delivered the local way
- Implementation must be monitored and measured to enable it to be assessed and evaluated
- Do not re-invent the wheel, instead leverage or integrate efforts from other organisations (or nations)
- Must have contingency or exit plans for each initiative – primarily to accommodate organisational changes

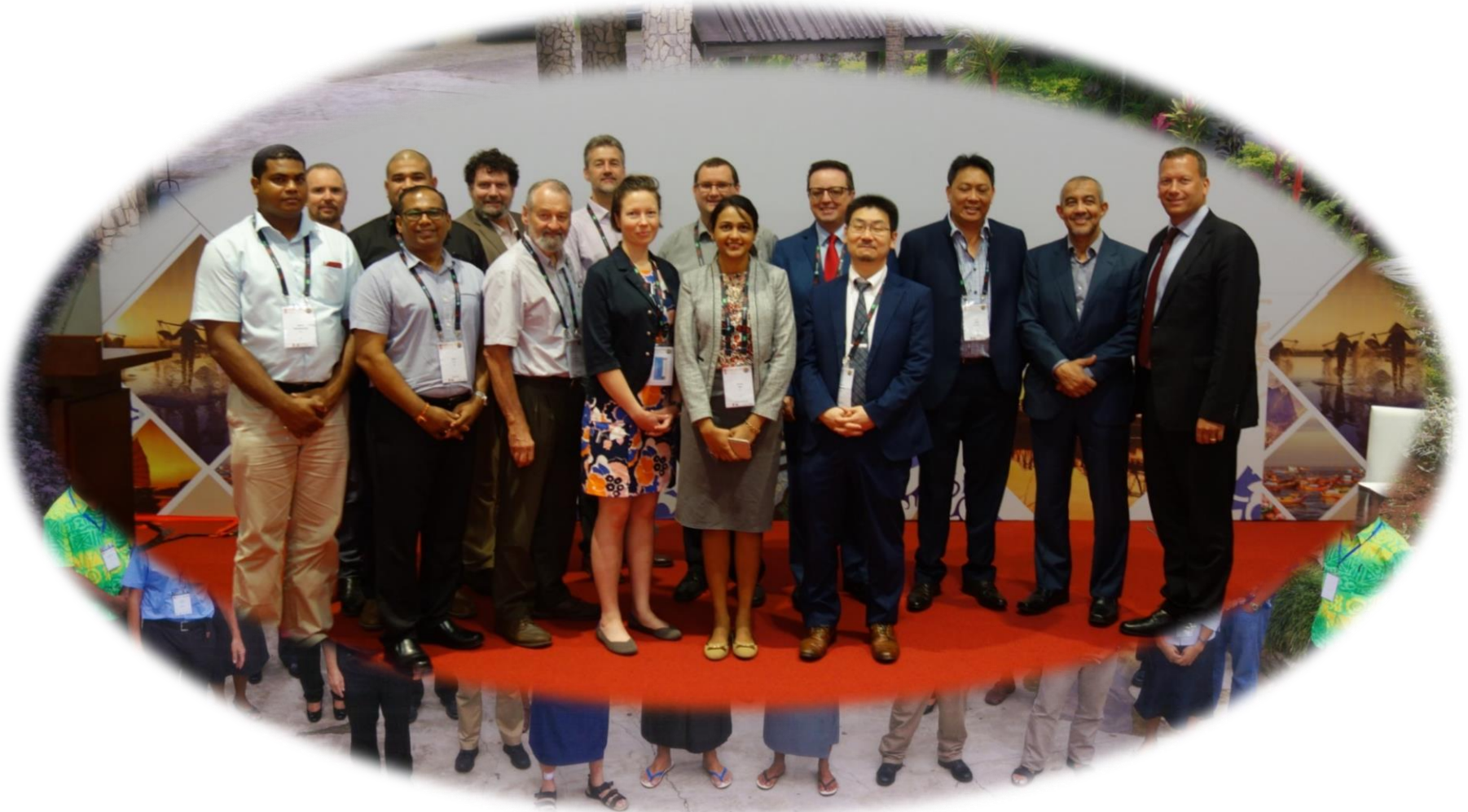


Step 5. Evaluate Capacity Development

- Establish mechanisms to capture feedback; lessons learnt
- Success, progress and results must be reflected in better performance
- That is, improved efficiency and effectiveness OR more outcome focussed than output
- Need a framework that assesses relevance; demonstrates improvement and impact
- Has the improved performance of the organisation lead to the objectives / vision being achieved?
- Have the changes in an organisation's institutional, leadership, knowledge, and accountability capabilities, improved the organisations performance, stability and adaptability?



