Perspectives on
Capacity Development & Organisational Planning
for a
Modernised Geodetic Framework

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UN-GGIM-AP
REGIONAL COMMITTEE OF UNITED NATIONS GLOBAL GEOSPATIAL INFORMATION MANAGEMENT FOR ASIA & THE PACIFIC

WG 1 - Geodetic Reference Frame "Positioning and Datum Modernisation Forum"
8th Plenary Meeting of UN-GGIM-AP Canberra - Australia, 3 November 2019

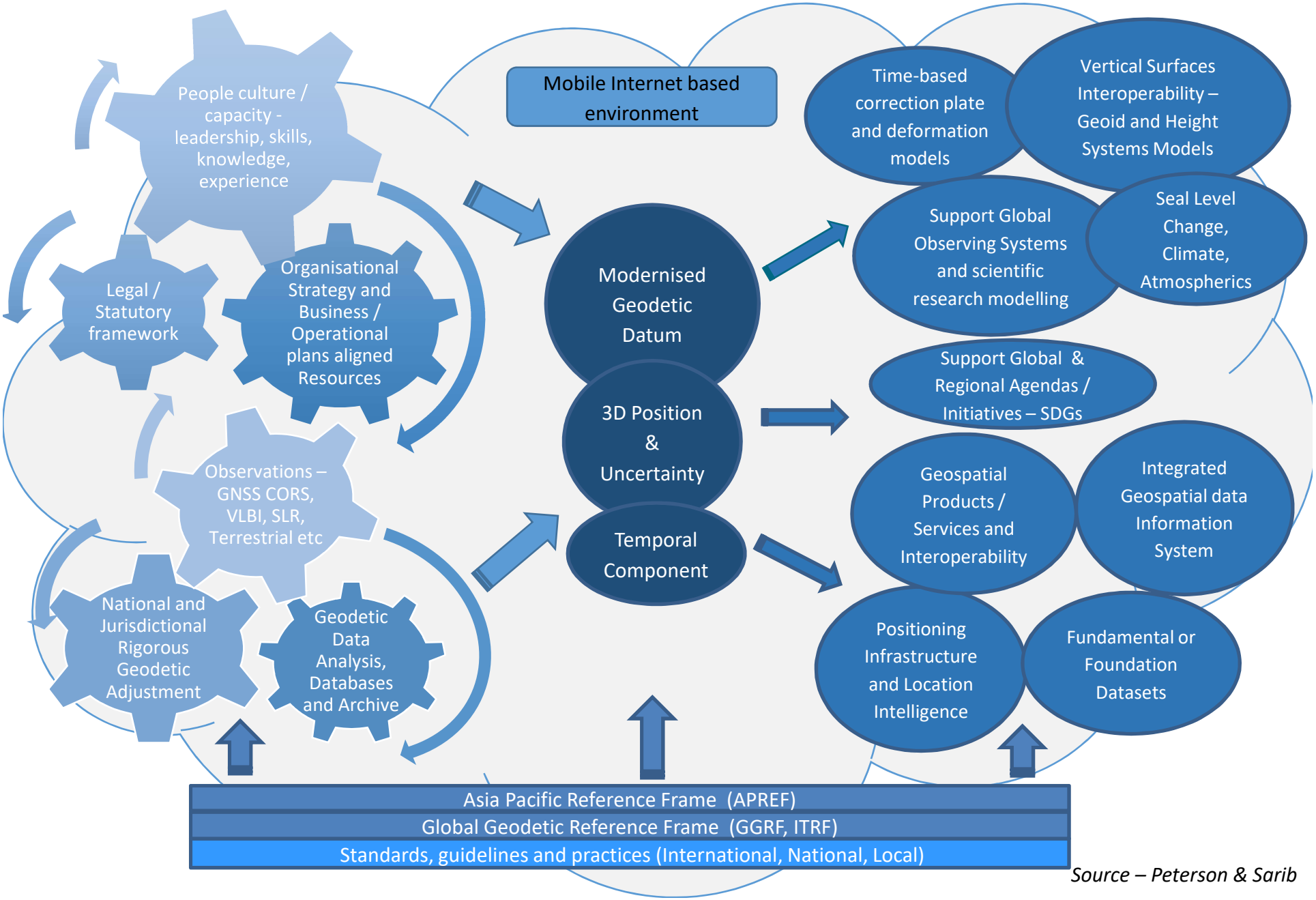
Presentation Content

The purpose of this presentation is to provide perspectives on –

- ***Modernised Geodetic Framework***
- ***Capacity development***
- ***Organisational “planning”***
- ***Establishing "long term" capability***

with respect to Geodetic Infrastructure or Systems; and related activities.

Modernised Geodetic Framework ?



Source – Peterson & Sarib

ATRF

Australian Terrestrial Reference Frame

7 cm/yr

Australian Plate Motion Model

GDA2020

Geocentric Datum of Australia 2020

σ = 1-8 cm

Australian Quasigeoid Model

AVWS

Australian Vertical Working Surface

Δ 1.8 m

Transformation parameters / grids

σ = 6-13 cm

AUSGeoid2020

AHD

Australian Height Datum

GDA94

Geocentric Datum of Australia 1994

σ = ?

AUSGeoid09

Standards

Infrastructure

Legal framework

Software

Technical Manuals

Source - ICSM PCG / Brown

The Australian Geospatial Reference System

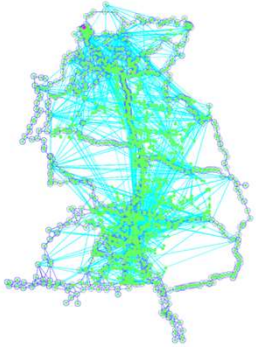
The Australian Geospatial Reference System is the collection of:

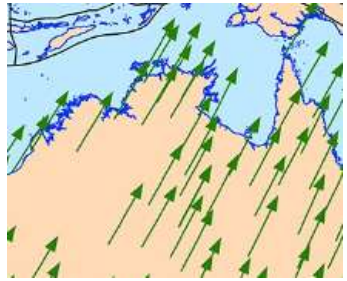
- **datums** (e.g. Geocentric Datum of Australia 2020, Australian Height Datum), **reference frames** (e.g. Australian Terrestrial Reference Frame) and **working surfaces** (e.g. Australian Vertical Working Surface) used to define latitude, longitude, height, orientation and gravity throughout Australia;
- **infrastructure**, including a national network of Global Navigation Satellite System Continuously Operating Reference Stations and survey marks to provide an authoritative and accurate network in support of positioning applications;
- **models** describing dynamic, geophysical processes that affect spatial measurements; and
- **standards** to ensure positioning information is Findable, Accessible, Interoperable and Reusable (e.g. ISO / OGC / GeodesyML).

