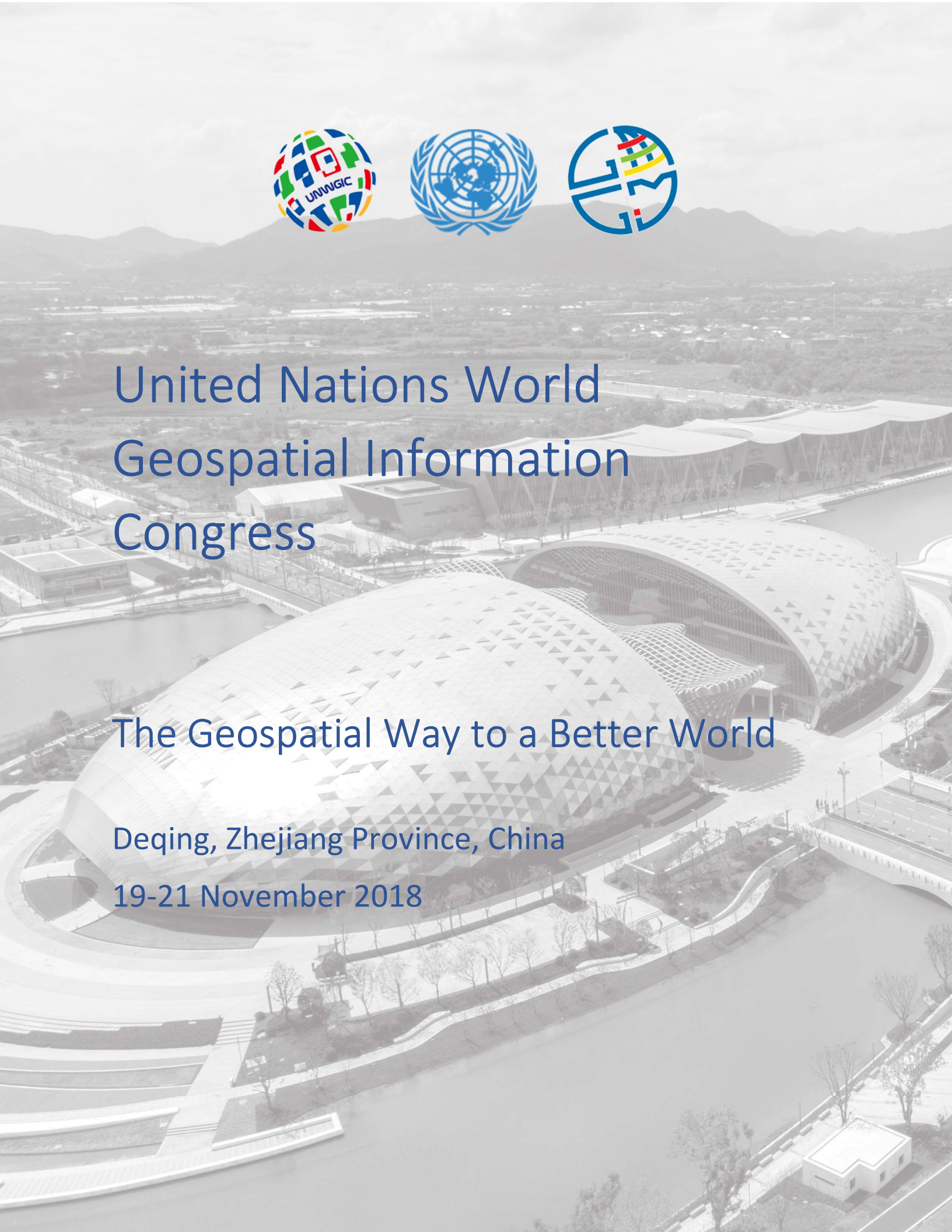

United Nations World Geospatial Information Congress

The Geospatial Way to a Better World

Deqing, Zhejiang Province, China

19-21 November 2018

"Your dedication, expertise and guidance - in geospatial data, methods, frameworks, tools, and platforms - is urgently needed. The data needs for the SDGs are great, and time is not on our side. Reliable, timely, accessible and disaggregated geospatial information must be brought to bear to measure progress, inform decision-making and ensure effective and inclusive national and sub-national programs that will chart the path towards the 'Geospatial Way to a Better World', to assist in the implementation of the SDGs, and transform our world for the better."

António Guterres
Secretary-General of the United Nations
(video message to the United Nations World Geospatial Information Congress)
19 November 2018

ggim.un.org/unwgic

Contents

Executive Summary

The first United Nations World Geospatial Information Congress (UNWIGIC) held in Deqing, Zhejiang Province, China from 19 to 21 November 2018, convened under the purview of the United Nations, substantively improved and strengthened the role of geospatial information management, innovation and related technologies towards implementing the 2030 Agenda for Sustainable Development and to keep the promise to leave no one behind.

The three-day event with a comprehensive programme provided a convening, participatory and inclusive environment to intensify collaboration at the regional and global levels; enhanced the communication, understanding, knowledge and application of geospatial information management; discussed the policy relevance and challenges to advance geospatial science, technologies and innovations; promoted the creation and sharing of more reliable, timely and quality geospatial data; and encouraged value-added applications and services to address local, national, regional and global challenges. The participating ministers, in their ministerial statements at the UNWGIC, stressed the importance of working together across borders, highlighted the benefits of partnerships and cooperation in sharing of good practices and transfer of technologies to meet the growing national, regional and global demand for geospatial information.

"The Geospatial Way to a Better World" the theme of the UNWGIC resonated with over 2000 participants and exhibitors from all continents. The hosts very ably prepared and provided a welcoming, friendly and conducive environment for participants from governments, international organizations, civil societies, academia and the private sector to share and exchange knowledge and experiences, who were informed and inspired to seek the highest and widest application of geospatial information, sciences, technologies and services for the wellbeing of society, environment and economy.

This was reflected in the **Moganshan Declaration**, issued on behalf of all participants at the end of the UNWGIC that resolved to work together to build a human data and geography community for a shared and better future, and to keep the promise to leave no one behind by fostering effective cross-sector and interdisciplinary international, regional and local collaboration and partnerships, and to support national development priorities. Participants requested a second UNWGIC in four years' time, to continue to promote comprehensive and inclusive dialogue with Governments and between Governments and all stakeholders, including young professionals, and to stimulate progress and advancement in global geospatial information management

Participants congratulated the host, the Government of China through the Ministry of Natural Resources in collaboration with the Government of Zhejiang Province, for their dedication and vision for realizing the UNWGIC, especially for having prepared and organized the venue, administration and logistics, and for the tremendous work of local volunteers who exposed the international geospatial information community to Deqing County in such a warm and engaging fashion. It was fitting that this was recognized with a rousing show of appreciation and admiration from the participants to the representative group of the over 750 local volunteers at the closing ceremony.

The UNWGIC Programme

The UNWGIC was a week-long (19-23 November 2018) event, with a plenary program which covered three days (19-21 November 2018) augmented by industry exhibitions, technology showcases, global and regional meetings, and technical side events. These included the seventh annual Plenary Meeting of national representatives from Member States to the Regional Committee of United Nations Global Geospatial Information Management for Asia and the Pacific (UN-GGIM-AP), the annual UN-GGIM Expanded Bureau Meeting, the second meeting of the United Nations Subcommittee on Geodesy, and the fifth meeting of the United Nations Expert Group on the Integration of Statistical and Geospatial Information. A broad overview of the delivered UNWGIC Programme is below.