***FIG Asia Pacific Capacity Development
Network perspectives on ...***



Environmental Scan / SWOT Analysis

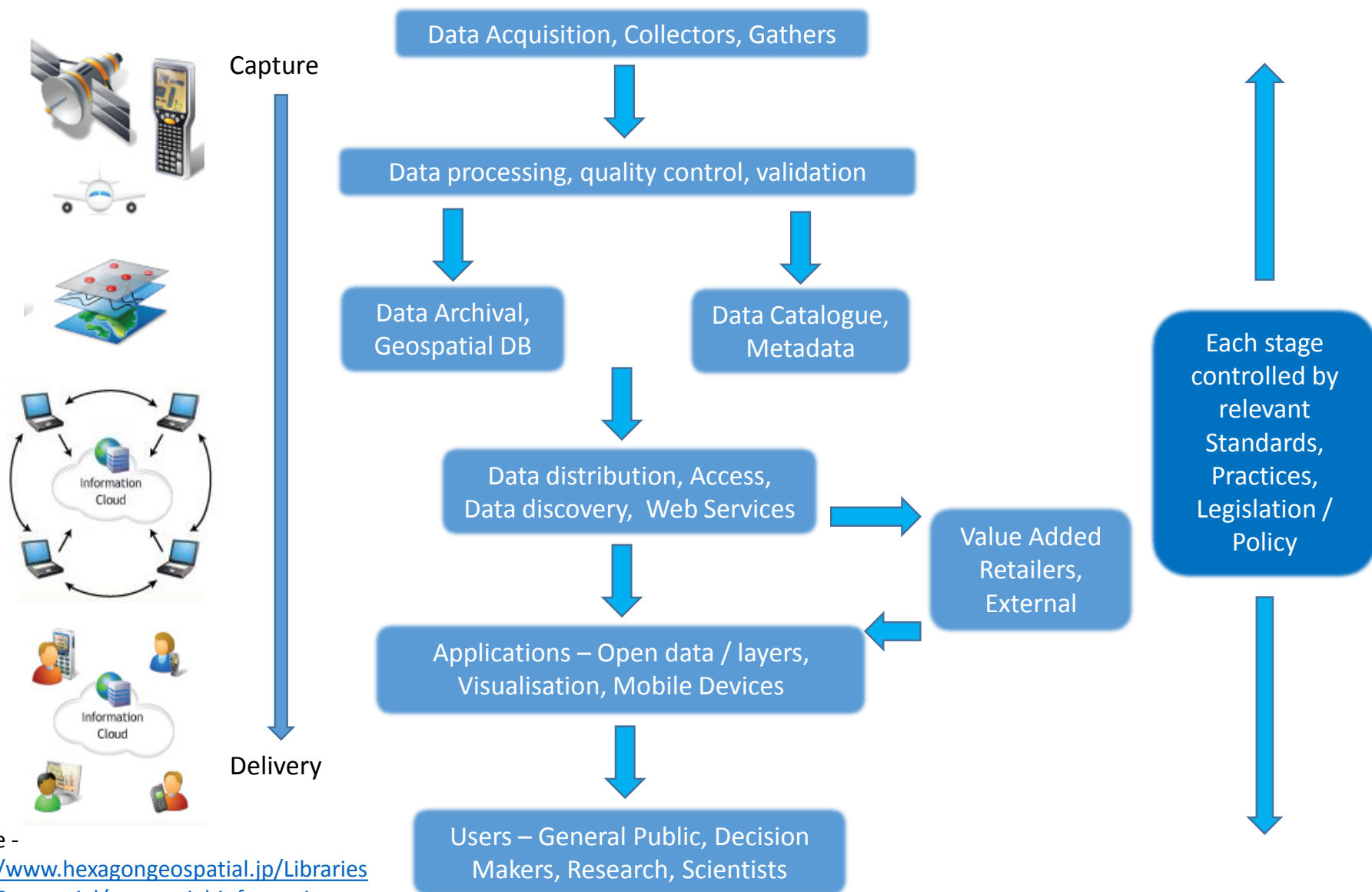
Geodetic and Geospatial industry need to understand the technical, social or community, organisational and individual environment !

WHY do we need to develop our capacity? What will be its purpose? What are *scientific, social, economic, political drivers* that will support capacity development? Consider not just local, but also national and regional.

WHOSE capacities need to be developed? Which groups or individuals need to be empowered? Examine not only within your agency, but externally and beyond your traditional stakeholders or consumers.

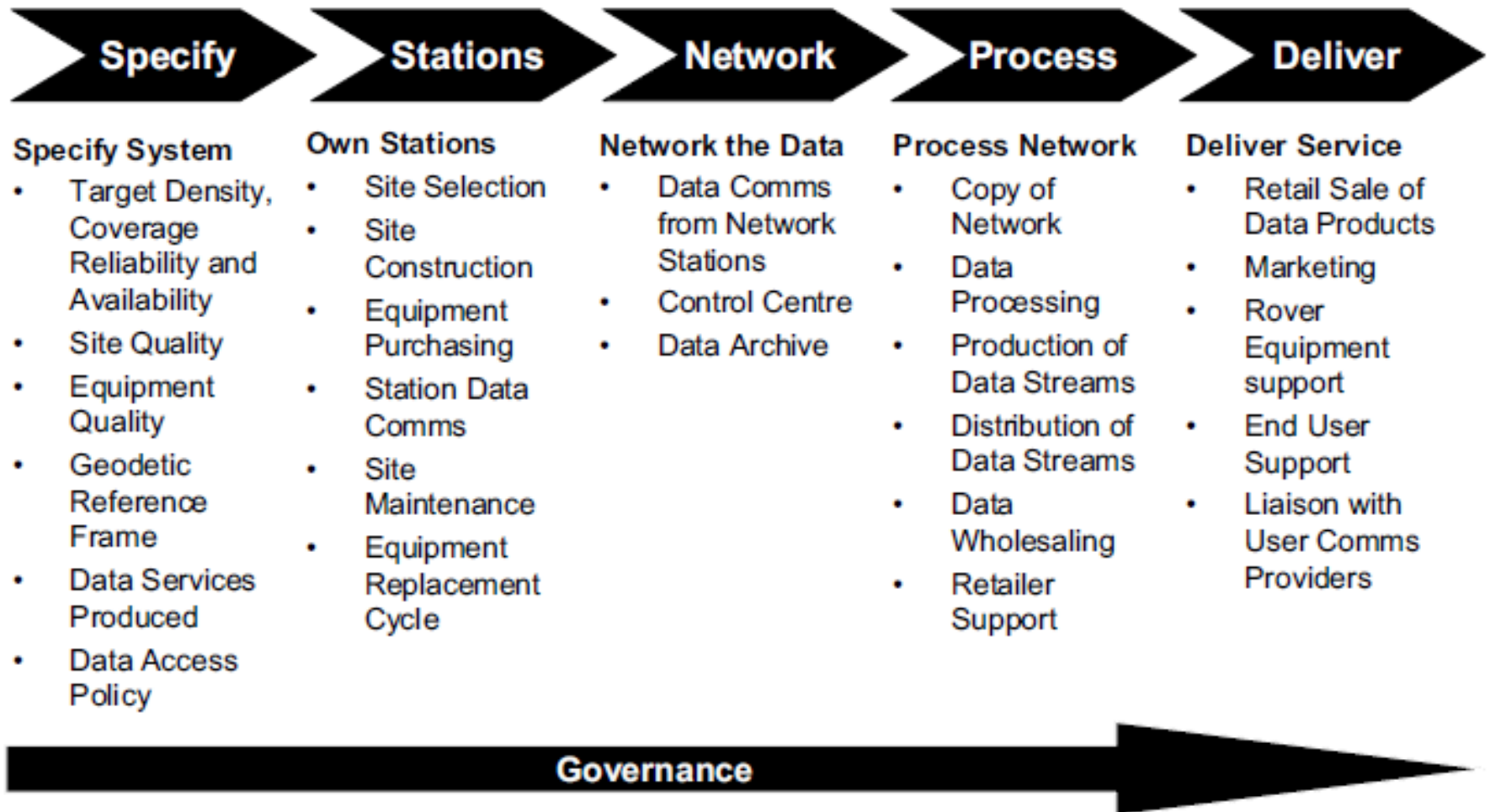
WHAT KINDS of capacities need to be developed to achieve the broader development objectives? Technical & Non-technical? Investigate - core competencies, specialised skills and who is best to deliver such activities.