Source - ICSM PCG

Implementation Plan for a Modernised Geodetic Framework (1)

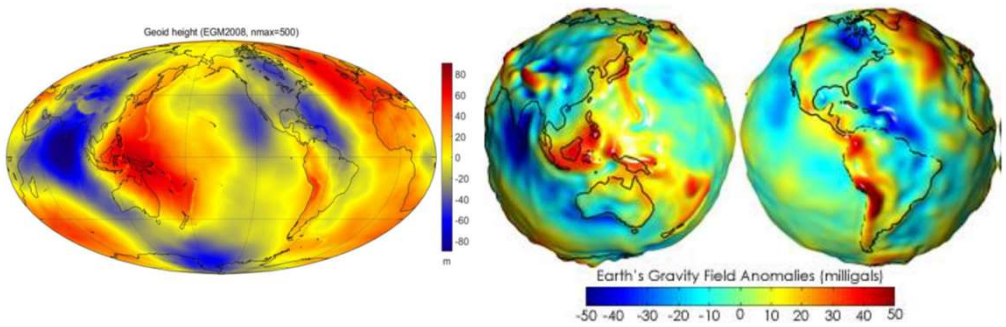
- **Establish more GNSS CORS** and derive ITRF / APREF positional information via an on-line GNSS processing service such as AusPos
- Select an ITRF / **APREF epoch** for their geodetic datum
- **Establish / Observe additional primary geodetic marks** at salient locations and **re-observe existing primary 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





Implementation Plan for a Modernised Geodetic Framework (2)

- **Observe (or re-observe) secondary geodetic network** via class 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**.
- **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



Implementation Plan for a Modernised Geodetic Framework (3)

- **Observe salient marks in the tertiary geodetic network** (i.e. cadastre) via class 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.
- 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

Implementation Plan for a Modernised Geodetic Framework (4)

- Develop a **maintenance and resource 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
- Continue to **advocate the benefits and applications** of geodesy and positioning

Should modernisation be done by each country?

Alternatively, can it be done collectively?

What are impediments to achieving modernisation?

CORE Geodetic Competencies / Skillsets ?

Level	Competency Requirements	Training provided by	
1	Basic understanding of: • GNSS • Reference frames, including geoid models, vertical and horizontal datums	• 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	The above plus knowledge of:	• Educational institutions – universities	Countries with small CORs network and those
	• 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. DORIS and InSAR	e.g. Bernese	

What base level of knowledge should be a prerequisite?

Are educational institutions providing appropriate curriculum?

Who can provide the necessary training of the CORE competencies?

How can we recognise qualifications through the region?

Source – UN SCoG - Education, Training and Capacity Building

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***
- **Advocate and communicate** to leaders, decision makers, politicians the importance of "24/7" ***geospatial information*** 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
- 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***

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 …

Source : Allan Kaplan

Fundamental Concepts of Capacity Development

Source : Capacity Development - UNDP

Organisational Sustainable Capacity Development

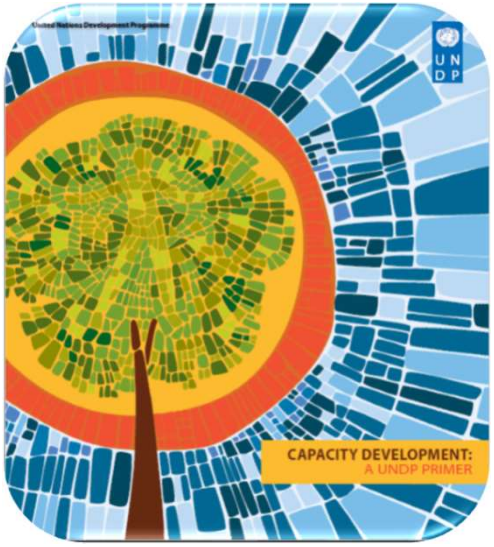
Organisations own, design, direct, implement and maintain the activity themselves

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

Source : Capacity Development - UNDP



Organisational components that influence “sustainable” Capacity Development

Source : Capacity Development - UNDP

1. Institutional (Governance) Arrangements

- Legislation, regulations, policies, standards, code of practices, guidelines, MoUs, agreements, licences (can include also social “norms / expectations”)
- Frameworks or Systems - Financial, Resourcing, Accountability / Delegation, Performance Monitoring / Evaluation, Human Resource Management and Employment Conditions
- Clarity of structure, roles and responsibilities within the organisation; in geodetic / geospatial information cycle and data management; interaction with stakeholders in the “user and supply chain”
- Engagement with community; understanding expectations and responsibility

Source : Capacity Development - UNDP

2. Leadership (Management)

Provision of **clear vision and direction; and integrity**

Influencing, inspiring and motivating others to achieve organisational and personal objectives

Employing different management styles for a diverse range of audiences

Recognising, understanding and engaging with "traditional" or "customary" stakeholders and related "cultural" communities

Supervising and **implementing change** and risk strategies ; supporting **champions; development of plans**

Ensuring organisational capacity and personal development

Accommodating and working with political authorities or public / community groups; building partnerships / networks

Source : Capacity Development - UNDP

3. Knowledge

Discovering the capabilities (existing and future) of the people – their knowledge, experiences, skills, qualifications, competencies

Includes technical, administrative, management (in particular people)

Recognising and understanding existing capability of the individual will influence / determine capability development

Acknowledging the environments such as the political, educational community / social) 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

Source : Capacity Development - UNDP

4. Accountability

Obligation to account for its' activities

Assists 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 with stakeholders, users, service providers and the community / public

