

# Capacity Development Program for a Modernised Geodetic Framework

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**Key words:** Capacity Development, Geospatial Reference Systems and Infrastructure

## **SUMMARY**

Capacity development is an important program in a contemporary organisation, as it identifies the obstacles that hinder the institution from accomplishing its objectives, and develops the necessary skills and competencies required to achieve them. Consequently, numerous survey mapping, and geodetic agencies are implementing capacity building programs so as to address the geospatial information challenges, and future trends, and to also maximise the benefits from opportunities associated with an expanding location intelligence industry.

This paper will provide perspectives, from the FIG Asia Pacific Capacity Development Network, on matters previously mentioned, and also views on the United Nations Development Program, in relation to developing the capabilities to modernise a reference frame or geodetic datum.

# Capacity Development Program for a Modernised Geodetic Framework

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## 1. INTRODUCTION

In Asia and the Pacific region, government based geodetic and geospatial related agencies, are re-evaluating what is their identity, role and function in today's growing and constantly changing "location intelligence and ubiquitous positioning" landscape. Some government agencies are re-engineering operations to be primarily data custodians or hubs of national foundation data, and service providers of spatial analytics, whereas others are considering their preferences and pathways to change. Many geodetic survey organisations (GSOs) are also modernising their geodetic and cadastral frameworks, and examining their options to better manage digitisation, the impacts of disruptive technologies, our natural and built environment, earth movement, disasters and emergencies. Nevertheless, these trends are indicative of a dynamic environment and influence an organisation's operations, delivery of service and business objectives. Consequently, to maintain operational performance, optimal effectiveness and efficiency, implement initiatives to obtain the desired outcomes, and meet public expectations, GSOs are compelled to examine the existing and future capabilities of their workforce, and what organisational changes need to occur to implement a capacity development program.

This type of "reform" activity is not just occurring in geodetic and geospatial government organisations from developed countries. It also extends to emerging nations who have made a commitment to accomplish the United Nations (UN) Sustainable Development Goals (SDGs); implemented the UN General Assembly resolution on a Global Geodetic Reference Frame (GGRF); and have used the UN Global Geospatial Information Management (GGIM) guidelines on Integrated Geospatial Information Framework (IGIF) and Country-level Action Plans (CAPs) as blue prints or roadmaps to a better and more sustainable future. Likewise, agencies have also employed the concepts of the United Nations Development Program (UNDP) approach to developing capacity programs for their geodetic and geospatial personnel.

To support the above, the International Federation of Surveyors (FIG) Asia Pacific Capacity Development Network (AP CDN), in collaboration with other geodetic and geospatial agencies, have encouraged governments to develop the capacity and capabilities of geodetic and geospatial professionals. More specifically the technical and leadership capabilities of survey professionals, technicians, and managers (decision makers) who are responsible for the geospatial reference systems and infrastructures (GRSI - includes the geodetic reference frame or datum), that underpin spatial datasets and the reference layer for earth observations.

## 2. STATUS OF GEODETIC AND CAPACITY DEVELOPMENT ENVIRONMENT

The FIG AP CDN (the Network) was formalised at the FIG Working Week in Christchurch, May 2016, however the Network has been actively supporting the capacity development of

geodetic surveyors since 2013. From an “outreach perspective” the FIG AP CDN has used capacity development, and advocated organisational change, to reduce the technical gaps and digital divide between the developed and emerging geospatial economies.

To interact and engage with surveyors, the Network has actively participated in seminars, workshops or specific meetings relating to the themes of Reference Frame in Practice (RFIP) and modernisation of GRSI. These events have attracted a diverse audience from the Asia and the Pacific region, and they have consisted of decision makers, individuals seeking professional development, specialists from the academic and scientific community, representatives from national GSOs, and regional geospatial or like-minded organisations.

From group discussions, reports, presentations, and papers submitted by participants at these events, the Network (since its inception) has compiled and refined a regional overview of the geodetic and capacity development environment of Asia and the Pacific. This high level analysis is a compendium of geodetic / geospatial trends and challenges (and expectations), and an evaluation of the “strengths, weaknesses, opportunities and threats” in relation to their GRSI and associated capabilities.

Note, the following Tables 1 and 2 are indicative of the type and range of issues being experienced by GSOs in Asia and the Pacific region. Please note more specific or detail information about modernisation of geospatial reference systems and infrastructures, trends and challenges can be sourced from Sarib (2019) and previous FIG AP CDN presentations and papers.