Agency role in the Geospatial Information Cycle?



Source - <http://www.hexagongeospatial.jp/Libraries/WhyGeospatial/geospatial-information-lifecycle.jpg>

Role in managing GNSS CORS infrastructure?



Impact / Interaction with Foundation Geospatial Datasets ?



Source - <http://www.anzlic.gov.au/fsdf-themes-datasets>

- Common asset of location information ***to facilitate informed decision making*** that affects people's safety, prosperity, and environment
- Comprising of the ***best available, most current, authoritative*** source of foundation geospatial data which is ***standardised and quality*** controlled

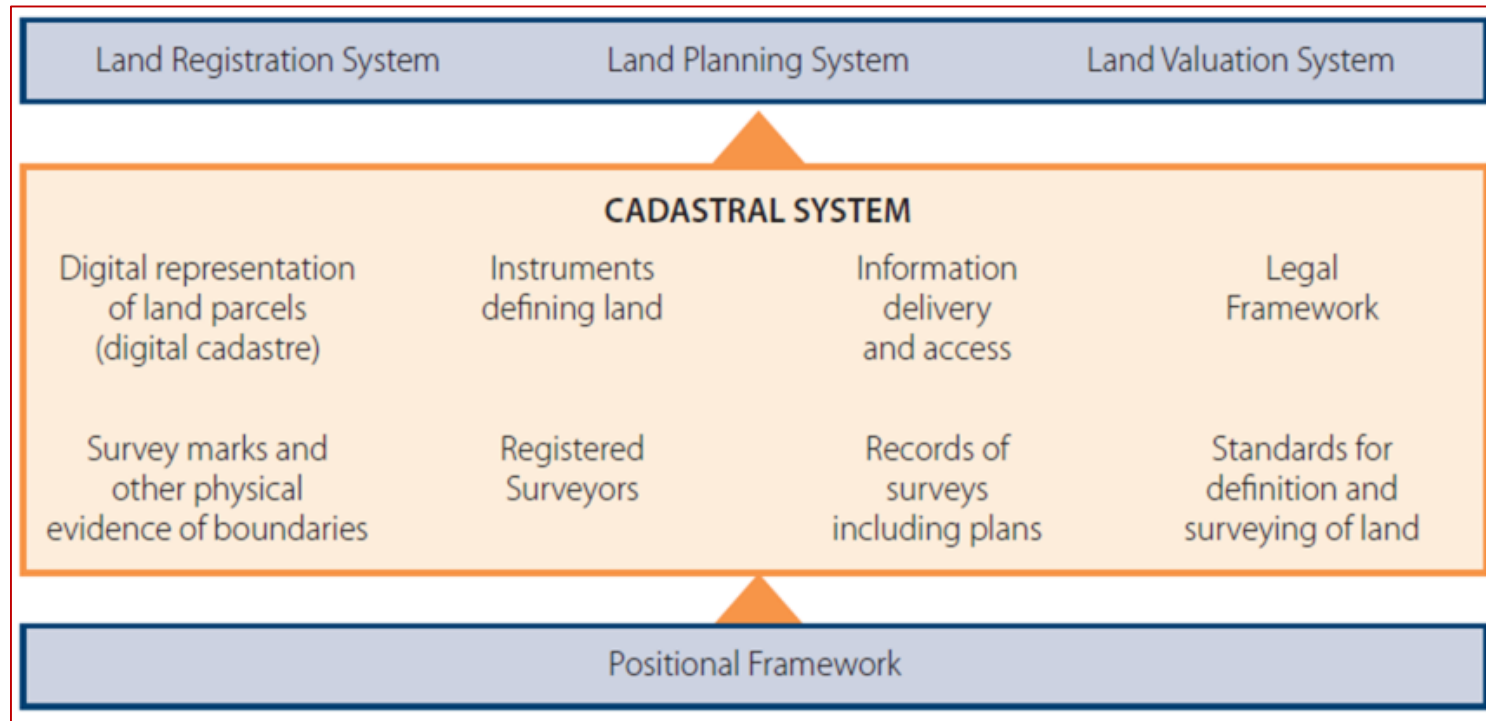
Underpinned by geodesy

Influence Land / Marine Administration, Management, and Governance ?