Provides legitimacy to decision making, and improves transparency

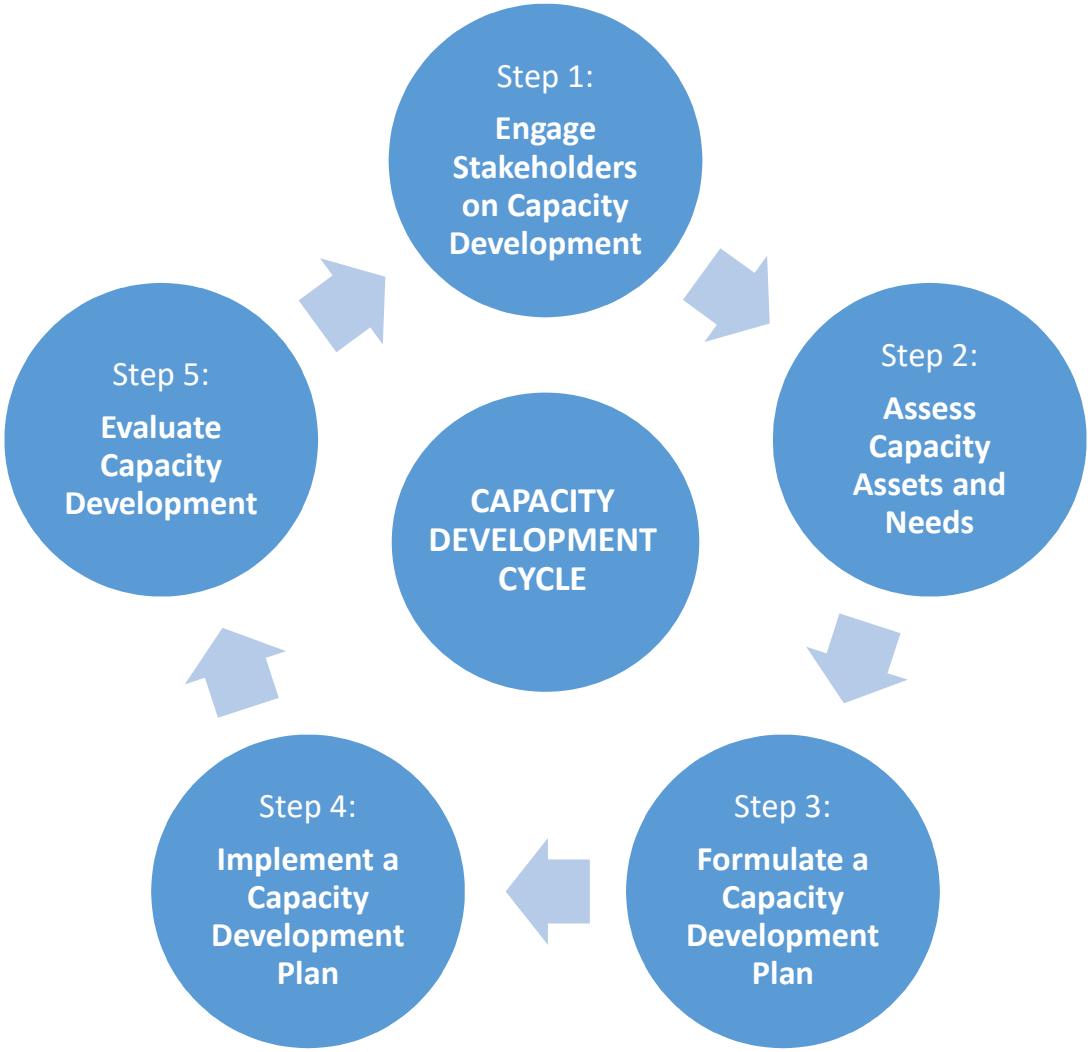
Supports ethical organisational and individual behaviour (reduces the influence of conflicting interests, corruption etc.) …..provision of ***Integrity***

Augments an organisations responsiveness to change

Helps the management of self-regulating environment

Source : Capacity Development - UNDP

5. Capacity Development Program



Via a collaborative / unified manner

Source : Capacity Development - UNDP

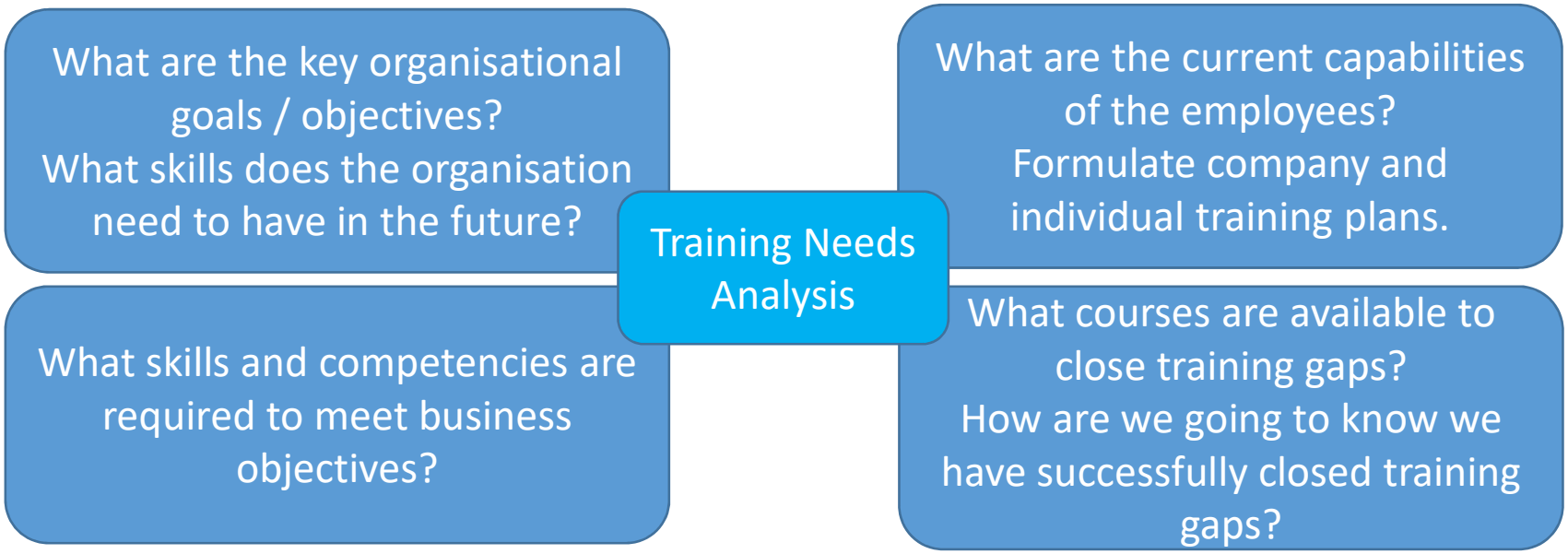
Step 1. Engage Stakeholders on Capacity Development

- 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.