## 2.1 Trends

**Table 1: Geodetic and Geospatial Trends**

<b>Impact of rapid urbanisation, and smart cities</b>
<ul style="list-style-type: none"><li>•Increased demand and access to reliable and intelligent geo-referenced spatial information.</li><li>•Datasets or analytics will be a necessity for evidence based decision making in the built environment.</li><li>•2/3 thirds of the world’s population will be living in “mega” cities serviced by smart technology by 2050, predictions indicate this will occur primarily in Asia and the Pacific region</li></ul>
<b>Disaster / emergency management and building resilience “before, during and after”</b>
<ul style="list-style-type: none"><li>•Increasing demand for geospatial industry to supply, deliver and integrate information for disaster / emergency management systems, in particular early warning systems.</li><li>•Geospatial information will be vital to the decision making process, operational management and outcomes of disaster relief, re-construction and the building of resilience</li></ul>

### Influence of disruptive technologies and digitisation

- Are technologies which will transform the way surveyors and geospatial professionals do their normal business (work flow) , as well as present day lifestyle patterns.
- The primary disruptors are automation, robotics, artificial intelligence, internet of things, cloud technology, autonomous vehicles, mobile internet devices, big data.
- More demand for digital, interactive, effective visualization
- There will be more internet / cloud based processing

### The growing market for and permeation of ubiquitous positioning or “the where is it? concept”

- The geospatial community desire for 24/7 real time positioning and location data will increase.
- Market base will increase in non-traditional sectors such as retail, logistics, mobility, smart cities, and real estate, building engineering, architecture, banking and financial services.
- Greater emphasis on real time measurement of earth dynamics; modernisation of geospatial reference systems and infrastructure; access to foundation datasets and imagery that has high integrity.
- Increased user needs for location data, map content, solutions, and services from the GNSS /Positioning, GIS /Spatial Analytics, Earth Observations and Scanning authorities and professionals.

### Increased UN lead activity

- Leveraging of initiatives such as the SDGs, and GGRF that reinforce the "where is it?" concept
- Are being used as high level mandates or justification for countries to share data, enhance geodetic / positioning infrastructure and systems, build capacity
- Enhances the use of geospatial information to evaluate community / societal / economic initiatives and be more accountable
- Leads to increased collaboration with industry bodies, professional member networks, commercial institution in products / applications (hardware, software, and content)
- Organisations develop capability through IGIF, CAPs and other UN GGIM tools

## 2.2 Challenges (and Expectations)

The following table describes the main challenges and expectations provided by geodetic and geospatial government organisations at FIG AP CDN events. Each item has been subjectively categorised into I = Institutional (Organisational), L = Leadership, and K = Knowledge (Technical). Note, the items are not in any specific order or priority.

**Table 2: Geodetic and Geospatial Challenges**

Type	Description of Challenge (and/or expectation)
K, L	Developing operational and capacity development programs to modernise GRIS.
K, L	Developing (and implementing) sub-agency “plans” to align with high level strategic objectives of the organisation.
I, L	Continually justifying the role, existence, value and importance of geodesy to various decision makers within the organisation

L, K	Lack of information and case studies that advocate the economic / fiscal benefits of geospatial and geodetic infrastructure / data
I, L	Responsible governance and administrative frameworks to support transparency, accountability to the community, and evidence based decision making.
I, L	Competing and securing organisational resources for geodetic/ geospatial projects and initiatives
I, L	Balancing organisational priorities – legal, technical, organisational, data, and people
K, I	Modernising legislation; developing relevant and agile policies and guidelines
K, I	Lack of policy and frameworks on spatial information with respect to “open”, “shared” (and/or with limited restrictions), or “closed” datasets
K, I	Contributing or sharing data for early warning systems, and the measurement of the effects of natural phenomena such as tsunamis, earthquakes, plate tectonics, storm and flooding events, and volcanic activity.
K	Building and maintaining or modernising geospatial (geodetic) infrastructures and systems for earth measurement and monitoring
K	Updating and complying with industry technical / operational standards and practices.
K	Modernising land administration systems to ensure indefeasibility of registration of rights, restrictions and responsibilities
K	Ensuring foundation (fundamental) data has integrity - accurate, current, geo-referenced, facilitates integration and interoperability AND in a modern information system
K	Administering and visualising geospatial information in 3 dimensions (with a temporal component) and in a digital environment.
I, K	Using and maximising the ability of the internet, mobile phones, web-based data portals, crowd sourcing, web services to deliver geodetic services
I	Having access to reliable communications
I, K	Provision of data (near real time) in the “cloud”, via distributed web services, data retrieval through catalogues and visualisation via Web Map Services.
I, L	Ensuring a sustainable workforce by creating and maintaining a diverse environment of gender, age and professional or scientific disciplines.
I, L	Establishing frameworks and mechanisms to facilitate collaboration between agencies or countries regarding capacity building, training, education and recognition of qualifications.