- Administration a *system* that provides *infrastructure* for
 - *securing land / marine tenure* (rights, restrictions, responsibilities),
 - *determining valuation* and taxation of land / water,
 - *land / marine use planning* and
 - *development of built environment* - utilities, construction
- Management *processes for the use and development of land / marine resources*
- Governance framework of *legislation, policies, processes and institutions by which land / marine , property and natural resources are managed*

To support modernisation of or improve geospatial readiness of agencies, the synergies of geodesy with the land administration, management and governance profession should be identified and leveraged.

Modern Land Administration System ?

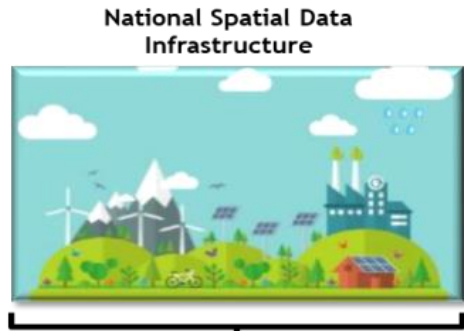


Source - <https://www.icsm.gov.au/sites/default/files/Cadastre2034.pdf>

- ***Defines and records*** the location and extent of property rights, restrictions and responsibilities - 3 dimensions plus a temporal (time) component
- ***Geometric representation*** of land and real property boundaries (digital visualisation)

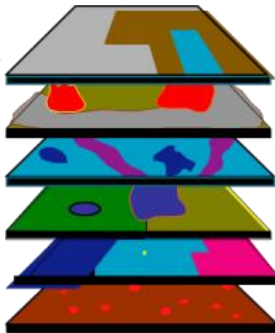
Must be easily, uniquely and accurately identified in a common reference system or geodetic datum or geospatial reference system

Connected to Global Geodetic Reference Frame / SDGs ?

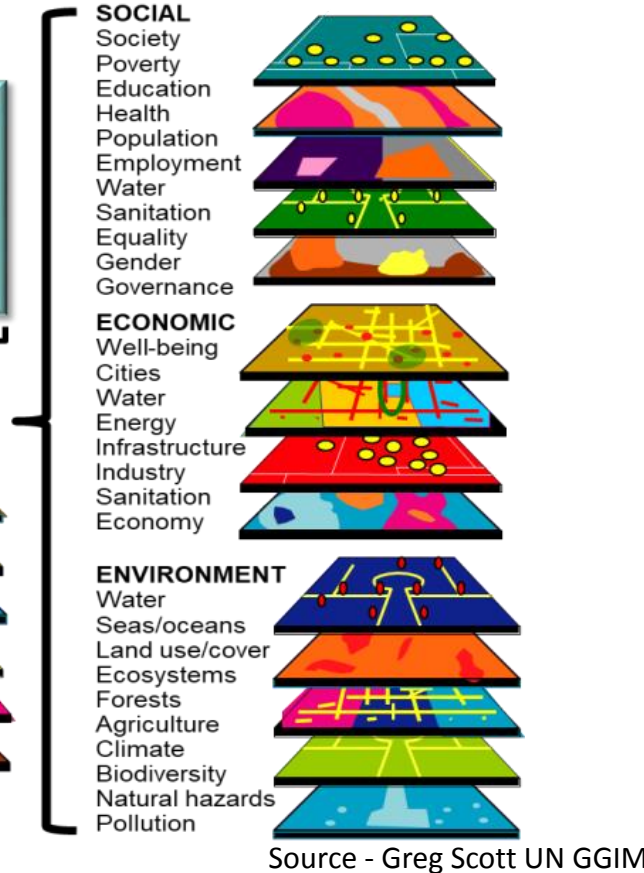
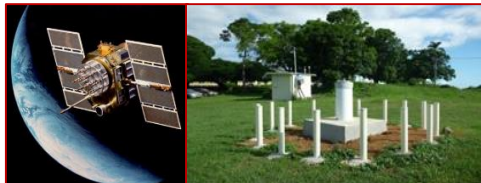


High quality, timely and reliable data

Elevation
Water/Ocean
Land use/cover
Transport
Cadastral
Population
Infrastructure
Settlements
Admin. Bdys.
Imagery
Geology/soils
Observations
Place Names
Addressing