Source : Capacity Development - UNDP

Step 2. Assess Capacity Assets and Needs

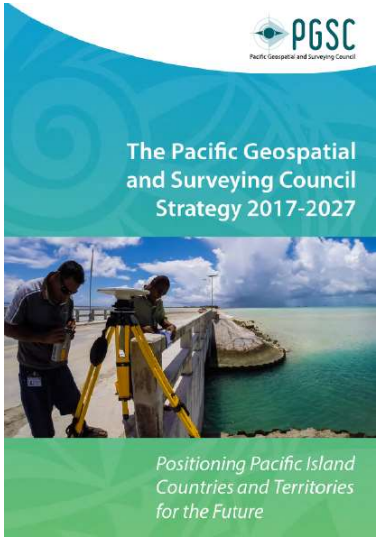
- Methodology to analyse existing capacity and future capabilities will depend on the environment and culture of the organisation
- Identifying, **assessing and prioritising capacity assets and needs** should be done collaboratively and in a unified manner
- The analysis should provide **capacity development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

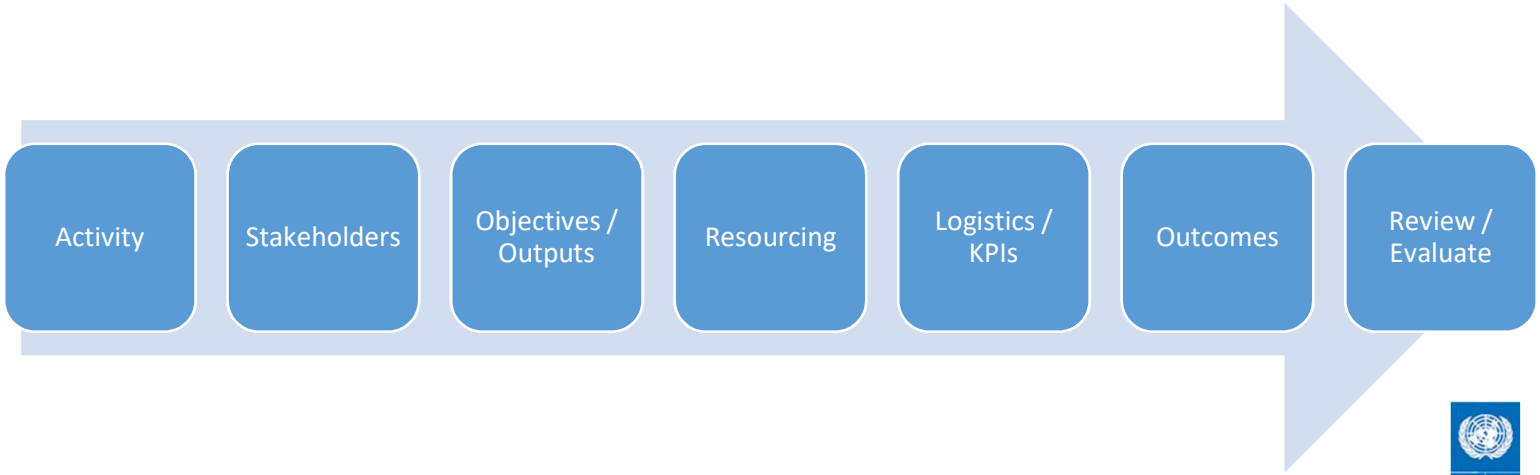


Source : Capacity Development - UNDP

Step 3. Formulate a Capacity Development Plan

- The plan should **build on existing capabilities** and **use capacity assets / strengths** to fill identified gaps
- Capcity 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** - **S**pecific, **M**easurable, **A**chievable, **R**ealistic, and **T**imely
- Prioritise the list of initiatives, and alternatives or contingencies





Source : Capacity Development - UNDP

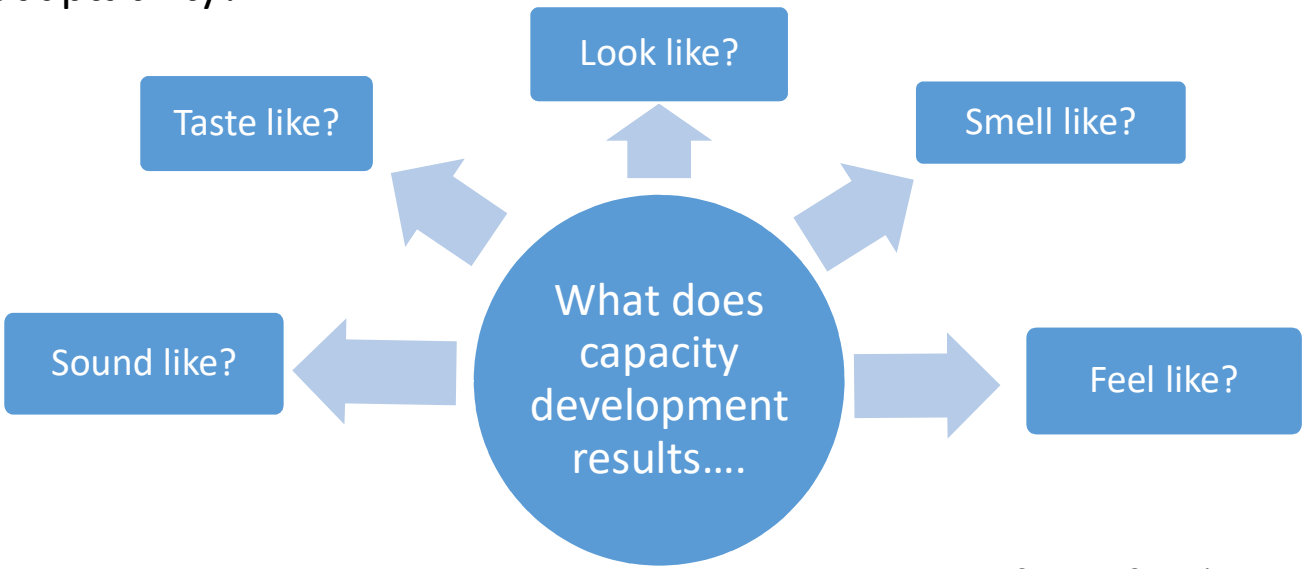
Step 4. Implement a Capacity Development Plan

- "**Executing**" is the most challenging part of the capacity development cycle
- Highly recommended **capacity development actions are incorporated or be part of the organisation's 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 flexibility, contingency and / or exit plans** for each initiative – primarily to accommodate organisational changes
- Capacity Development Champions **– CDCs!**

Source : Capacity Development - UNDP

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?