<table>
<tr><th>Monday
19 November</th><th>Tuesday
20 November</th><th colspan="2">Wednesday
21 November</th><th>Thursday
22 November</th><th>Friday
23 November</th></tr>
<tr><td>Opening Ceremony</td><td>Plenary Session #2
(Attaining Sustainable Development)</td><td>Parallel Sessions
(fourth series)</td><td rowspan="2">Young Professionals Summit</td><td colspan="2" rowspan="4">Side Events, Meetings, and Global and Regional Meetings including:
UN-GGIM Expanded Bureau Meeting
Seventh annual Plenary Meeting of national representatives from Member States to the Regional Committee of United Nations Global Geospatial Information Management for Asia and the Pacific (UN-GGIM-AP)
Second meeting of the United Nations Subcommittee on Geodesy
Fifth meeting of the United Nations Expert Group on the Integration of Statistical and Geospatial Information
Meeting of the UNWGIC International Advisory Committee</td></tr>
<tr><td>Parallel Sessions
(first series)</td><td>Plenary Session #3
(Building Smart Societies)</td><td>Parallel Sessions
(fifth series)</td></tr>
<tr><td>Ministerial Dialogue
(Towards a More Sustainable World for All)</td><td>Parallel Sessions
(second series)</td><td colspan="2">Plenary Session #4
(Growing International Cooperation)</td></tr>
<tr><td>Plenary Session #1
(Sharing the Digital Economy)</td><td>Parallel Sessions
(third series)</td><td colspan="2">Issuing the Moganshan Declaration and Closing Ceremony</td></tr>
<tr><td colspan="6">Industry exhibit and technology showcase</td></tr>
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This featured a high-level Opening Ceremony, a Ministerial Dialogue, 4 Plenary Sessions and a comprehensive programme of seven technical Parallel Sessions:

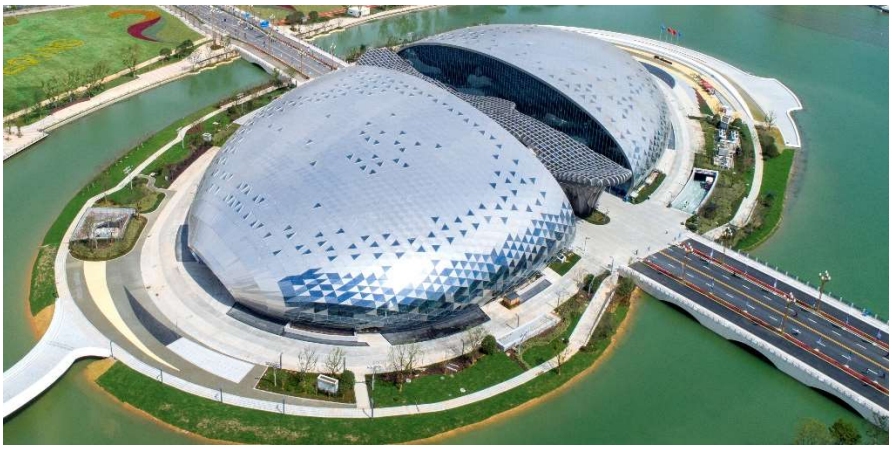
1. Measuring and Monitoring the SDGs;
2. Digital Economy, Location Analytics, and Big Data;
3. Smart, Resilient, and Sustainable Societies;
4. Growing Global Geospatial Capability and Capacity;
5. Geospatial Innovation, Science and Technology;

6. Digital Silk Road and International Partnerships; and,
7. Sustainable Development in Action.

These were augmented by three Special Sessions, showcasing:

1. Measuring Deqing's Progress Towards the SDGs with Geo-Statistical Information;
2. The UN-GGIM/ World Bank Integrated Geospatial Information Framework; and
3. Young Professionals Summit.

Delivering the UNWGIC



The UNWGIC Venue: Deqing International Convention Center

This diverse and inclusive programme enabled the UNWGIC to convene over 2,000 participants, in Deqing, Zhejiang Province, China. Participants came from over 78 countries: Antigua and Barbuda, Australia, Austria, Barbados, Belgium, Brazil, Burkina Faso, Cambodia, Cameroon, Canada, Chile, China, Denmark, Dominican Republic, Egypt, Ethiopia, Fiji, Finland, France, Germany, Ghana, Greece, Guyana, India, Indonesia, Iran (Islamic Republic of), Ireland, Israel, Italy, Jamaica, Japan, Kenya, Kuwait, Kyrgyzstan, Lao People's Democratic Republic, Latvia, Madagascar, Malaysia, Malta, Mexico, Monaco, Mongolia, Morocco, Myanmar, Namibia, Nepal, Netherlands, New Zealand, Niger, Nigeria, Norway, Oman, Pakistan, Palestine, Philippines, Poland, Portugal, Qatar, Republic of Korea, Russian Federation, Saudi Arabia, Senegal, Serbia, Singapore, Slovenia, South Africa, South Sudan, Spain, Sri Lanka, State of Palestine, Sudan, Sweden, Switzerland, Tajikistan, Thailand, Togo, Tonga, Uganda, Ukraine, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, United Republic of Tanzania, United States of America, Uruguay, Venezuela, Bolivarian Republic of, and Viet Nam.

The UNWGIC was organized by the United Nations Department of Economic and Social Affairs (DESA), with the support of the Government of China, through the Ministry of Natural Resources and the Zhejiang Provincial Government. Additionally, the UNWGIC was substantively supported by each of the Regional Committees of UN-GGIM, including: Africa (UN-GGIM: Africa); Asia and the Pacific (UN-GGIM-AP); the Americas (UN-GGIM: Americas); Europe (UN-GGIM: Europe); and the Arab States (UN-GGIM: Arab States), as well as the UN-GGIM Geospatial Societies, the UN-GGIM Academic Network and the UN-GGIM Private Sector Network. At the nexus of this coordination effort was the UN-GGIM Secretariat within the United Nations Statistics Division, DESA.

UNWGIC

Plenary Sessions

Opening Ceremony

The Opening Ceremony was moderated by Mr. Kurexi Maihesuti, Vice Minister, Ministry of Natural Resources of China and Chair of the Congress Bureau. It began with high-level Ministerial welcome statements from H.E. Mr. Li Keqiang, Premier of the State Council of China, H.E. Mr. António Guterres, Secretary-General, United Nations, and H.E. Mr. LU Hao, Minister, Ministry of Natural Resources of China.

Geographic information is an important basic and strategic resource that plays a role in economic and social development… We need to continue to work with countries within the UN framework to promote geographic information cooperation to serve the world

H.E. Mr. LI Keqiang, Premier of the State Council of China

These remarks were extended through welcome addresses by H.E. Mr. Liu Zhenmin, Under-Secretary-General for Economic and Social Affairs, United Nations, H.E. Mr. Yuan Jiajun, Governor of Zhejiang Province, China and Ms. Dorine Burmanje, the Co-Chair of UN-GGIM, each reinforcing the importance of geospatial information to the three pillars of Sustainable Development, society, the economy, and environment, stressing the role of geospatial information in achieving a better world for all and leaving no one behind.

Jack Dangermond, President of Esri providing the opening keynote

Following these addresses, Mr. Jack Dangermond (above) and Mr. James Fallows, luminaries of the geospatial information industry and policy realms provided thought-provoking keynote addresses, stressing the need for collaboration and innovation within all sectors of the geospatial information industry, charting how geospatial information will help us realise a sustainable future, while also considering the journey to date.

"Digital Transformation is just beginning… We need to come together and think about what's coming next, now is the time to go faster – not to slow down!"