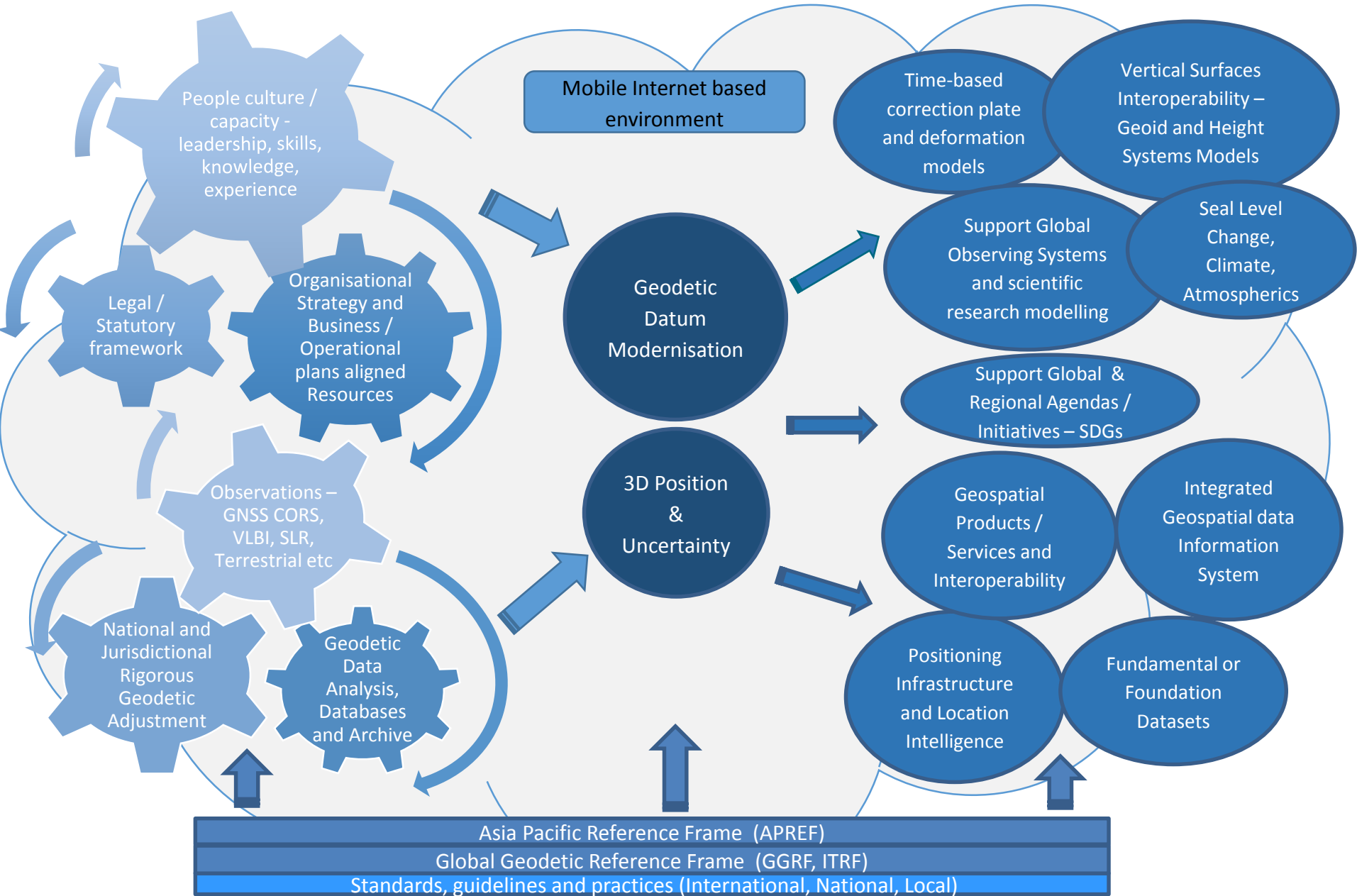


Geodetic & NPI



- The **WHOLE** to the **PART**
- Data is **underpinned** by the **geodetic framework** or **positioning infrastructure**
- To facilitate IT, computers, systems, software and applications to communicate - **interoperability**
- To facilitate extraction and amalgamation of spatial data - **unification**
- To facilitate **measuring and monitoring of SDGs**
- At all levels – **agency** (local), **national**, **regional**, and **global**.

Modernised Geodetic Framework ?



Implementation Plan for a Modernised Geodetic Framework (1)

- Establish more GNSS CORS and derive ITRF / APREF positional information via an on-line GNSS processing service such as AusPos
- Select an ITRF / APREF epoch for their geodetic datum
- Establish additional primary geodetic marks at salient locations and re-observe existing primary geodetic marks using classic static GNSS measurements
- Develop an operational geodetic network least squares adjustment dataset consisting of GNSS CORS as constraint stations and the network of primary geodetic marks.
- Create transformation parameters from this primary dataset and over time create velocity models for this primary network
- Observe (or re-observe) secondary geodetic network via classic static GNSS observations or high accuracy real time kinematic solutions.
- Create a secondary geodetic network dataset; adjust the secondary network via least squares and create transformation parameters.

Implementation Plan for a Modernised Geodetic Framework (2)

- Connect as many local vertical datum (i.e. MSL / tide gauge based) marks as possible via classic static GNSS observations to derive geodetic datum heights (ellipsoidal) and their relationship.
- Perform any additional terrestrial levelling to connect local vertical marks
- Derive a geoid model and use a global gravity model for the zero order term
- Observe salient marks in the tertiary geodetic network (i.e. cadastre) via classic static GNSS observations or high accuracy real time kinematic solutions.
- Create a tertiary geodetic network dataset; adjust the tertiary network via least squares and create transformation parameters.
- Propagate new geodetic datum through other geospatial or geo-referenced datasets / systems via transformation parameters or a grid interpolation file method.

Implementation Plan for a Modernised Geodetic Framework (3)

- Develop a maintenance program based on the above to monitor and upgrade geodetic datum over time.
- Develop a geodetic project to manage earth dynamics for tectonic and seismic activity
- Develop a geospatial geodetic database to allow custodians to manage and maintain data; users and stakeholders to access the information; and to facilitate integration and interoperability with other datasets

Should this be done by each country?

Alternatively, can it be done collectively?

Role of PGSC, Pacific Community, other?

CORE Geodetic Competencies / Skillsets ?