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## 2.3 Capabilities Required to Modernise Geodetic Reference Systems and Infrastructures

### 2.3.1 Technical Capabilities

To identify the technical capabilities for present and future GRSIs, the FIG AP CDN in conjunction with the Education, Training and Capacity Building (ETCB) working group of the UN Sub-Committee on Geodesy (SCoG), and the UN GGIM Asia Pacific Geodetic Reference Frame working group, designed an “evolving” geodetic competency matrix from questionnaire responses (Keenan et al, 2020) and also GSO status reports. This matrix provides to GSOs an insight into the description of the skills, experience and knowledge required to build and operate modern GRSI, along with training and education requirements, and possible sources to provide the relevant capability.

**Table 3: Geodetic Competency Matrix**

Level	Competency Requirements	Training provided by	Comments
1	Basic understanding of: <ul style="list-style-type: none"> <li>GNSS</li> <li>Reference frames, including geoid models, vertical and horizontal datums</li> <li>Geospatial information integration and interoperability</li> </ul>	<ul style="list-style-type: none"> <li>Educational institutions – universities and polytechnic institutes</li> <li>Government geodetic, survey and mapping agency</li> <li>Private companies</li> <li>Global Geodetic Centre of Excellence (GGCoE) participant</li> </ul>	Countries that might have one CORs and maintain a traditional geodetic network of reference marks.
2	The above plus knowledge of: <ul style="list-style-type: none"> <li>Constructing, building and running a small CORs network</li> <li>GNSS processing using standard commercial / consumer off-the-shelf software</li> <li>Least squares processing and provision of datum access</li> <li>Geoids models, precision, determinations and basic implementation</li> <li>Implementation of a vertical datum including use of geoid models</li> </ul>	<ul style="list-style-type: none"> <li>Educational institutions – universities and polytechs</li> <li>UN-GGIM Geodesy Capacity Group</li> <li>FIG / IAG</li> <li>Government geodetic, survey and mapping agency</li> <li>Private companies</li> <li>GGCoE participant</li> </ul>	Countries with small CORs network and those who adopt global Reference frames for their nation reference frames.
3	The above plus high knowledge of: <ul style="list-style-type: none"> <li>Implementing and running large CORs networks</li> <li>High end GNSS processing and datum access</li> <li>Geoid model computation and implementation into a vertical datums</li> </ul>	<ul style="list-style-type: none"> <li>Specialized courses – e.g. geoid school</li> <li>UN-GGIM Geodesy Capacity Group</li> <li>IAG / FIG</li> <li>Government geodetic, survey and mapping agency</li> <li>Private companies</li> <li>GGCoE participant</li> </ul>	Countries with a more extensive CORS and developing their own specialized national and vertical datum.

	<ul style="list-style-type: none"> <li>Monitoring earth dynamics and including in datum realization</li> <li>Geodetic database management</li> </ul>		
4	<p>The above plus expert knowledge of:</p> <ul style="list-style-type: none"> <li>Reference frame determination and computation</li> <li>High end GNSS analysis and processing</li> <li>SLR including analysis and processing</li> <li>VLBI including analysis and processing</li> <li>Gravity collection, processing and geoid determination</li> <li>Analysis centre – combining various geodetic techniques to determine reference frame parameters</li> <li>Use of other potential geodetic techniques – e.g. DORIS and InSAR</li> </ul>	<ul style="list-style-type: none"> <li>IAG</li> <li>Specialist training courses run by space or government geodetic, survey and mapping agency – e.g. on VLBI or SLR</li> <li>Private companies</li> <li>GGCoE participant</li> <li>Specialized software training courses – e.g. Bernese and GipsyX</li> </ul>	Countries engaged in Global Reference frame determination and Geodesy Science.

### 2.3.2 Soft (Non-technical) Capabilities

In addition to developing the technical capabilities to tackle the trends and future challenges, FIG AP CDN have observed that individuals of a GSOs, including leaders / managers, will need to consider diversifying or refining “soft” or non-technical knowledge and skillsets. That is, improve an individual’s capabilities to be a better people manager, enable better interaction amongst people, and to influence work related decision making, think and actions. Once again based on FIG AP CDN’s engagement with a various stakeholders over several years, GSOs need to enhance knowledge and develop skillsets, such as – leadership, teamwork, communications, problem solving, work ethic, flexibility/adaptability, and interpersonal skills, to deliver the GRSI related outcomes and /or outputs. Refer to Table 4.