Mr. Jack Dangermond, President of Esri

Mr Sanjay Kumar, CEO of Geospatial Media and Communications receiving the Global Geospatial Industry Ambassador Award

In closing the Opening Ceremony, the Global Geospatial Industry Ambassador award was conferred upon Mr. Sanjay Kumar, the CEO of Geospatial Media and Communications by Ms. Dorine Burmanje, Co-Chair of UN-GGIM and Mr. Stefan Schweinfest, Director of United Nations Statistics Division.

"During my 20-year journey, I am blessed to have been helped, motivated and supported by a large number of people in pursuing my mission. I always like to be friends with people I work with and that friendship keeps me going"

Mr. Sanjay Kumar, CEO of Geospatial Media and Communications

Ministerial Dialogue – Towards a More Sustainable World for All

The Ministerial Dialog underlined the critically of geospatial information to support the economy of their countries by discussing the policy relevance, challenges, and role of geospatial technology and innovation in providing national implementations for measuring and monitoring the SDGs; Ensuring economic development and social prosperity. 12 ministers representing Barbados, Cambodia, Indonesia, Lao People's Democratic Republic, Madagascar, Nepal, Niger, Saudi Arabia, Slovenia, Tonga, and State of Palestine demonstrated the global reach of the UNWGIC.

The ministerial dialogue discussed the economic impact that geospatial information has and can have, through the further adoption of geospatial information management practices and dissemination of geospatial information. Ministers' highlighted that availability of geospatial information needs to be extended to further support the digital transformation agenda and to have one data policy, using internationally adopted standards, across government. The provision of geospatial information enables investment, both internally and externally and helps drive economic development of lesser developed countries as well as the developed ones.

"For a finance minister, GIS is critical for both revenue and spending"

Dr. Bambang Permadi Brodjonegoro, Minister of National Development Planning, Indonesia

The Hon. Mr. Poasi Tei, Minister for Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communications, Tonga, speaking during the Ministerial Dialogue

It was noted that Ministers need to be champions for geospatial information, regardless of the ministry they represent, and the discussion on geospatial information needs to be elevated at the political level. It is vital for geospatial information to be coordinated and cooperated across government ministries. In communicating the benefits of geospatial information better, we can maximise the impact. Geospatial information supports better urban planning, agriculture, and crosses across other sectors. It can also act as an enabler for international cooperation, but needs to be utilized more. Additionally, the challenge of old maps and geospatial information needs to be resolved, if we want to improve decision making.

"We need to give more space to innovation, whether it's individuals or groups"

Dr. Hussein Al Araj, Minister for Local Government in the State of Palestine

Ultimately the Ministerial Dialogue stressed the need to combine national priorities with international frameworks, such as the Integrated Geospatial Information Framework, enabling progression for the 2030 Agenda and regional, national, and sub-national priorities.

Plenary 1: Sharing the Digital Economy

Plenary 1: Sharing the Digital Economy, focused on the immense potential of 'digital transformation' and focused on how the information technology sector is a major disruptor that is triggering a new digital economy. Geospatial information is leading the way in enabling this transformation and as such is being mainstreamed across major industry sectors. The Plenary was moderated Mr. James Fallows, a renowned writer, journalist, and geospatial advocate with The Atlantic magazine and featured presentations from:

- Mr. Jack Dangermond the President of Esri;
- Mr. Nigel Clifford, Operating Executive, Marlin Operations Group;
- Mr. Daniel Zhang, the Chief Executive Officer, Alibaba Group; and,
- Mr. William Priest, Director, UK Geospatial Commission, UK.

In featuring global technology and business leaders, the plenary drilled into the potential opportunities of mainstreaming the enabling technologies that are emerging and discussed the influence and impact that these innovations will have within the geospatial data ecosystem and its life-cycle.

"Every business in the future will use geospatial information"

Mr. Daniel Zhang, the Chief Executive Officer, Alibaba Group

The plenary discussed that people are passionate about the future and seriously consider the 'what if's' and alternative approaches to using and developing technology. If the technology is properly applied, we will create key benefits and sustainable development, but these opportunities are tempered by the need to use data in a proper way, whether conforming to ethical or legal requirements, or both.

"Systems thinking is key to geospatial information. We need to unlock ecosystems, economics, and entrepreneurship. This leads to us unlocking and enhancing engagement."

Mr. Nigel Clifford, Operating Executive, Marlin Operations Group

The speakers informed participants on how disruptive technologies and the applications and interfaces that enable robust and repeatable modelling and location analytics in the modern digital economy, are fundamentally altering the way geospatial information is being used and delivered. While this allows the gathering and management of large volumes of both structured and unstructured data in a standardized and interoperable way from many sources – both traditional and non-traditional – there are concerns about its use. As remarked by Mr Jack Dangermond, there is a huge need to create a spatially literate next generation to fully harness and realise this opportunity.

Each of the speakers underlined the need to consider how to safe guard individual privacy and ensure cyber security, as much of the impact of digital transformation will be realised through the amalgamation of consumer and individual data. These datasets will contain information derived from consumer spending or from location information. The potential of this information was stressed by Mr Daniel Zhang, noting that such information can be used in many ways, but for those companies who create platforms for its use; ultimately there needs to be a lot of self-discipline to use this data responsibly and these are augmented by policy and legal frameworks.

"We need to keep bridging the digital divide, this related to bridging the productivity gap. Geospatial information enables us to understand the size of the gap and to effect measures to bridge it"

Mr. William Priest, Director, UK Geospatial Commission

Plenary 2: Attaining Sustainable Development

"There are many opportunities for geospatial information agencies to engage and support the achievement of the SDGs"

Dr. Virginia Burkett – Chief Scientist, Climate and Land Use Change, US Geological Survey

Plenary 2: Attaining Sustainable Development discussed the 17 SDGs, 169 targets and 232 global indicators of the 2030 Sustainable Development Agenda. This global agenda is at the nexus of the intrinsic relationship between people and their environment, their place and their geography. The plenary was moderated by Mr. Stefan Schweinfest, Director, UN Statistics Division with presentations from:

- Ms. Rosamond Bing, Chief Executive Officer, Ministry of Lands and Natural Resources, Kingdom of Tonga;
- Dr. Virginia Burkett, Chief Scientist, Climate and Land Use Change, US Geological Surveys, United States of America;
- Ms. Simonetta Di Pippo, Director, United Nations Office for Outer Space Affairs; and,
- Mr. Feng Fei, Executive Vice Governor, Zhejiang Province, China.

Accordingly, this session discussed how new data acquisition and integration approaches, including Earth observations and geospatial information, can recognise and realise a shared vision which urges the development and use of new and innovative data sources and methods.

"Space is a global commons; the advancements of space technology benefit all member states of the UN in one way or the other"

Ms. Simonetta Di Pippo – Director, UNOOSA

Furthermore, the ensuring discourse discussed that geospatial information can enable nations and those who support them to address local, regional, and global development challenges. In doing so, we will ultimately support the implementation and achievement of the 2030 Agenda and its Sustainable Development Goals. In covering the full gamut of location, the importance of global data was noted, but it was stressed that we need to leave no-one behind.

"The protection of the environment is the most important competitive edge that we have in Zhejiang Province"

Mr. Feng Fei – Executive Vice Governor, Zhejiang Province, China

Plenary 3: Building Smart Societies

"Everything happens somewhere, let's have it happen in smart societies and leave no-one behind"

Ms. Dorine Burmanje – Co-Chair, UN-GGIM

Plenary 3: Building Smart Societies took a deep dive into the cities and how to build smarter societies. Cities form an ideal "spatial location" and generating and consuming massive amounts of data related to people, their place, their activities and their environment. Urban areas house more than half of the world's population and generating 80% of global economic activity. Geospatial information is a recognised key driver that will create and enable smarter cities and societies that improve the livelihoods of their residents in reducing poverty and raising shared prosperity. This plenary was moderated by Ms. Dorine Burmanje, the Co-Chair of UN-GGIM with presentations from:

- Mr. Jure Leben, Minister for the Environment and Spatial Planning, Slovenia;
- Dr. Bowen Zhou, Vice-President, JD.com, China;
- Mr. Tan Boon Khai, Chief Executive Officer, Singapore Land Authority, Singapore;
- Mr. Jonathan Hoeflinger, President and CEO, Sharemeister; and,
- Mr. Colin Bray, Chief Executive Officer, Ordnance Survey, Ireland.