Level	Competency Requirements	Training provided by	
1	<p>Basic understanding of:</p> <ul style="list-style-type: none"> GNSS Reference frames, including geoid models, vertical and horizontal datums 	<ul style="list-style-type: none"> Educational institutions – universities and polytechnic institutes Government mapping agency Private companies 	Countries that might have one CORs and maintain a traditional geodetic network of reference marks – e.g. small Pacific Island Nations?
2	<p>The above plus knowledge of:</p> <ul style="list-style-type: none"> Constructing, building and running a small CORs network GNSS processing using standard software - e.g. TBC (Trimble), Compass Solution (ComNav), LGO – Infinity (Leica),.... Least squares processing and provision of datum access Geoids models, precision, determinations and basic implementation Implementation of a vertical datum including use of geoid models 	<ul style="list-style-type: none"> Educational institutions – universities and polytechs UN-GGIM Geodesy Capacity Group FIG Government mapping agency Private companies 	Countries with small CORs network and those who adopt global Reference frames for their nation reference frames – e.g. Fiji?
3	<p>The above plus high knowledge of:</p> <ul style="list-style-type: none"> Implementing and running large CORs networks High end GNSS processing and datum access Geoid model computation and implementation into a vertical datums Monitoring earth dynamics and including in datum realization Geodetic database management 	<ul style="list-style-type: none"> Specialized courses – e.g. geoid school UN-GGIM Geodesy Capacity Group IAG and FIG Government mapping agency Private companies 	Countries with a more extensive CORS and developing their own specialized national and vertical datum – e.g. New Zealand and Sweden?
4	<p>The above plus expert knowledge of:</p> <ul style="list-style-type: none"> Reference frame determination and computation High end GNSS analysis and processing SLR including analysis and processing VLBI including analysis and processing Gravity collection, processing and geoid determination Analysis centre – combining various geodetic techniques to determine reference frame parameters Use of other potential geodetic techniques – e.g. 	<ul style="list-style-type: none"> IAG Specialist training courses run by NASA/JPL – e.g. on VLBI or SLR Private companies Specialized software training courses – e.g. Bernese 	Countries engaged in Global Reference frame determination and Geodesy Science - e.g. US, Australia and Germany?

Soft Capabilities / Competencies for the Future

Our profession and leaders of organisations need to have skills to -

- Prepare for ***continuous change***; transform our attitude towards change, ***be progressive in their thinking, be agile, be less risk adverse***
- Collect, process, deliver, reliable, accurate, interoperable and “24/7” ***geospatial information to decision makers*** in real time via a combination of “***disruptive technologies*”, *crowd sourcing techniques, and web services***
- Convey ***professional advice and services*** to facilitate design, risk assessment, investment analysis, asset management and resource deployment.
- ***Innovate in multi-disciplinary teams*** to effectively manage diminishing resources, increased data volumes; and resolve legal data matters such as privacy, custodianship, sharing, liability etc.

Soft Capabilities / Competencies for the Future

Our profession and leaders of organisations need to have skills to -

- Actively ***lead, negotiate, influence, and permeate collaboration*** amongst a diverse team of survey and land professionals
- Understand the need to build frameworks to balance commercial influences, the consumption of resources and the environment
- ***Advocate and communicate relevance*** to influence leaders, decision makers, politicians; and attract a ***diverse group of new professionals***
- ***Form and administer strategic plans*** with an outcome / output focus; and qualitative and quantitative monitoring / evaluation frameworks.
- Create an environment or community that is ***self-reliant, self-determinate, diverse, and has gender equity***
- Implement relevant ***standards and practice***; deliver ***legislative reform; develop policies***

Legislation and Policy

- Legislative reform lags behind technology / challenges - it needs to be implemented in parallel with **“Geodetic Modernisation”** plans
- Legislative reform needs to be future proof - 4 to 5 years ahead?
- Legislate the power or delegation to delineate in an ACT ... BUT “dynamic features” of geodetic datum and co-ordinates in Regulations and Codes of Practice with outcome based foci
- Develop legislation to be less prescriptive - supports innovation and facilitates flexibility / agility over time, accommodates change
- Ensure legislative changes or implementation consider institutional arrangements and resourcing



Legislation and Policy

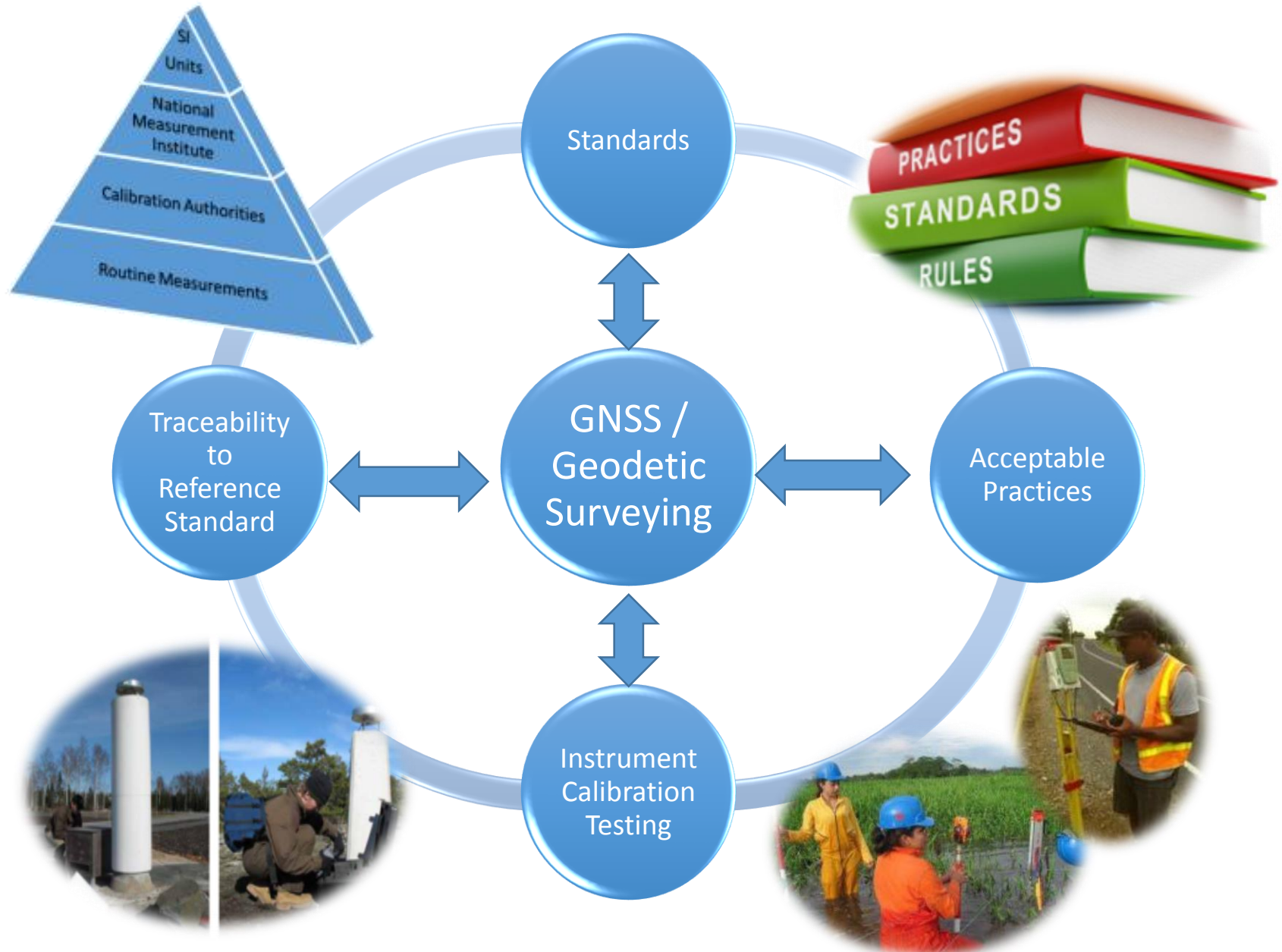
Agency or whole of government policies on-