Source : Capacity Development - UNDP

FIG Asia Pacific Capacity Development Network perspectives on Implementation

FIG AP CDN - Delivery of Capacity Development (1)

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

FIG AP CDN - Delivery of Capacity Development (2)

- **Professional development –** opportunities for discussion and exchange of knowledge, information, experiences and new geodetic , positioning and geospatial developments.
- **Institutional development** – support to educational / academic networks, member associations, and industry in the development of geodetic core competences, curriculum, courses of study, standards, guidelines, codes of practice / conduct.
- **Global development** – Collaboration with international / regional NGO's such as the UN GGIM, UN SCoG, UN OOSA ICG World Bank, and sister organisations such as IAG, ISPRS; cooperation on activities / policies / initiatives to modernise geodetic frameworks.

Discovering the Why, Who and What!

Geodetic and Geospatial agencies need to understand the technical, social or community, political, economic 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.

Location Intelligence Industry

- Location data / map content / solutions / services will continue to account for nearly **two-thirds of the market .**
- User **industries of the future** for location intelligence - retail, logistics, mobility, smart cities, real estate.
- Asia-Pacific region is deemed as the **'engine' of the global economy** as it constantly continues to outstrip its western peers with an above average GDP growth rate.

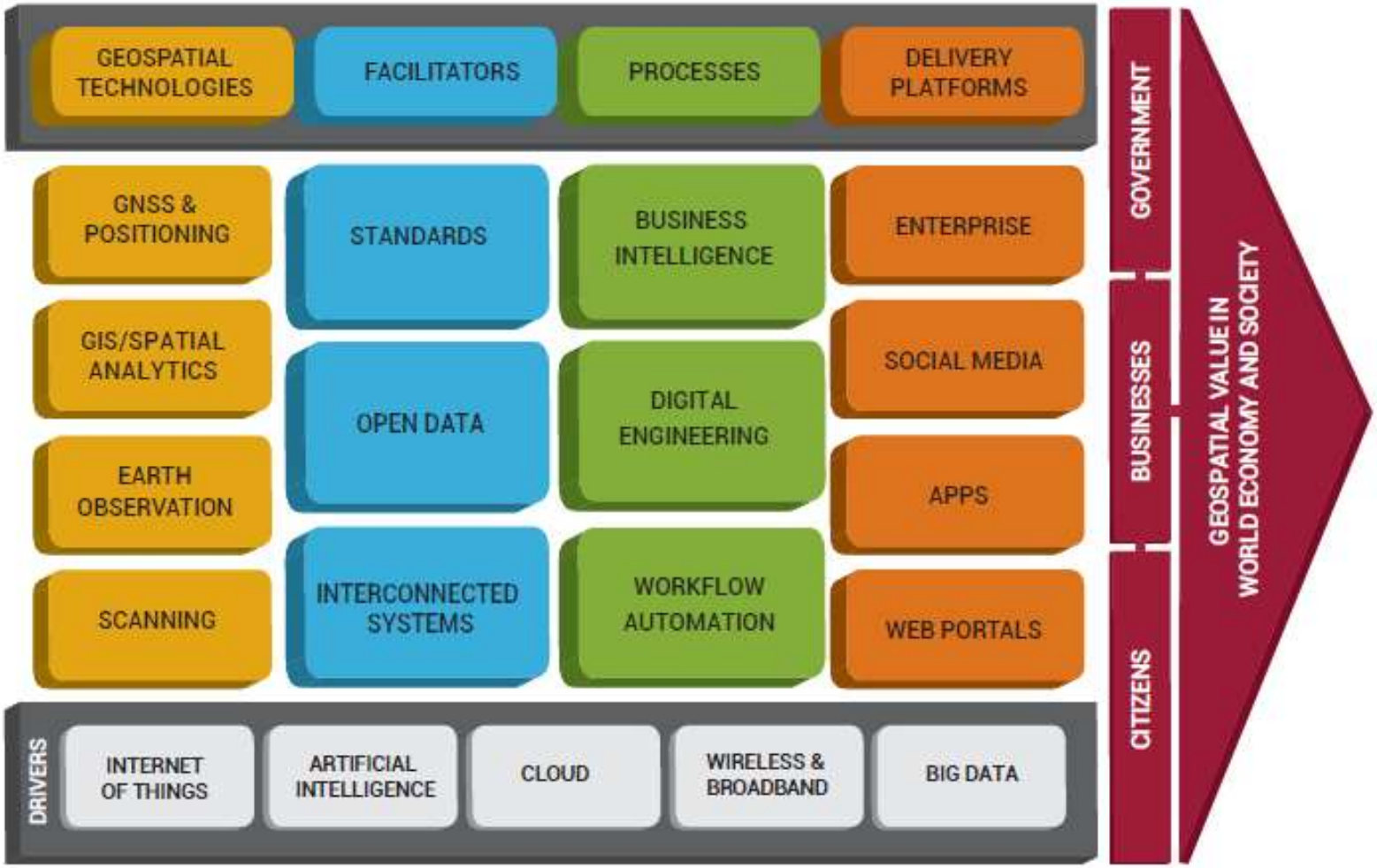
Source : Geospatial Media and Communications