Speakers envisioned the cities of the future as being *smarter* through data driven insights that are *location-enabled* to ensure effective and efficient planning, development, management, and resilience. Land use planning and consumption rates; housing; urban expansion and monitoring; transport, utilities and related infrastructure; to energy consumption, health, education and other social services are all areas which will benefit from enhanced decision making as stressed by the plenary's speakers.

"Geospatial information empowers smart societies, communities, improved decision making, and economic development, both within the state and within the private sector… Experimentation is key. When something works, we need to take it to scale… you may not get it right the first time around, but if you constantly try you will succeed."

Mr. Tan Boon Khai – Chief Executive Officer, Singapore Land Authority, Singapore

There is a massive need for information management platforms which will enable the discovery, analysis, and communication of the nexus that the integration of statistics, geospatial information, and data will bring. The Federated Information Systems for the SDGs is one such platform that is crucial to achieving this vision. In summary, smart and location-enabled societies will become a reality when digital technology is thoughtfully deployed by governments with the end goal of improving the well-being of citizens, the economy, and the environment.

"Whether statistics, SDGs, or local government, we need to have the same data and in hubs to enable our users to tell stories and make decisions. The Federated Information System for the SDGs makes this possible."

Mr. Colin Bray, Chief Executive Officer, Ordnance Survey Ireland

Plenary 4: Growing International Cooperation

Plenary 4: Growing International Cooperation examined the vital role and interrelationships of international cooperation and capacity development for the sustainable development agenda, underpinned by geospatial information. This plenary was moderated by Ms. Ingrid Vanden Berghe, Administrator-General, National Geographic Institute, Belgium with presentations from:

- Mr. Jasper Kakooza, Senior Staff Surveyor, Ministry of Lands, Housing and Urban Development, Uganda;
- Mr. Ross Comstock, Vice President, Information Systems and Technology, Kellogg Foundation;
- Mr. Sanjay Kumar, Secretary-General and CEO of the World Geospatial Industry Council;
- Dr. Stuart Minchin, Chief, Environmental Geoscience Division, Geoscience Australia; and
- Mr. Alexandre Caldas, Chief, Country Outreach, Technology & Innovation, UN Environment.

The speakers underlined that a major capacity development goal for many developing countries is to ensure that international cooperation and partnerships leverage and recognise the opportunity afforded by geospatial information. However, many countries are limited by a lack of capacity with respect to the management, analysis and dissemination of geospatial information that enables informed decision making.

> *"Countries have expressed a need for better access and capacity for applying Earth observation data to national priorities"*
>
> **Dr. Stuart Minchin, Chief, Environmental Geoscience Division, Geoscience Australia**

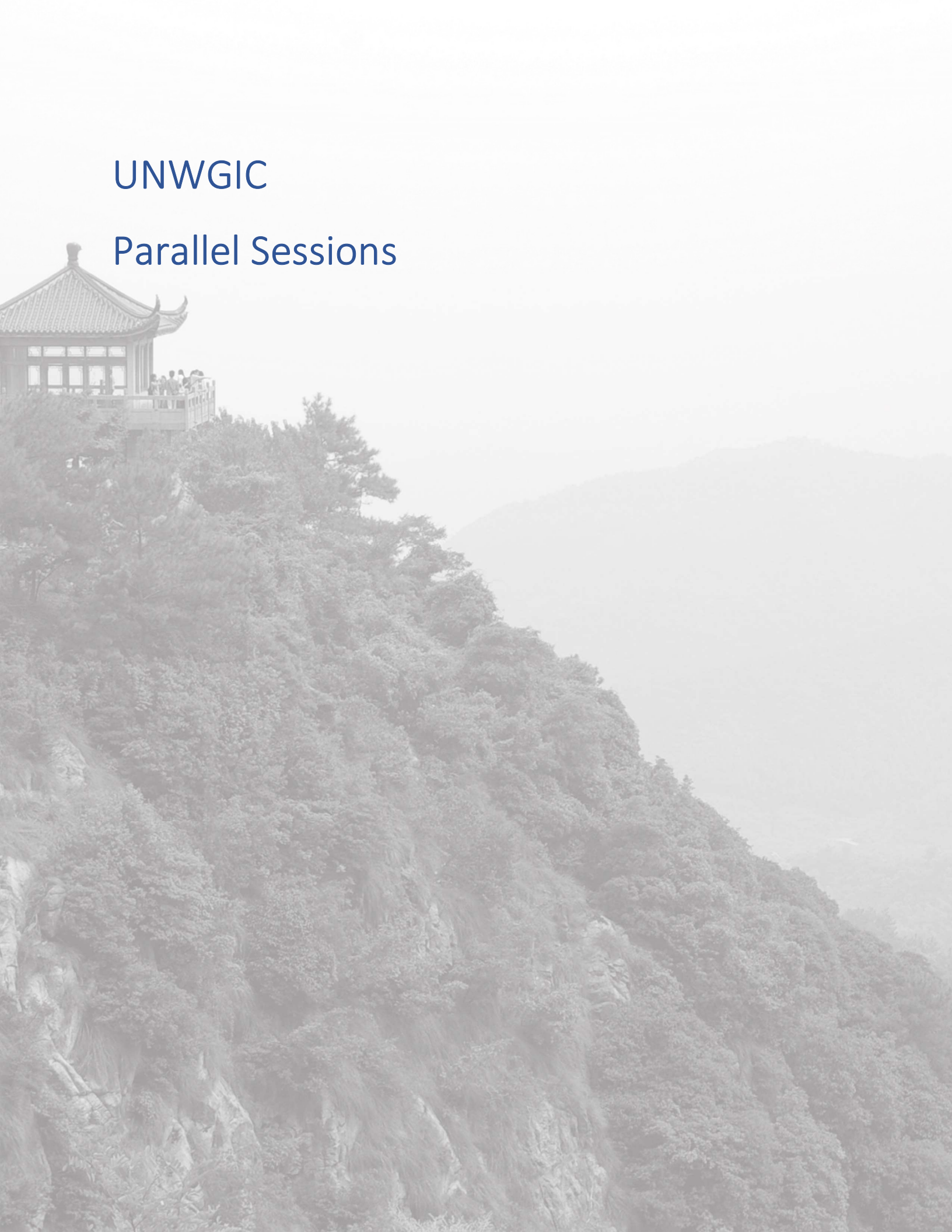
International partnerships between countries, the geospatial information industry, and civil society are one plank that can be used to bridge this gap and are key to fostering the cooperative foundation needed for sustainable development. International partnerships are key to collaborating across borders and increasing trade and socio-economic development; this is exemplified the Belt and Road and Digital Earth Africa initiatives. The Belt and Road region covers 65% of the world's population, 85% of the world's major disasters, and 18 cities with populations of 10 million or more. Digital Earth Africa provides an operational data infrastructure, deployable in the cloud or locally, that gives the government control over the management and exploitation of analysis ready insights from Earth observation data. From the industry perspective, the World Geospatial Industry Council (WGIC) was introduced, as a newly formed entity which facilitate exchange of knowledge within the geospatial industry, with a global representation. The WGIC will represent business interests, share perspectives of the geospatial industry, and undertake policy advocacy and dialogue with public authorities, multilateral agencies and others.