- Geospatial / Geodetic data sharing - open, closed, licensed?
- National Spatial Geospatial Reference System and Datum
- Fundamental datasets and SDGs

Challenges wrt legislative reform

- Monitoring, ensuring compliance and enforcement of legislation
- As evidence in legal proceedings
- National Security & Defence
- Privacy
- Freedom of information
- Intellectual property
- Indemnity and Liability
- Communication – Spectrum Management
- Land Use Planning, Tenure and Building Regulations

Standards & Practices - GNSS / Geodetic Surveying



Standards and Acceptable Practices for GNSS CORS and Survey Control

- Discover what exists, what is relevant and what are the benefits
- Involvement in “Geospatial and Surveying” standards and practices community – internationally, regionally, nationally and locally
- Ensure you have traceability / connections to international / regional (and national / local if they exist) standards and practices AND its impact or role in achieving the SDGs
- Need to establish and agree on what is important for the region and what you want to achieve – fit for purpose
- Consult and collaborate to reach consensus
- Ensure there is flexibility and agility so that quick change is possible - outcome focus standards and practices

Standards and Acceptable Practices for PICTs GNSS CORS and Survey Control ?

Exist?

PICTs -
STANDARDS
Network

Other
Committees

Committee of Geodetic
Experts



Standard



BEST
PRACTICES

Guidelines

Development
Partners

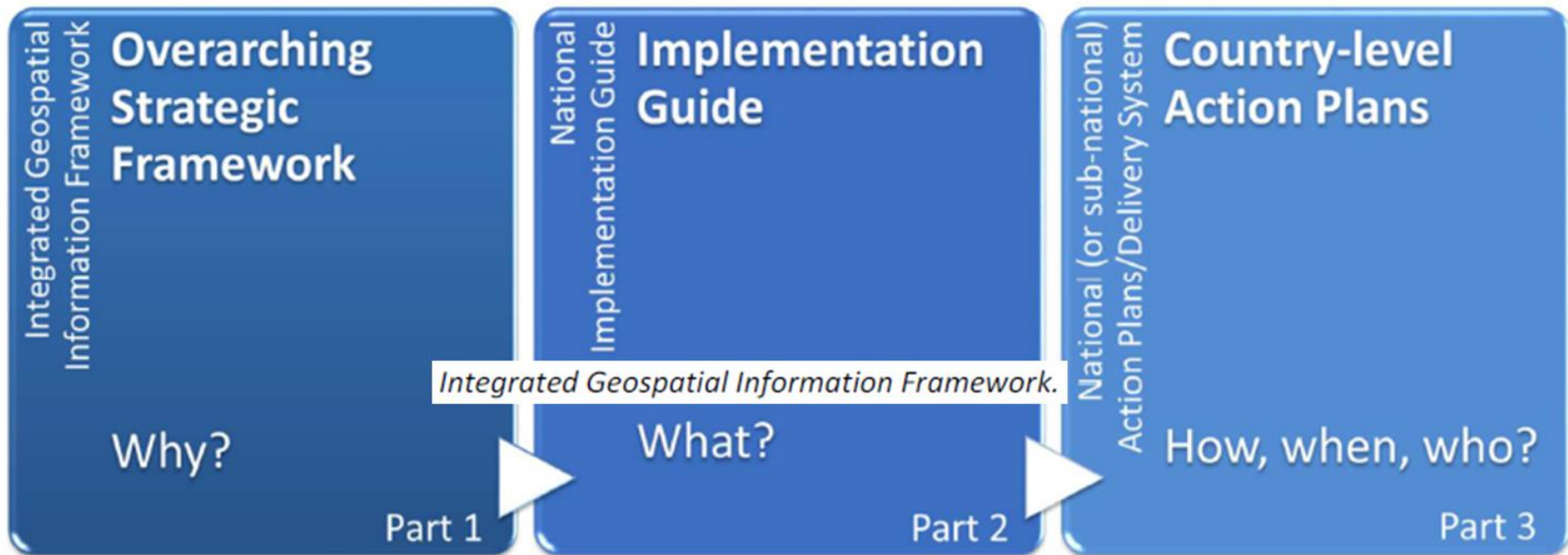


Delivery of Capacity Development

- Collaborate to form alliances with “like minded agencies”, and
 - Professional / Scientific organisations - PGSC, FIG, IAG, LINZ, Geoscience Australia, NGS, SSSI, SSNZ, RICS
 - Academic / Educational institutions (secondary / tertiary) – USP, University of Fiji, UNSW, University Otago
 - International agencies - UN GGIM, UN ICG, UN SCoG – ETCB, World Bank
- Evaluate the status of geodetic capability, and determine immediate needs, future core capabilities, educational and training requirements, institutional curriculum, mutual recognition of qualifications
- Promote and create an awareness of the geodetic profession through an effective technology-based marketing campaign
- Developed mechanisms to access and exchange information and experience wrt GNSS / geodetic technical developments, data management, operations, applications
- Create opportunities for professional development, mentoring, sponsorship
- Provision of “advice” through workshops, forums, meetings, seminars

Capacity Development Strategy , Framework, Implementation

- Plans that reflect your organisations culture.
- Plans that that convey clear purpose with measurable outcomes, resourcing needs, and capture political will.



- Plans that are inspirational but realistic, achievable, focused on agency / national / regional challenges and flexible to accommodate a changing industry
- Leverage UN initiatives as mandates for policy development

Summary FIG AP CDN Perspectives

To develop GNSS CORS capability organisations and agencies need to consider -

- Analysing their ***role and responsibilities*** in geospatial information
- Collaborating with other ***disciplines outside geospatial / geodesy***
- Formulating a capacity building strategy, framework and implementation plans that are linked to the ***needs / priorities / objectives*** of the nation or broader community i.e Climate Change / Sea Level Rise / Disaster Management
- Advocating that intelligent ***real time geospatial information and systems*** for decision making across many sectors

Summary FIG AP CDN Perspectives

To develop GNSS CORS capability organisations and agencies need to consider -

- Identifying **core competencies** for geodetic surveying
- Investigating who can provide the required **professional or capacity development**
- Examining **mutual recognition of professional qualifications OR accreditation OR sharing skills**
- **Sustainable solutions** that enhance **self-reliance and development**
- Utilising and engaging with the PGSC , USP and Pacific Community – local stakeholders