ASIA PACIFIC RANKINGS			
COUNTRY	OVERALL SCORE	OVERALL RANK	REGIONAL RANK
China	41.19	7	1
Singapore	41.16	8	2
Japan	39.03	12	3
South Korea	38.70	13	4
Australia	38.10	15	5
New Zealand	35.77	20	6
India	31.91	25	7
Thailand	21.82	36	8
Philippines	20.17	37	9
Indonesia	19.94	38	10
Malaysia	19.66	39	11
Brunei	15.47	45	12
Sri Lanka	13.46	54	13
Vietnam	13.32	55	14
Bangladesh	9.68	67	15
Nepal	9.41	69	16
Regional Average	25.55		

Environment of Geospatial Organisations (1)

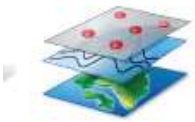
- Using **intelligent geospatial data** as a highly advanced tool for "**spatial analytics**" and decision making.
- **Big Data specialists** - digital, interactive, effective visualization; internet / cloud based processing
- Greater emphasis on - earth observation, outdoor / indoor position, location data,
- Incorporation of geospatial information and technology in **workflow management** – automation, artificial intelligence, robotics
- Ongoing provision of **innovative solutions** for traditional sectors - asset management, surveying / geospatial, agriculture, construction, mining and disaster management.
- **Market diversity into specialized sectors** - real-estate, building engineering, architecture, banking and financial services, retail and logistics, forestry.
- Geospatial technology business programs are part of **- national / regional / global agendas, SDGs, and community / societal initiatives,**
- **Increased collaboration** with a diverse group of industry bodies, professional member networks, commercial institution in products / applications (hardware, software, and content) – to meet challenges of the future and new segments

Environment of Geospatial Organisations (2)



Source : Geospatial Media and Communications

Agency role in the Geodetic Information Cycle?



Capture

Delivery

Data Acquisition, Collectors, Gathers

Data processing, quality control, validation

Data Archival, Geospatial DB

Data Catalogue, Metadata

Data distribution, Access, Data discovery, Web Services

Value Added Retailers, External

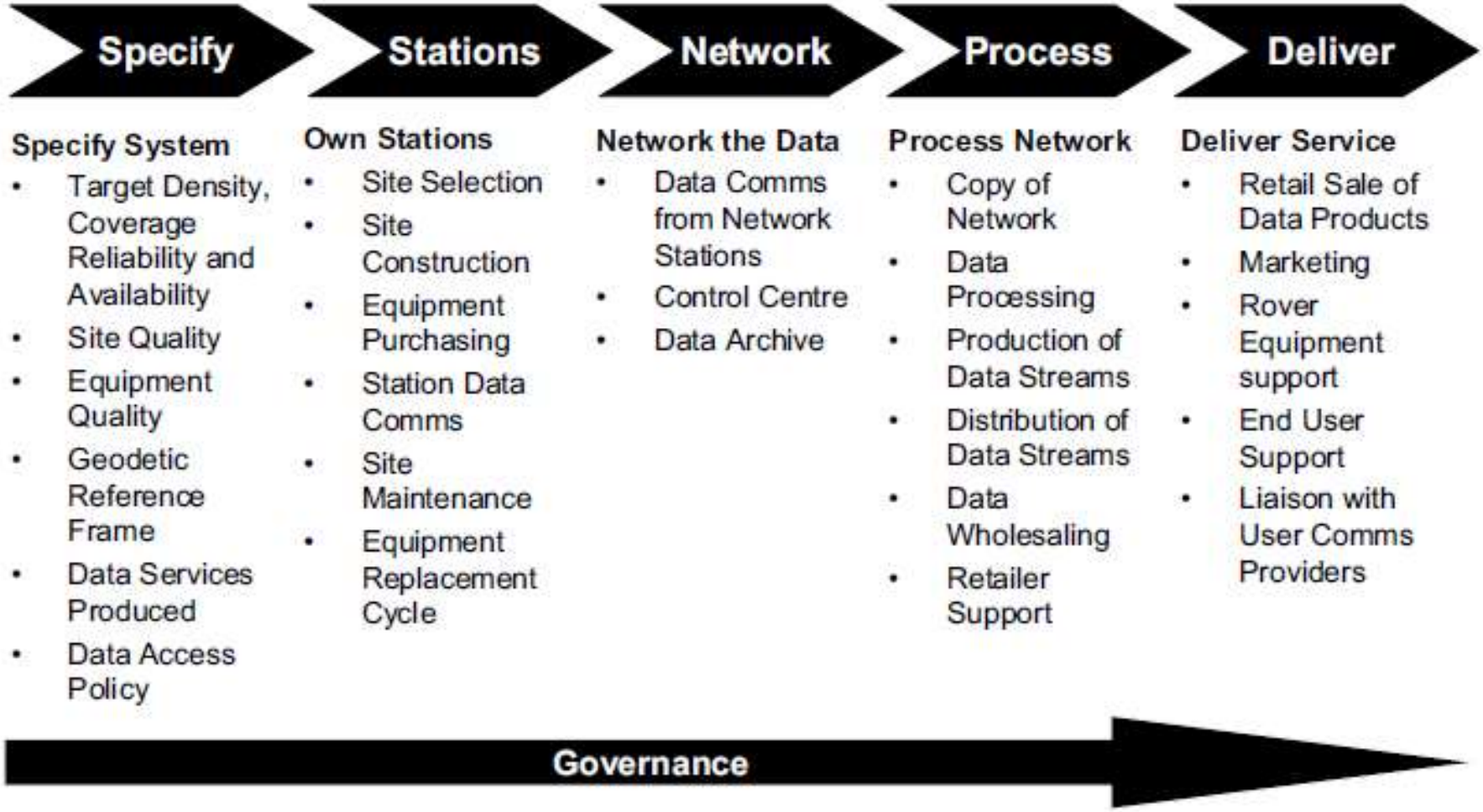
Applications – Open data / layers, Visualisation, Mobile Devices

Users – General Public, Decision Makers, Research, Scientists

Each stage controlled by relevant Standards, Practices, Legislation / Policy

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

Role in managing GNSS CORS infrastructure?



Source - Matt Higgins "A model for organisational roles within a Positioning Infrastructure"

Interaction with Foundation Geospatial Datasets ?