**Table 4: Geodetic Soft Skill Outcomes / Outputs**

Soft Skills Development Outcome / Outputs
Through a participatory and collaborative process, engender ownership, form and administer strategic and operational plans (with an outcome / output focus) and qualitative / quantitative monitoring / evaluation frameworks.
Organisation is prepared for continuous change through the transformation of attitudes towards change, progressive thinking, being agile and flexible, having a more open mind and less risk adverse.
Continuous advocacy and communication to leaders, decision makers, politicians on the importance of “24/7” geodetic and geospatial information in real time via a combination of “disruptive technologies”, crowd sourcing techniques, and web services.

Implementation and compliance frameworks for relevant technical standards and practices

Legislative and policy reform program delivered on geodetic and geospatial information matters such as geodetic datum, privacy, custodianship, data sharing, liability etc.

Resourcing frameworks effectively managed to accommodate increased geospatial data volumes; to balance commercial influences; and to sustain the built environment.

Provision of professional advice and services to facilitate design, risk assessment, investment analysis, asset management and resource deployment.

Organisation's leaders are actively leading, negotiating, influencing, and permeating collaboration amongst a diverse team of survey and land professionals from various disciplines.

Create an organisational environment (or community) that is self-reliant, self-determinate, diverse, and has gender equity.

### **3. FIG AP CDN SYNOPSIS**

The high level precis of the GRSI status and associated capabilities in Asia and the Pacific, indicates individuals and leaders of GSOs need to take affirmative action to improve their organisational performance and existing capabilities, so as to be functional, competitive and relevant in a rapidly changing environment. To improve organisational effectiveness and sustainability on all levels, an integrated strategic organisational plan that incorporates a capacity development program (CDP) is one of the key pathways. In terms of developing geodetic capacity and capabilities the CDP will require individuals or teams to learn new skills, acquire new knowledge, and gain new experiences, both "technical and soft". From an organisational perspective, it will need to create a structure and resourcing framework that supports capacity development, empowers leaders and individuals, and most importantly engender a culture to embrace change.

As a consequence, the next sections of this paper focuses on the process of capacity development planning, and is to be read in context of the geodetic survey and geospatial environment previously described.

### **4. DEFINING CAPACITY DEVELOPMENT**

To alter the capabilities of personnel in a GSO is not a simple transformation. It requires organisational change through the enhancement, modification or creation of capacity building or development programs or plans over time. That is, undergo a periodic process of identifying the challenges or obstacles that impede the organisation, and its individuals, from accomplishing the business objectives; and then developing the necessary knowledge, skills, competencies and frameworks to achieve them. Often, capacity development also involves



strategies and learning activities to manage change (or paradigms); understanding how decisions are made; and recognition that capacity development (and change management) must be supported by resources and the political commitment to achieve results. FIG AP CDN have adopted this as the definition of capacity development.

## **5. CAPACITY DEVELOPMENT PROGRAM OVERVIEW**

According to various United Nations Development Program (UNDP) publications and similar research, successful CDPs are multi-level as they consider the interrelating needs and objectives of the individual (people), institution (organisational), and society (broader environment). They are also characterised by realistic or tangible outcomes, outputs and results, which enables the organisation to measure and monitor the performance of the CDP for not only success, but also possible shortcomings and improvements.

From previous case studies, change management strategies are articulated in most CDPs or part of people management plans, however they have been implemented with mixed results. This occurrence is primarily due to the lack of appropriate skills of the change agent(s) and the absence of ownership by the CDP stakeholders. To engender ownership and acceptance of capacity development needs, the CDP, must have the political will and support of its leaders, be clearly understood by the organisation's participants, and have numerous "champions" of change and capacity development. GSOs must acknowledge these facets are integral to the success of implementing capacity development initiatives and overall organisational change.

To gain impetus and wider support of CDPs within geodetic and geospatial organisations, leaders will need to discover and define the why case for CDPs, who and what skills need to be enhanced, and who needs to be empowered to facilitate change. Consequently, GSO CDP objectives should be aligned with the nationwide strategic agendas or regional initiatives, such as establishing "fit for purpose" geodetic and geospatial infrastructure and systems to –

- a) Support location intelligence activities;
- b) Reform land governance, administration, titling and registration;
- c) Build resilience with respect to disasters;
- d) Manage the impacts of climate change and sea level rise;
- e) Measure and monitor the dynamics of the earth for global science or
- f) Attain the UN SDGs or GGRF