> *"The World Geospatial Industry Council is a collaborative platform to advance role of geospatial industry and strengthen its contribution in world economy and society"*
>
> **Mr. Sanjay Kumar, Secretary-General and CEO of the World Geospatial Industry Council**

In each case, governments and industry are using geospatial information as a foundation for working and collaborating across borders, further emphasising the need for partnerships and cooperation.

UNWGIC

Parallel Sessions



Measuring and Monitoring the SDGs

This parallel session underlined the criticality of geospatial information as an underpinning foundation for the SDGs. It observed that there is a need to not build separate geospatial, statistical, or earth observation communities but build an overarching, interoperable data community. This data community foundation will optimise the potential of integrated geospatial information to support the measurement and monitoring of SDGs. Innovations such as Data Cubes, approaches to statistical aggregation and disaggregation, and data sources (i.e. from Big Data sources like mobile phones) are being researched, developed, analysed, and piloted. This ultimately leads to good practices being developed to enable access to accurate, validated, meaningful data and they are the key to measure and monitor meaningful SDGs. The parallel session identified that there is a crucial role for government leadership and geospatial information in engaging decision makers to measure and monitor the SDGs.

Statistical-Geospatial Integration for the SDGs and 2020 Censuses

The session began with an overview of statistical-geospatial integration, discussing that national, regional and international data users and producers face a range of challenges integrating statistical, administrative and geospatial datasets to generate insights and informing decision making. In response to this challenge, the Global Statistical Geospatial Framework (GSGF) was introduced. The GSGF was developed through extensive international discussion and consultation, with strong participation from both the geospatial and statistical communities. The GSGF is critical to geospatially enabling statistical information and facilitation integration with geospatial information (in both directions). In 2018, the GSGF has strong regional (Africa through the African Statistical Spatial Framework; the Americas through the MEGA project) and national adoption (including Australia, Egypt, Mexico, New Zealand, Sweden and others) and is enabling interoperability between the statistical and geospatial realms. The criticality of this is reinforced by the data needs of the upcoming 2020 round of Population and Housing Censuses. While implementing the GSGF is an opportunity for nation building and for nations to go beyond household censuses to bring technological advancement and capacity to their communities, the impact and opportunity of the convergence of global policy agendas such as the SDGs, Sendai Framework, Paris Climate Agreement among many others is one that the world needs and can fully harness. Ultimately, the GSGF enables the linkages between the Environment, Society, and the Economy to empower people, businesses and an understanding of location.

Geospatial Disaggregation and Aggregation for the SDGs

This session discussed the need to look beyond traditional data sources to enable nations with capacity challenges to produce subnational data. Aggregation and disaggregation are key statistical concepts. An aggregate is often used to show a total of an average of a number. For example, the population of a country. Conversely, disaggregation of data could be demographically disaggregated i.e. by population at a sub-national level, by gender, or any other data point collected. As the overarching principle of the 2030 Agenda is that no one should be left behind. There is an urgent need for data which is high quality, accessible, timely, reliable and disaggregated by income, sex, age, race, ethnicity, migration status, disability and geographic location and other characteristics relevant in national contexts. Accordingly, this session provided three case studies, covering the theoretical, methodological and practical aspects of geospatial disaggregation and aggregation. The session concluded that there is a great need of methodology for disaggregation and aggregation of both geospatial and statistical data and that good practices on geospatial disaggregation and aggregation are important and should be collected for sharing

to inform capacity development, while recognising that the reliability of SDG indicators affected by the disaggregation and aggregation issues should be addressed in future.

The Global Indicator Framework: New and Innovative Methods for Disaggregation by Geolocation

This session discussed the numerous innovative methods being developed, explored and importantly used to produce indicators, to improve master samples and for disaggregation, these include machine learning, Small Area estimation, and other innovative mapping techniques. These new techniques are being augmented by novel data sources to produce SDG indicators. The process of integration of geospatial and statistical communities at global, regional and national levels allows leveraging and cross-regional pollination of new methodologies (e.g. Mexico using Australia's data cube and using this technology to produce SDG indicators at the sub-national level) but also the need to exploit further (e.g. Earth Observations allowing Brazil to count rooftops as a proxy for poverty). Innovation is the key to strengthening national statistical systems and to support integration efforts between the statistical and geospatial communities, this can be amplified by fostering partnership with global initiatives (e.g. UN Global Pulse Lab, UNEP, UN-Habitat, World Bank). The role of international efforts to coordinate the development of new methodologies and approaches to developing data for the global indicator framework was discussed, focusing on the work of the Inter-agency and Expert Group on the Sustainable Development Goal Indictors' Working Group on Geospatial Information (IAEG-SDGs WGGI). This includes the preparation of a shortlist of global SDG indicators where geospatial data is directly needed. Finally, experiences of national implementations of the Federated Information Systems for the SDGs (FIS4SDGs) project was discussed by Senegal and Mexico, where the FIS4SDGs platform has enabled the bridging between both the geospatial and statistical communities with producing open SDG data and placing it in a portal to assist with informed decision making at the policy level, subsequently aggregating this data at the global level. The session was summarised by the moderator, noting that implementing systems like the FIS4SDGs enables countries to implement mechanisms which report and monitor the Global Indicator Framework, supporting aggregation and disaggregation of data at the regional and global level, while providing the infrastructure for a country to understand and make informed policy decisions at the national and sub-national levels - *One size may not fit all, it has to be national relevant*.

Geospatial Innovations for Detecting and Mapping Infrastructure, Censuses, and Modelled Population

The session considered two technologies GRID3 and FinitEdge and associated case studies that use outputs from Earth Observation and innovative, research-led approaches to generate novel forms of geographic data to inform the SDGs and national priorities through country-level case studies. The case studies and technology demonstrations raised discussion within the session, noting that for many of the SDG indicators, the definition and conceptualisation of terms is still not clear. For instance, what is urban? What is land consumption? There is a need for further research, discussion, and dissemination of lessons learned in the development and implementation of specific indicators. This includes sharing examples indicator by indicator of how a country conceptualised it, what data source they used, what methodology they used, and how the resulting data was used. The opportunity of taking an innovative approach was underlined, noting that sometimes, one problem can provide an opportunity for resolving another problem. This was exemplified by Nigeria's transition from cholera to polio monitoring with GRID3 to utilising the approach to strengthening capacity across Nigeria and applying lessons learned in other

countries. It was noted that government leadership and ownership is the critical factor for success. Whereas the barriers of software and hardware have reduced over the years and has allowed easier data collection and processing, but other issues such as privacy, confidentiality, protecting count data, and special considerations remain as a concern. The session summarised that governments need to step up and take a leading role in activities to support the promotion and adoption of innovative geospatial information activities to inform decision making.

Sustainable Development Outcomes Using Geospatial Data

This session demonstrated how geospatial data can be integrated into delivering tangible outcomes in the reporting of sustainable development. It discussed the steps that statistical institutes who have the responsibility for data to track progress towards the SDGs and geospatial organizations that support them can take to achieve the SDGs, through case studies from Senegal and the United Kingdom and an ensuing discussion. It was noted that the 2030 Agenda is enabling a transformative process with the Global Indicator Framework supporting collaboration and partnerships using new data sources (for example with using Earth Observations and machine-learning). This process is augmented and further accelerated by the changing role of government authorities, with change from supplier to coordinator, regulator to partnership facilitator. As such, it is important to not just limit the focus on SDG reporting but more broadly on improved outcomes across a country's information infrastructure. Frameworks, such as the GSGF are providing an enabling mechanism that creates a bridge between the statistical and geospatial communities, which in turn facilitates information sharing for the sustainable development agenda and ultimately strengthen a country's infrastructure. It was stressed that organisational collaboration is key – not just between geospatial and statistical agencies but also with other sectors that produce relevant and usable data, such as meteorological agencies. This is exemplified through Senegal's experience of implementing the FIS4SDGs, which is building a system of federated geospatial platforms between NSOs, NMAs, the private sector allowing the mapping SDG indicators, but also providing a foundational information infrastructure for the nation.