- Formalising **collaboration** with FIG AP CDN, other FIG Commissions & Networks, UN GGIM AP, UN ETCB, UN OOSA ICG, academic / educational institutions etc



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Strategic Collaboration is the Key !



Good Will and Volunteerism is NOT Sustainable - we need to

***Formalise collaboration / co-operation - Shared objectives and expectations ;
Defined roles and responsibilities ; Measurable benefits and value ;
Shared commitment***

Pacific Skills Summit – Innovation and Skills for a Sustainable Blue Pacific

FIJI SUN | TUESDAY, JUNE 25, 2019 | FIJISUN.COM.FJ

Summit to Inspire and Strengthen Pacific Skills Pool

VIKASH PRASAD and MARAIA VULA SU VA "I understand there are more than 30 thinkers, futurists, leaders



"We hope that the Summit will push forward this critical Pacific – led agenda to ensure the link between skills development receives the priority it needs and deserves - for the benefit of the people of Blue Pacific" – Baron Divavesi Waqa

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The
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launched at the 49th Pacific Islands Forum in Nauru last September. "Today, I am delighted to once more be in the company of fellow advocates and champions for skills and sustainable development," Mr Waqa said. "We all aspire to a region that is inclusive, productive and sustainable. We know that there is much valuable work being done in the region on determining and sup-

"All of this lends itself to driving and supporting a wider regional agenda, espoused by leaders for a safe, prosperous healthy sustainable region. "This agenda places importance on collective and coherent action. "We hope that the Summit will push forward this critical Pacific-led agenda to ensure the link between skills development and sustainable development receives the priority it needs and deserves – for the benefit of the people of our

From Left : Kaye Schofield, Chair, Australia Republic of Nauru Baron Divavesi Waqa Chanc

economic growth while leaving one behind. The region, he noted needs a flexible and inclusive vehicle to explore and find new ways to address skills challenges. The theme for the Pacific Sk

KEYNOTE ADDRESS AT THE SUMMIT WILL FOCUS ON ACTION:

- Action at the regional level to support national efforts for skills development;
- Action at the regional level to support labour market integration and the mobility of Pacific people;
- Actions to strengthen regional collaboration between governments, business and civil society;
- Actions to strengthen regional collaboration between national skills development institutions;
- And to determine who will pay for these actions – how can costs be shared by governments, businesses and individuals, all of whom stand to benefit from stronger skills systems?

Summary FIG AP CDN Perspectives

Moving forward the FIG AP CDN recommend **more capacity development** for geospatial and surveying professionals and **decision makers** wrt –

- Understanding and determining the **value and importance** of geospatial and geodetic infrastructure and systems
- Forming **capacity development plan(s)** for geospatial professionals / geodesists / surveyors – national / regional?
- Developing **strategic and operational plans** for the organisation based on IGIF and aligned with national / regional objectives
- **Modernising** legislation, policy, standards & practices and guidelines
- Preparing proposals and **business cases** for national geospatial or geodetic or capacity development initiatives and resourcing (or specific projects)
- **Technical matters** - geospatial and geodetic infrastructure, systems and operations
- Building a framework and mechanisms to **share our knowledges and experiences** – “a body of knowledge”

TAKEAWAY MESSAGE - Does your organisation have the capabilities to

- Engage with stakeholders?***
- Assess a situation and define a vision?***
- Formulate policies and strategies?***
- Budget, manage, implement?***
- Evaluate?***



Vinaka !

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KEY DATES



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GLOBAL SPEAKERS