Case studies suggest strategic agendas or organisational objectives are obtained incrementally over time, subsequently CDP timeframes or schedules should be similar. This implies CDPs should be an ongoing organisational commitment and not just for specific purposes or projects. Ideally a CDP should be built for long term gain and be able to sustain changes. That is, be agile, flexible and adaptable to strengthen capabilities, and ensure ongoing development. Therefore, for GSOs to have sustainable CDPs they need to –

- Own, design, direct, implement and maintain CDPs themselves
- Empower their workforce and engender ownership of CDPs

- Utilise local resources (people, skills, technologies, institutions) to implement CDPs
- Have greater diversity and inclusion in the workforce
- Enshrine CDPs into organisational policies,
- Link CDPs to industry standards / guidelines
- Collaborate, co-operate and engage with industry, professional surveying and geospatial bodies, the scientific and academic sectors, and general community.

In addition, it is important GSOs have an appreciation for the four key elements that will influence the success of the organisation's CDP. Based on the UNDP principles, these are –

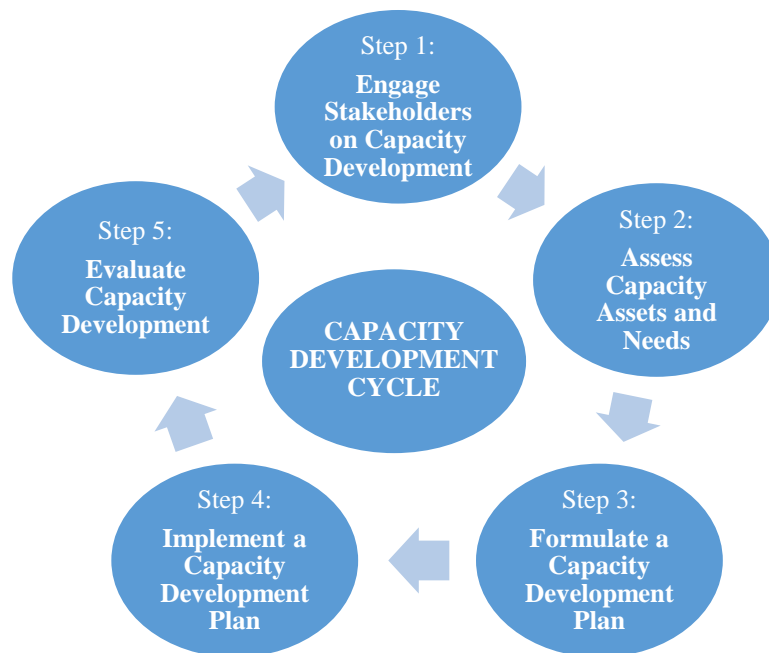
1. **Institutional (Governance) Arrangements** – relates to the GSO's surveying and geospatial legislation, regulations, policies, standards, code of practices, guidelines, memorandums of understandings, agreements, and licences. It can also include also community, social or industry "norms or expectations". From an administrative or management perspective it also takes into account frameworks or systems associated with matters such as financial, resourcing, accountability or delegation, performance monitoring and evaluation, human resource management and employment conditions. Overall it is about having clarity of structure, roles and responsibilities within the organisation and in the geodetic / geospatial information data cycle and management; and interaction with stakeholders involved in the "supply and user chain" of geospatial information.
2. **Leadership (Management)** – pertains to the GSO's leaders having the ability to provide clear vision and direction, and with integrity influence, inspire and motivate others to achieve both organisational and personal capacity development objectives. Leaders should be capable of employing different management styles for a diverse range of audiences, this also includes liaising with decision makers and politicians. In some environments, leaders will need to recognise, understand and engage with "traditional" or "customary" stakeholders and related "cultural" communities thus alter their approach. To ensure sustainability of CDPs, it will be critical that leaders actively supervise and implement change management and risk strategies, and identify champions of change. It will also be prudent for leaders to collaborate with public / community groups, build partnerships / networks with likeminded agencies.
3. **Knowledge** – is about recognising and understanding existing capability of the individual (and teams) and how it will influence / determine capability development. It will involve discovering present and future technical, administrative, management, and "soft" capabilities of the people that is their knowledge, experiences, skills, qualifications, and competencies. This element is also about examining "how" knowledge is ascertained and facilitated through local agencies, professional associations, international agencies, scientific community, academic institutions and networks involved with geodesy and earth sciences. Assessment of this may also

provide opportunities for how ongoing or sustained geodetic capacity development can be delivered effectively and efficiently. For some circumstances alternative or non-traditional methods of learning many need to be considered.