Digital Economy, Location Analytics, and Big Data

This parallel session took an in-depth look in the opportunities and innovations within the realms of earth observation, artificial intelligence, data privacy and security, new decision-making applications, the shift from data access to answers, and the need for data provenance – so we know how much to trust information. Over the last 40 years Earth Observation has been collected and we are now able to make full and effective use of this data for time analysis on a global scale, with this maturation, the Earth Observation sector has moved on from simply processing data for analysis to delivering 'application ready' data to create 'decision products' for informed data driven decision making.

Artificial Intelligence within the Digital Economy

This session discussed the hype around Artificial Intelligence (AI) and its challenges. Yet there are also significant opportunities when general computing technologies meet geospatial data and applications, particularly big geospatially enabled data for environmental monitoring. To take full advantage of AI capabilities, the Geospatial and computing faculties and businesses need to work more closely together. Today, AI is facing implementation issues and there are serious research challenges. Predictive models have an excessively high error rate, but its potential to inform the world is massive and is starting to be delivered, for example through improving disaster preparedness through prediction can deliver preventative tools e.g. flood prediction models, landslide prediction models. It was noted that it is these opportunities that will open the door for the mass adoption of AI. There is potential to remove the mundane tasks to focus on the more creative tasks; there is a mass amount of data available and potential to infer new knowledge; hardware advances and Internet of Things (IoT) devices increase have in number; machine-learning used to target specific tasks, such as for healthcare, automotive, financial services, transportation and logistics, media and communications, retail, energy and manufacturing. Ultimately, the session found that while there is massive potential for AI to inform the creation, curation, dissemination, and use of geospatial information more research is required in the heterogeneous syntactic and semantic variability, dynamic 'spatial and temporal' environments, global coverage systems, finer granularity systems, privacy and security areas.

Intelligent Transportation and Autonomous Vehicles

This session examined the opportunity of geospatial information to inform the advancement of global transportation. It was noted that high-precision positioning and reliable spatial data are necessary conditions for proactive prevention of accidents as standard road maps for navigation are not suitable for intelligent transport systems. Discussions of the technical challenges included: a) Data Collection and Updating such as the integration of professional and crowdsourced data; b) Map production and data processing such as multi-semantic segmentation, computer vision and geometric rendering and topology; c) Dynamic data interactions such as machine vision and target detection, multi-source sensor collaboration, and Vehicle to Vehicle Infrastructure; d) Computing Patterns such as cloud computing, edge calculations (cloud and terminal collaboration); e) Application and Usage such as lane level map matching, map-assisted perception and precision, planning and obstacle avoidance; and f) Autonomous intelligent control, such as the accurate matching between traffic signs and dynamic position of vehicles, real-time driver control through information using a vehicle-based IoT, Environmental and behavioural monitoring, and driver behaviour and driving control. In conclusion, the session found to fully take advantage of the opportunity that intelligent transportation and autonomous vehicles offer, there is a need for high precision data, sensors, and processing capability.

Knowledge On-demand Environments

This session presented an architecture for 'Knowledge On-demand' environments, along with an explanation of how governments are publishing machine-readable linked data to support knowledge inferencing and semantic interoperability. Geospatial information powers applications for understanding the impact of climate change and the optimisation of mining and agriculture, among many other sectoral applications. This session discussed the impact that can be achieved through leveraging machine learning for on-demand and evidence-based decision-making. It was noted that our society has an expectation for instant access to information through mobile applications, but data needs to be linked to fully harness this opportunity. Ultimately, the session recommends that National Mapping Agencies and governments generally can enable Knowledge On-demand applications by publishing Linked Data to openly, in a machine readable, standardised manner so it can be integrated with other data. This can be achieved through following the principles of the "5-star deployment scheme" for geospatial computations, geoprocessing, analysis, and knowledge inferencing.

Ubiquitous Location Values and Big Data Analytics

This session identified areas where the bottleneck of current practices in technology, business models, and regulations exist, and demonstrated how to break through these difficulties. This was achieved by providing an insight into what can be done by policy makers to accomplish the power of location analytics in the future, through case studies on real-time for sports analytics, indoor positioning, and urban transport planning. In each of these case studies, location privacy, how to provide/receive data from sensors such as mobile phones, and the need (and challenges) of big data. The session noted that there is an urgent need to educate decision makers on these issues, so that legislation can balance the potential benefits and minimise potential risks.

Innovative Techniques for Big Earth Observation Data Analyses

This session demonstrated emerging new approaches of analysing big Earth observation data enabled by recent developments in information technology including machine learning, artificial intelligence and cloud computing. This was achieved through examining new remote sensing image classification methods and how new information generated by those innovative analysis approaches provide new knowledge of the environment that supports better decision-making. It was discussed that over the last 40 years Earth observations have been collected and we are now able to make full and effective use of this data for time analysis on a global scale. However, the Earth observation sector have faced increasing challenges with how to process and make sense of this data in an automated way. Here, the opportunity of AI, and in particular machine learning techniques, have made it possible to efficiently and effectively conduct image processing on a globe scale including feature extraction of buildings leading to inferences on population density to create a representation of a global human settlement – to-date, roughly 1,300 city centres have been identified using this technique raising awareness of how urban development has grown and where the social challenges are likely to be occurring. Ultimately, space technologies are still an underutilised data commodity and so the Earth observation industry have been increasing engaging and working collaboratively in support of open data, disaster risk management, and other areas. As such, the session concluded that it is essential to promote the potential of Earth observations. This can be achieved through raising awareness at conferences, developing and disseminating cases studies; developing open toolsets to support platform development, and support mechanisms to trigger funding for the exploitation and development of Earth observation data analyses, whether through commercial research and development, government provided grants, or seed investment.

Smart, Resilient, and Sustainable Societies

This parallel session focused on the use of geospatial information to build a smart, resilient, and sustainable societies. The main point emanating from this parallel session was that identifying, validating and improving fundamental geospatial data; the use of geospatial data standards and having a robust geodetic network are essential to supporting disaster risk reduction, resilience, and management. Accordingly, high precision, real time geospatial data is crucial to support the sustainable operation of smart cities. Other factors critical to sustaining smart cities are interoperability, the creation of 3D models and importantly sustaining geo-capability by training young persons. Ultimately, technology is not the panacea in the creation of smart cities, particularly given that one size does not fit all; decision makers should also examine and integrate social, economic and environmental needs.

Artificial Intelligence and the Future of Urban Planning

This session examined the use of artificial intelligence and deep learning and demonstrated the potential of these innovations to understand population growth and the growth and development patterns of cities over time. Machine learning is used to see similarities among cities, and their common challenges. The Intelligent City Simulation Platform (supported by UNESCO) allows city planners to see the process of a city's evolution – growth, land use changes, use of electricity and water and need for social services in hours and no longer years. This supports efficient and effective infrastructure management and the creation of smart cities. The session noted the shift in planning systems towards comprehensive spatial planning, where cities can be smart and ecological - the "Eco-Smart City". This new planning framework is supported by a complex system of modelling which simulates the interaction of human and land, with reaction to policy decisions, and stakeholder intervention. Many other factors can be considered and inputted to create better physical designs for cities and regions. In conclusion, it was stressed that research, development, and innovation, are crucial in maximising the opportunity of artificial intelligence to inform decision making and building smarter, eco-friendly cities.