Source – UN GGIM

- 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***

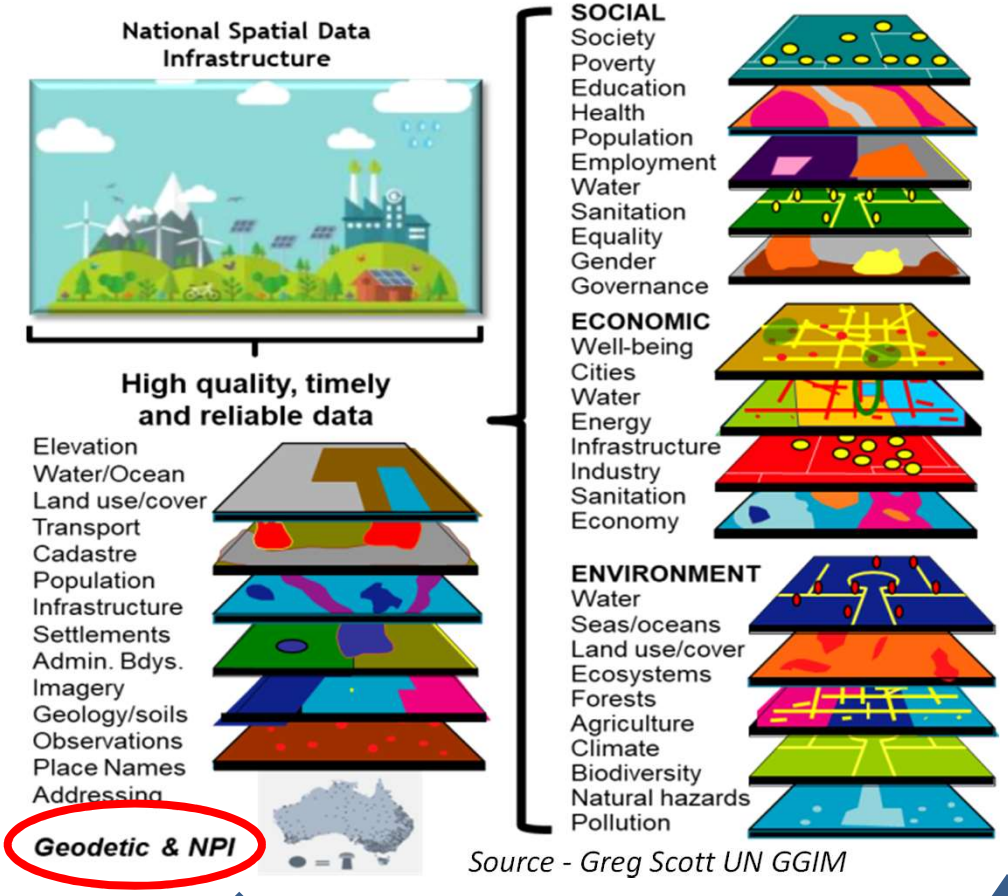
To support modernisation the synergies of geodesy with the land administration, management and governance profession should be identified and leveraged.

Modern Land Administration System ?

- ***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)

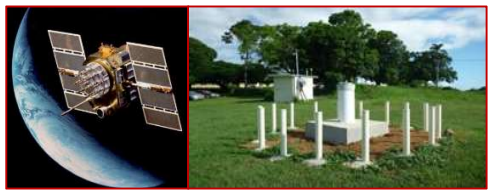
Must be easily, uniquely and accurately identified in a common positioning framework or reference system or geodetic datum or geospatial reference system

Connected to Global Geodetic Reference Frame / SDGs ?



Source - Greg Scott UN GGIM

- 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***.