4. **Accountability** - means the GSO's obligation to account for CDP activities, and consequently provide legitimacy to decision making. In other words it is a term used to describe the delivery of an organisation's CDP obligations (outcomes) through systems which allow the analysis, evaluation, monitoring, measurement and reporting of "inputs / outputs" via performance indicators. As such, these systems can also augment and reflect an organisations responsiveness to change. In some organisations accountability will provide greater transparency, support ethical organisational and individual behaviour, and thus integrity to the process. This occurs because normally accountability structures have both an upward and downward stream with clearly stated responsibilities and milestones, hence traceable. Accountability mechanisms also facilitates interaction, and engagement with stakeholders, users, service providers and the community / public during an evaluation or feedback process.

## 6. CAPACITY DEVELOPMENT CYCLE

FIG AP CDN recognise that to develop the relevant capabilities required for GRSI modernisation, CDPs must be part of a GSO's overall road map and pathways to achieving its vision and goals. Consequently the Network has provided perspectives on each step of the UNDP's systematic and participatory approach to capacity development. The following diagram has been reproduced from UNDP (2015).



## **Step 1: Engage Stakeholders on Capacity Development**

During the scoping process of a CDP, it is important to have engaging, open and frank conversations when constructing the why, what and how of CDPs. This part of the process is an opportunity for participants to exchange information, stories, experiences, knowledge and to ask questions. It also enables the CDP convenors to understand and discover the organisation's shared benefits, the value, the "opportunities, strengths, weakness, threats" of capacity development. Such meetings should also be used to create a common focus, engender ownership, investment and commitment, and to establish accountability in the capacity development process. That is, who will do what, who will ensure that it gets done, and what will the consequences be if it does not get done. Topics of engagement or debate should not be limited to just GSO matters, as to be sustainable CDPs will need to consider not only local challenges but also relevant national and regional issues and priorities. Consequently dialogue should also occur with non-traditional stakeholders or those external to the GSO. The method of consultation / communication could vary, depending on the audience. In some circumstances it may be prudent to convene meetings in a format that are familiar to the GSO environment, however no matter what style is used the process should encourage inclusiveness and diverse views.

## **Step 2: Assess Capacity Assets and Needs**

The structure and methodology to identify, assess and prioritise capacity assets and needs will depend on the environment and culture of the organisation, nevertheless the approach adopted should be unified, inclusive, collaborative, and seek views from a diverse group of interested stakeholders. This should ensure participants embrace the CDP and gain a sense of empowerment. A successful analysis of the existing capacity and future capabilities should also –

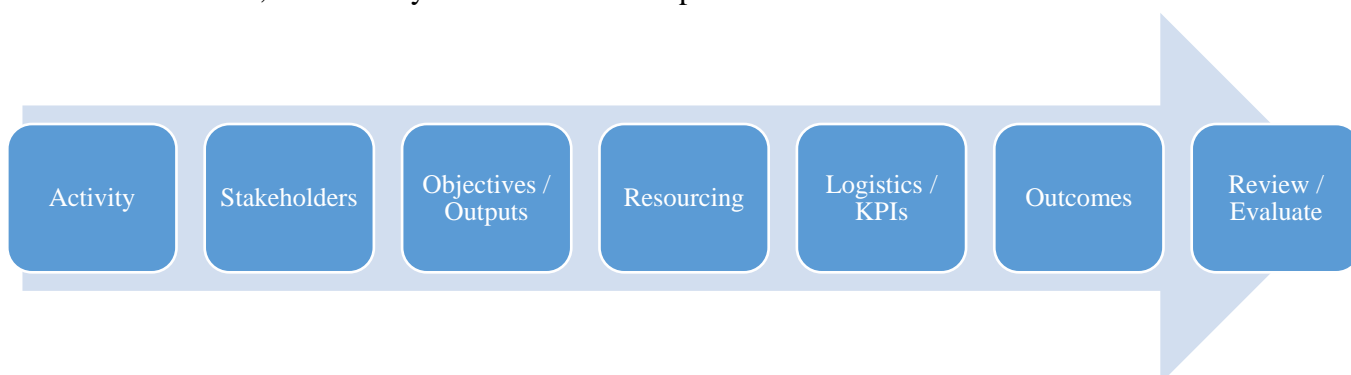
- a) Clearly identify capacity and capability gaps
- b) Provide "baseline capabilities" so that progress can be measured
- c) Identify who can deliver the capacity needs, be a partner or collaborator
- d) Define realistic capacity outcomes that are achievable and measurable
- e) Link capacity outcomes with both organisational and personal development objectives; and
- f) State relevance and alignment (if necessary) with broader community or national objectives.