Innovations in Location Intelligence for Smarter, Sustainable Cities

This session considered how innovative technologies and approaches, such as the Internet of Things, Crowd Sourcing and Big Data coupled with geospatial information and related tools are being used to create smart management platforms for intelligence monitoring, assessment and evaluation in the creation and management of sustainable cities. Presenters shared that geospatial information and its enabling technologies are fostering collaborative innovation across governments, businesses communities and the society in general. This is evidenced by the "I love Beijing" initiative, the "Zanzibar Mapping Initiative" community mapping using Drones in Zanzibar Tanzania, and the creation of companies such as MoBike. These have all resulted in cross cutting benefits, including the reduction in congestion; improved transportation; reduction of carbon monoxide emissions; among others, all leading towards a greener environment and a more transparent government.

Bringing New Ideas to Plan Sustainable Societies

This session explored how available, timely and accurate geospatial data are important for the current and future monitoring and prediction of agricultural productivity, for making accurate decisions and to support unmanned farming. Physical sensing (photogrammetry, remote sensing, field surveys) and social sensing (smart phone, video surveillance, navigation devices, wearable devices) must be combined/integrated to better understand the geographical space. A virtual geographic experience can

be created with the combination of virtual reality and GIS, this can be used to model and manage cities, for example to generate simulation models for crowd evacuation. The session concluded that in addressing many sustainable development challenges, a multidisciplinary approach must be adopted, with geospatial information and its associated tools having the capability to bring everything together and bridge the gaps; it brings together many practitioners with different skills sets, many places over time, many databases and many applicable data sets.

Disasters will Happen: How can we be Better Prepared

This session reviewed how authoritative, timely and accessible geospatial data is integral to every stage of the disaster risk reduction and management cycle, particularly for rehabilitation and reconstruction activities. To achieve the sustainable development goal of safe cities and therefore to effectively respond to disasters, geospatial information providers must be prepared; background, vulnerability and base line datasets must be properly analysed with clear messages and made available on shared platforms to be readily accessed by responders; the data need not be perfect, but most importantly be available in a timely manner. In responding to emergencies supporting technologies should not be tested at the time of a disaster, this is to be done at the preparedness stage. Given increasing population growth and complex economic, social and environmental situations resulting from disasters, it is important to improve resilience and resilience impact of land and geospatial information systems in providing a common platform for countries and to map the interconnectivity between the SDG's and disaster management for resilience. key elements to support this work is the Strategic Framework on Geospatial Information and Services for Disasters and the Integrated Geospatial Information Framework closer together, ultimately leading to a stronger foundation for DRM. The session concluded that the human element is critical in building climate resilience. All stakeholders must work together to understand their differences and requirements to have them translated to sensible context.

Spatially Enabled Future Cities

This session reviewed the opportunities gained through geospatially enabling future cities. In the design of smart cities, it is important to consider that for future cities to thrive, high precision, and real time geospatial data is crucial to sustainably support future cities. Other factors critical to sustaining smart cities are interoperability, the creation of 3D models, and most importantly, sustaining geo-capability by training the next generation of urban planners, disaster risk officers, and geographers. Countries like Singapore take an ecosystem approach to examining how to best develop and progress their cities, including all stakeholders, whether software and technology providers, users, academia, and government being convened to collaborate to develop policies and standards, data and technology, skilled and qualified personnel, a committed organization, quality control and evaluation and reactivation, and research and development are all essential elements for utilities mapping in support of planning and land administration. It was stressed that it is important to consider that technology is not the panacea in the creation of smart cities, particularly given that one size does not fit all; decision makers should also examine and integrate social, economic, and environmental factors to achieve sustainable development.

Growing Global Geospatial Capability and Capacity

This parallel session stressed that geospatial information is essential for making informed decisions. Data and maps are not end, but the beginning of creating an environment that can be sustainably leveraged to impact the societal, environmental and economic pillars of sustainable development. Democratising accessible, free and reliable geospatial information unlocks the true potential of data to be utilised by communities, governments, citizens and the private sector. Academia, global and regional organisations, and specialist societies complement each other through enabling users to keep up with the pace of technology. Ultimately, this parallel session urged participants to consider that capacity building is critical to adapt to technology and societal changes and this requires constant engagement with partners to gain a full insight and establish clear long-term strategy and objectives towards growing capability and capacity.

FIS4SDGs: Engaging Government and Citizens with the SDGs

This session covered the Federated Information System for the SDGs (FIS4SDGs). The FIS4SDGs is a federated information system that promotes the exploration, analysis, and use of authoritative SDG data sources for evidence-based decision-making and advocacy, with the goal of enabling data providers, managers and users to discover, understand, and communicate patterns and inter-relationships in the wealth of SDG data and statistics that are now available. Starting as a research project in 2016, as of the UNWGIC, it is now running at scale globally and is helping set national, regional, and the global agenda for sharing data and information for attaining the SDGs. Speakers at the session, from Ireland, African Centre for Statistics (United Nations Economic Commission for Africa), UN Environment, and Esri underlined the need to turn data into action and that this can be achieved by collaboration between differing national ministries and agencies, turning data into action.

National Mapping and Geospatial Agencies: To Change is to Prosper

This session discussed the changing nature of National Mapping and Geospatial Agencies, considering their criticality within a nation's infrastructure and how they continue to transform to maximise the opportunity afforded by geospatial information. Featuring geospatial leaders from Belgium, India, Singapore, Mexico, Senegal, Sweden, the United Kingdom, and Esri, speakers discussed how they are addressing change within their organisation and how they are leveraging technology as a mechanism for positive change, both institutionally and nationally. The importance of national agencies was belied, with speakers discussing that trusted data and services remains the key differentiator for the dissemination of national geospatial information and that includes maintaining its quality to an agreed standard. In summary, it was discussed that the need to develop technology platforms and infrastructure should be based on your current and anticipated needs in an open manner, whilst keeping adaptable as technology changes so that long-term capacity building can align with national strategic objectives and build sustainable partnerships with the private and donor sectors.

Laws, Regulations, and Policy Impacting Collection, Storage, Access, and Use of Geospatial Information

This session reviewed the legal, regulatory, and policy dimension of geospatial information and the challenges and opportunities in balancing concerns regarding open data policies, privacy, and other relevant factors. The speakers remarked that the legal and policy frameworks must balance opposing interests of opening up data verses protecting commercial/privacy interests and overcome the barriers that technological change causes national legal and policy environments. Resources such as the Compendium on Licensing of Geospatial Information can be used to guide and inform on the legal issues surrounding geospatial information but are to be considered a starting point to operating within the national legal and regulatory framework of a country.

Marine Geospatial Information: Development and Applications

This session's speakers focused on the impact and potential of geospatial information to support the monitoring of the arctic and oceanic marine environments. The speakers came from the intersection of academia and industry, reviewing how geospatial information and earth observations are supporting monitoring sea level rise and the rapid changes within the polar ice coverages, but stressing that there are gaps within the coverage of geospatial information to make informed decision making. This is further amplified by the disjointed nature of collaboration within the oceanic and polar worlds, as no one country has domain over these environments, collaboration between industry, academia, and governments is necessary. The session summarised that while the progressive use of technology will help safeguard these fundamental environments, further investment within digital and virtual geospatial information systems is needed to help maximise and manage the opportunity that is presented by monitoring change in these environments.