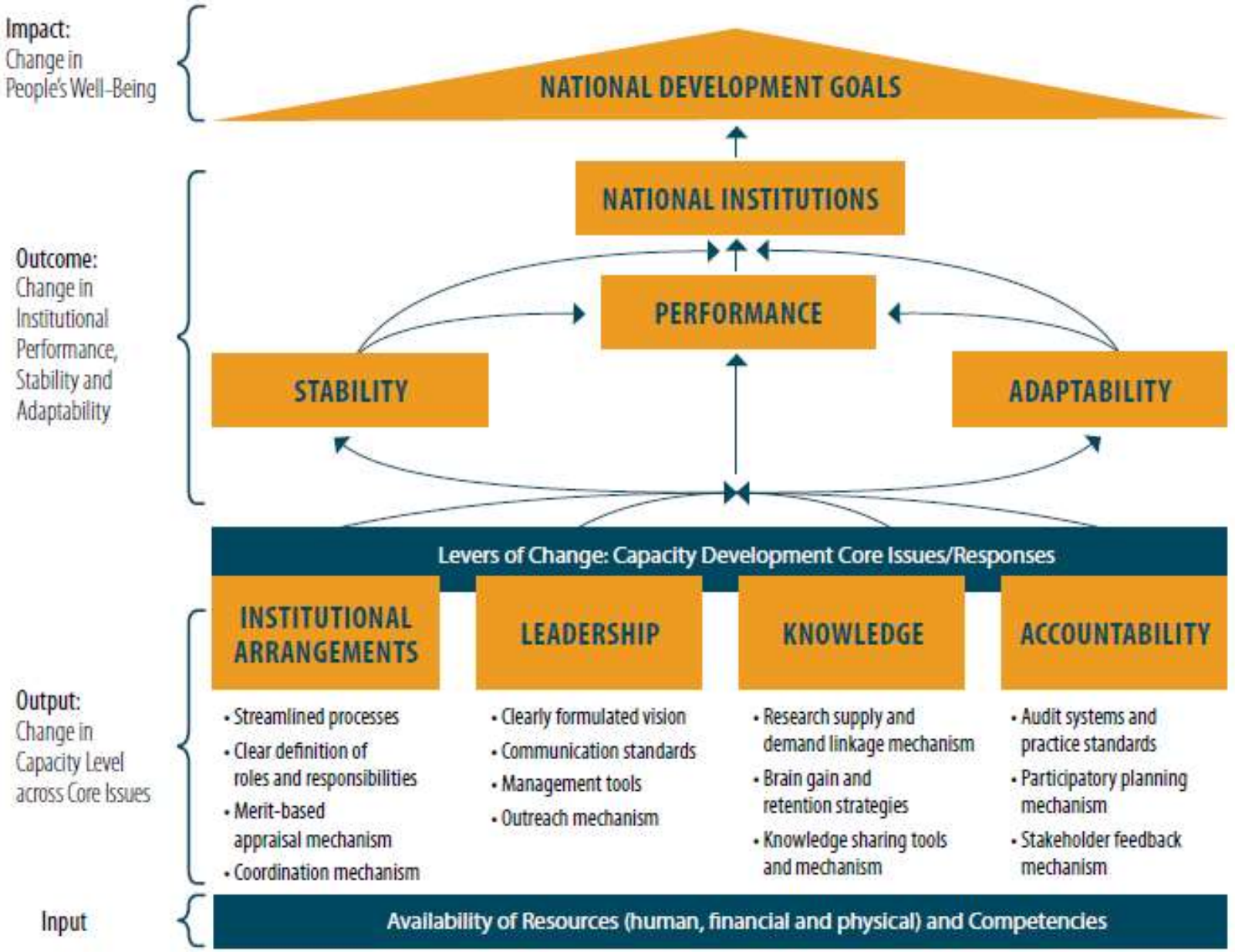
SUSTAINABLE DEVELOPMENT GOALS

Sendai Framework for Disaster Risk Reduction
2015 - 2030

Legislation, Policy, Standards and Practices

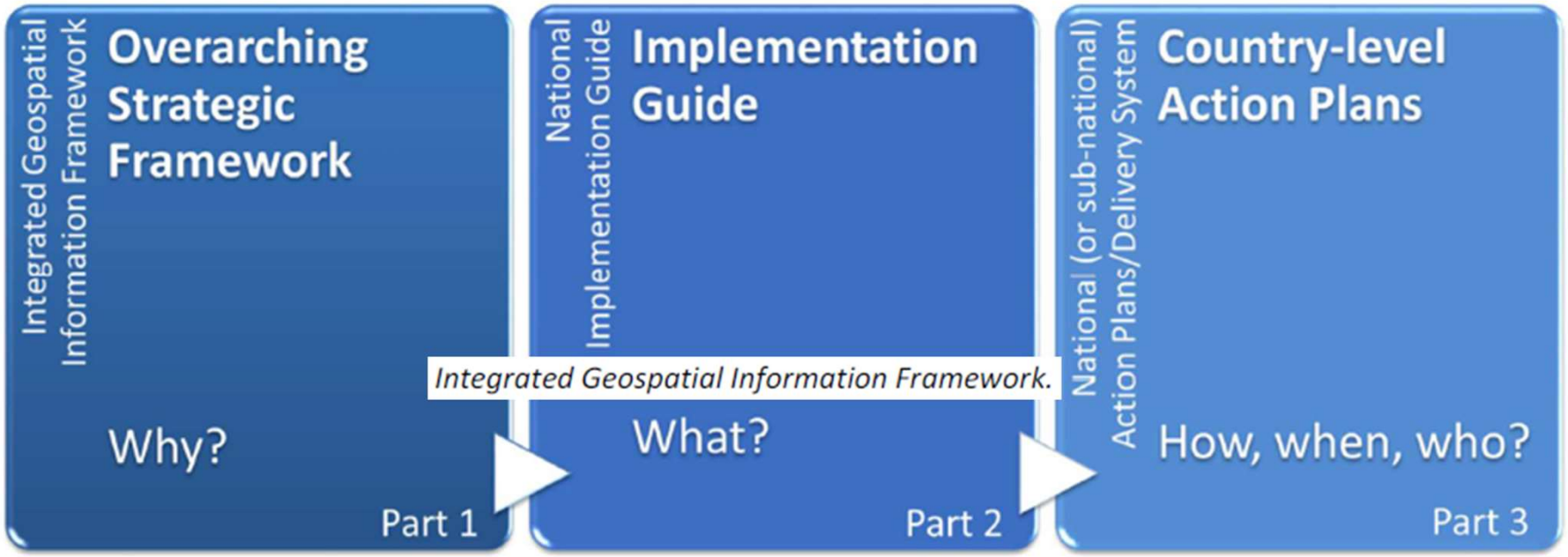
- Discover; Reform or development - it needs to occur in parallel with *"geodetic modernisation"* plans
- Be future proof (4 to 5 years ahead); less prescriptive and more outcome focused; fosters innovation; facilitates flexibility / agility over time; accommodates change; delegated power
- Considerations –
  - geodetic datum declaration, management, and techniques;
  - co-ordinates and digitisation of data;
  - geospatial / geodetic data sharing - open, closed, licensed?;
  - role /function in fundamental datasets and SDGs;
  - privacy;
  - freedom of information
  - spectrum management
- Leverage existing information

Capacity Development Strategy &Framework (1)



Capacity Development Plans - Strategy , Framework, Implementation (2)

- MUST reflect your organisation's culture and integral to organisational planning.
- 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 / tools (IGIF) as mandates for policy development and action!

Summary FIG AP CDN Perspectives (1)

Moving forward the FIG AP CDN recommend ***more capacity development*** for geospatial and surveying professionals and *decision makers* w.r.t –

- 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"

Summary FIG AP CDN Perspectives (2)

To develop geodetic capability organisations and agencies need to consider -

- Analysing and adjusting their ***role and responsibilities*** in geospatial information
- Engaging and collaborating with other ***disciplines outside geospatial /geodesy*** or traditional sectors
- 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 (3)

To develop geodetic capability organisations and agencies need to consider -

- Identifying ***core competencies*** for geodetic surveying
- Examining ***mutual recognition of professional qualifications OR accreditation OR sharing skills***
- ***Sustainable solutions*** that enhance ***self-reliance and development***
- Investigating **who can provide the required professional or capacity development**
- Formalising ***collaboration*** with –
  - FIG AP CDN, other FIG Commissions & Networks, UN GGIM AP Working Groups, UN ETCB, UN OOSA ICG,
  - Academic / Educational Institutions,
  - CORPORATE and COMMERCIAL sector (manufacturers)

Strategic Collaboration is the Key !

Co-operate with organisations who represent a diverse group of members

*Work **collaboratively** to* build the ***capabilities*** of geospatial and surveying professional to meet the ***challenges of the future***

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*

Next Collaboration Opportunity ?

Thank you !