### Step 3: Formulate a Capacity Development Program

CDPs must be part of a GSO’s overall strategic and operational planning that is, it must not be an afterthought nor developed in isolation. A CDP needs to be **Specific, Measurable, Achievable, Realistic, and timely** that is, “**SMART**”. Like other programs or plans they will need to include the fundamental components such as resourcing, budget and time schedule, along with performance measures / indicators that relate to the organisation’s and stakeholder objectives / outcomes / outputs. For effectiveness and sustainability reasons the CDP should –

- a) Articulate the building of existing organisational capabilities, and the use of its own (or “local”) capacity assets or strengths to fill identified gaps
- b) Address multiple capacity development issues and levels
- c) Align with existing organisational strategies, plans, initiatives
- d) Incorporate a change management plan
- e) Prioritise the list of capacity development initiatives
- f) Include a framework for a knowledge library or database
- g) Consider risk or threat scenarios with mitigating actions, alternatives or contingency (or exit) plans for each initiative, and
- h) Clearly articulate the organisations accountability sequence, both upward and downward, with clearly stated roles and responsibilities.



### Step 4: Implement a Capacity Development Plan

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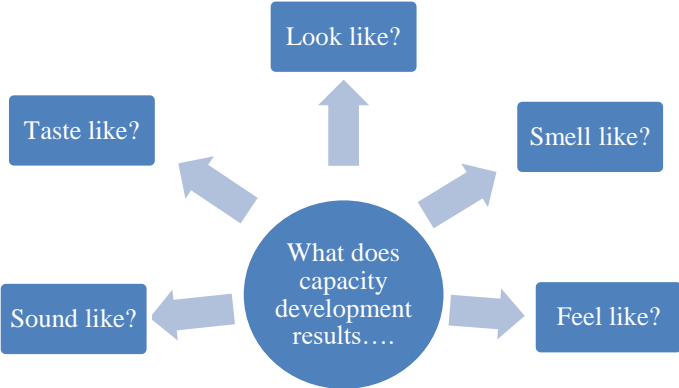
The execution or implementation phase of a CDP will be a challenge. Organisations that experience a positive transition of plans into action, have often incorporated CDPs into the organisation’s existing process, systems and structure, and also utilised “local” resources to deliver the programs. In some circumstances, organisations have taken advantage or leveraged or integrated the efforts from other organisation’s (or even other countries) operational CDPs, so as to avoid duplication of time, effort and resources. Several other approaches taken by organisations is to –

- a) Select and support “capacity development champions” who will advocate CDPs and lead by example and
- b) Formulate and undertake capacity development activities or initiatives that will provide quick wins or demonstrate effectiveness, and thus gain immediate recognition, and potentially ongoing support.

Overall such mechanisms assist with implementation, and underpin a learning culture and a sense of empowerment through the organisation, industry and community. It also needs to be re-iterated that each phase of CDP implementation must be regularly monitored and measured so as to facilitate the overall assessment and evaluation of the CDP progress. This in turn will allow the organisation to make informed and evidence based decisions on related CDP action.

**Step 5: Evaluate Capacity Development**

A successful evaluation framework will enable the GSO to justify or demonstrate the accomplishments or results of CDP initiatives, which must also translate into or reflect overall better organisational performance and achievement of the outcomes, objectives and the vision. The evaluation framework needs to have mechanisms to capture feedback, gather quantitative / qualitative information on the CDPs. This data will then facilitate the analysis of how efficient and effective the CDPs were, what can be learnt and improved, what was successful, and what impact they had on changing an organisation’s performance. For example - have the changes in an organisation's institutional, leadership, knowledge, and accountability capabilities, improved the organisations performance, stability and adaptability?



Source - UNDP (2015)

## 7. CAPACITY DEVELOPMENT PROGRAM CHALLENGES (OR PATHWAYS)

In light of the capacity development cycle, and considering the information provided by GSOs in relation to their GRSI and capacity development, the following table describes the geodetic and geospatial CDP challenges, and subjectively categorises them into the four main elements that affect organisational capacity development, I = Institutional, L = Leadership, K = Knowledge, and A = Accountability. It is recommended that the listed challenges also be seen as possible pathways or actions for consideration. Note CD = capacity development.

**Table 4: Capacity Development Challenges (conversely pathways)**

Type	Description of Challenge (or Pathway)
I	Lack of CD frameworks / mechanisms for - exchanging knowledge / learnings; recognising and assessing qualifications, sharing resources, accessing educational / academic institutions.
I	No clear pathways, structures and roadmaps to facilitate CD collaboration and engagement - within an organisation, between organisations, and with organisations in the Asia and Pacific region.
I	Aligning (link) individual, organisational, and national CD plans to a regional “initiative” or “issue”.
I	Including CD programs and arrangements as part of an organisational action agenda and incorporating ongoing strategies to justify resourcing
I	Developing more relevant strategies and policies to reflect the potential benefits of CD, the CD needs, interaction with other sectors / disciplines on CD
I, K	Improving the awareness, and understanding of the CD resourcing programs / opportunities from “donor” agencies; know who to contact; how to apply for support, and what to submit / provide
I, K	Effectively discovering, understanding existing organisational capabilities; and prioritising the training and competency needs for future CD
I, L	Having the capability to advocate (and tangible material) CD to enable decision makers to recognise its value or importance and contribution to an organisation (and the nation).
L	CD leaders having the necessary skillsets to influence, inspire and motivate others to achieve both organisational and personal CD objectives
L	CD leaders securing the political (and community) will, support, and commitment; and having the ability to maintain CD momentum
L, I	CD strategies to encourage existing agencies (and countries) with “capability” to provide more support, and be more involved in “core competency” education / training
L, I	CD leaders and organisations being able to managing and implementing change

L, I	CD strategies, plans and policies being linked to technical improvements AND other significant “drivers” – environmental, economic, social and political.
K, I	Undertaking a regional analysis of capabilities to identify - knowledge “gaps” between member countries and the provision of core competencies – who, how, where and quality / suitability
K, I	Developing frameworks / mechanisms to access and learn relevant theory and practical experience with respect to core competencies from a variety of sources. Ideally a knowledge database or portal or a repository for CD tools and information – presentations, papers, etc.
K, I	Developing frameworks / mechanisms to utilise and support “providers, trainers, educators, experts, and specialists” to deliver CD.
A, I	Developing CD evaluation systems to demonstrate that individual, organisational, national objectives have been achieved – NOT just technical – economic, social and political
A, K	Ensuring standards, and practices (incl. professional / ethical) are maintained or complied with

## 8. CONCLUSION

In concluding, this paper has provided FIG AP CDN’s perspectives on the geodetic capabilities of government based organisations in the Asia and Pacific region, and the future requirements for modernised geospatial reference systems and infrastructures (GRSI). The paper has also outlined the principles and elements of the United Nations Development Program (UNDP) in terms of a capacity development program (CDP) for geodetic survey organisations (GSOs), and also suggests pathways to change the capabilities of the organisation’s workforce.

More specifically, FIG AP CDN recommend the following points should be considered when developing and implementing a GSO CDP –

- Seek national support and ownership to drive the planning and implementation of the CDP
- CDP to be led by both organisational and national leaders who are empowered and willing to change structures and processes in order to improve GRSI performance and overall organisational efficiency and effectiveness.
- A common understanding of the CDP purpose, scope and objectives, and agreement on the end outcomes.
- An objective assessment process (inclusive and diverse) to reach a consensus view of CDP needs, recommendations, and activities.
- Adapting a capacity development “participatory” approach which suits the GRSI environment and accommodates circumstances of other organisations (or nations) involved.



- Clarity of CDP roles and responsibilities including who is accountable for implementing, evaluating, and deliver of CDP activity.
- CDP planning, and budgeting (includes resourcing) should be prepared and incorporated as part of the initial programme development to support modernisation of GRSI.
- Integration of “realistic” and incremental (phased) CDPs with existing organisational (and national) plans and strategies, rather than being seen as separate programmes.
- Include participating donors, development partners, and stakeholders at the planning stage, to ensure coordination of various capacity development initiatives, cost sharing, and resource sharing.
- Through a structured evaluation mechanism, regularly review and update the CDP to monitor progress and make necessary changes.
- On-going and transparent communications and collaboration with “all stakeholders” regarding the CDP and its progress.

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Rob Sarib obtained degree in Bachelor Applied Science – Survey and Mapping from Curtin University of Technology Western Australia in 1989. He also holds a Graduate Certificate in Public Sector Management received from the Flinders University of South Australia. Rob was registered to practice as a Licensed Surveyor in the Northern Territory, Australia in 1991. Since then he has worked as a cadastral and geodetic surveyor, and a land survey administrator.

Mr. Sarib has been an active member of the FIG since 2002, and is now Chair of the FIG Asia Pacific Capacity Development Network. He is presently a Board member of Surveying and Spatial Sciences Institute; the Chair of the Surveyors Board of Northern Territory; and member of the Inter-governmental Committee on Survey and Mapping – Australia.

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