Global to National Geodetic Frameworks: Core to Building a Better World

This session's speakers reviewed three diverse themes related to geodetic frameworks: the importance of geodesy to nations and society including key drives; the challenges of managing existing geodetic infrastructure for Member States and collaborative measures needed to sustain a modern global geodetic reference frame; and, general geodetic capability development and associated challenges. At the heart of this geodetic discussion was the Global Geodetic Reference Frame, a foundational block within the development of the International Terrestrial Reference Frame. The speakers stressed the critical nature of partnerships and networks to establish and raise awareness of the GGRF and the need for Member States to maintain and contribute to the ITRF, but also recognising the complementary role played by academia, the private sector, civil society, and others in providing the business case for global geodesy. This does not yet resolve the challenges and political will to invest within geodetic infrastructure, but global initiatives, such as the United Nations Subcommittee on Geodesy are raising the profile of why accurate positioning is critical to sustainable development and national priorities.

Geospatial Innovation, Science and Technology

This parallel session examined the central innovative role of geospatial information, discussing that artificial intelligence, data privacy and security, analysis ready data, and trust are all critical to the digital economy and require geospatial information to fully harness their potential. This is exemplified by the role of geospatial information in supporting the earth observation sector from processing data for analysis to delivering 'application ready' data to create 'decision products' that decision makers and others within the global community can rely – ultimately, the future is bright and positive, and geospatial information will drive the future of the digital economy.

Geospatial Innovation, Science and Technology

This session introduced current trends in geospatial innovation, science, and technology, with key industry leaders discussing the potential of artificial intelligence and machine learning, blockchain, and other frontier areas for the geospatial community. The advent of technology is enabling the digital transformation that is changing our culture and challenges traditional governance, business, and other models. By attaching location information to other data streams, the possibility arises to collect, organise, and enrich insights that would not traditionally be possible, for example, through identifying how cities 'breathe' in near real-time through visualising the movement of people by their mobile phone records. In summary, location is at the heart of innovation and is key to unlocking global sustainable development; it will only serve as an accelerator for sustainable development.

Towards the Future of Geomatics Science: It's Global Impacts

This session reviewed the tremendous change and impact of Geomatics Science. This is a multi-faceted science which uses a systematic approach by integrating all the means for spatiotemporal data acquisition, information extraction, networked management, knowledge discovering, spatial sensing and cognition, as well as intelligent location-based services of any physical objects and human activities around the earth and its environment. The speakers presented a broad spectrum of innovations, from using mobile phone sensors for indoor positioning and 3D modelling; Automated change detection within unmanned aerial vehicle imagery; and, leveraging the impact of the commons through platforms such as the Missing Maps initiative which coordinates volunteers around the world to digitise aerial imagery to support communities with disaster resilience. To summarise the session, it was remarked that the depth and breadth of these innovations ultimately demonstrates how Geomatics Science is now in the mainstream.

Millions of Mappers: Organising Citizen Generated Geospatial Data for the Global Goals

This session examined the potential of crowdsourced geospatial information, with the case studies of Ramani Huria, a community mapping initiative in Dar es Salaam, Tanzania that has empowered community residents to successfully map over 3 million residents in one of Africa's fastest growing and disaster prone cities – this was expanded upon by reviewing how Uganda is scaling the Tanzanian experience to build a geospatial infrastructure that underpins the 2030 and Africa 2063 Agendas, and national development priorities. The discussion moved from crowdsourcing to expert sourcing, where Israel is ensuring that all geospatial information collected across government is managed through a standards-based quality assured approach, by identifying and empowering geospatial experts within government agencies and departments. The session was concluded by the International Hydrographic Organization which is motivating mariners and any vessels to collect and share Crowdsourced Bathymetry as part of their navigation routes helping seabed mapping efforts.

National LiDAR Programs: Strategies, Data Management, and Analytics

This session discussed best practices in acquiring complete coverage LiDAR datasets, strategies for leveraging funding from public and private sources, and successful approaches towards data management, storage, processing, and dissemination. Through this, case studies of shore line mapping – covering the assessment and monitoring of sea level rise, disaster management, forest and wildfire management, and 3D modelling of cities were presented. This was augmented by the national experience of the United States of America, where their 8 steps to developing a successful national LiDAR program were presented: 1. Documentation of requirements and benefits; 2. Maximise the return on investment; 3. Establish and adhere to a clear program goal; 4. Vet and publish a program plan; 5. Establish an operational infrastructure; 6. Establish governance; and, 7. Provide outreach to critical stakeholders. This session ultimately underlined the potential of LiDAR to support national development priorities.

Global Land Cover and Intelligent Analysis of Remotely Sensed Images

This session discussed the importance of Global Land Cover datasets, which are fundamental for a wide range of users and applications such as planning, nature and biodiversity protection, natural resources management, among many other application areas. Speakers covered a diverse range of topics, including how to monitor land use change using satellite images and artificial intelligence, how the GlobeLand30 dataset is being updated, the spatiotemporal evolution of urban areas within the Guangdong-Hong Kong - Macau Bay Area in the period 1987-2017, and how to validate Global High-Resolution Land Cover datasets through crowdsourcing. In exploring these areas, the sessions summarised that Global Land Cover datasets are a key input to monitor the SDGs and promote evidence-based decision making.

Digital Silk Road and International Partnerships

This parallel session examined the role of international partnerships and collaborations, reviewing how initiatives like China's Belt and Road can foster collaborations that strengthen knowledge sharing and develop capacity. Common themes across the sessions included the critical nature of sharing data and the need to derivate statistics from earth observations, but also noting that there is a need to accelerate efforts to document, record and recognize people-to-land relationships in all its forms and provide secure land and property rights to the 70% of humanity that does not currently have it. Regional level action plans, such as those proposed by Africa can support the sustainable development agenda, but need active participation from countries and funding to succeed.

Digital Belt and Road: Using Big Earth Data for Sustainable Development

This session focused on demonstrating and fostering the use of big data on Earth observations in support of environmental monitoring, promoting data sharing and policy-making support in the Belt and Road region. The Digital Belt and Road International Science Program was presented, which promotes cooperation among the Belt and Road countries, focused around the smart use of earth observations, aiming to fill gaps in scientific knowledge to support the achievement of sustainable development goals. In reviewing the private sector perspective on the Digital Belt and Road, it was discussed that Public Private Partnerships need to be based on the identification of key products and services required to support the geospatial sector and the factors impacting their feasibility and ability to receive investment. The importance of international partnerships in delivering positive outcomes for the building of geospatial capacity was further underlined by the example of the International Centre of Excellence on Integrated Climate Change, Disaster Risk and Environmental Research and Capacity Building which builds on existing international partnerships, which in-turn enable scientific cooperation; sharing earth observation outputs to monitor and measure SDG accomplishments; and, identifying emerging challenges and (environmental, disaster etc) risk in a timely manner.

Standards That Make Innovation Possible

This session underlined the importance of standards in the advancement of geospatial information. The presentations delivered information on current standards in development regarding core issues of global geospatial information management sustainable development monitoring, land administration and addressing, building smart societies, global geodetic reference frames. Commencing with a general overview on ISO standards - highlighting that ISO is devoted to support the SDGs, with 957 ISO standards identified to be directly applicable to these. Also, an overview on geospatial standards supporting Geodesy was also delivered, stressing that standards are stable platforms for innovation, and enable efficiency gains in time and money. But more importantly, standards make it easier for products to be compatible with existing technology, and to be introduced and accepted faster into new markets. This is exemplified by the Land Administration Domain Model in supporting a data model that provides a standardised global vocabulary for land administration; Work regarding the International Addressing Standards, which highlight that addresses are a key element particularly regarding good governance, rule of law, poverty reduction, disease prevention and the provision of basic services such as electricity, sanitation and water; and, Intelligent Transportation Systems and the future benefits that autonomous vehicles, connected cars, mobility as a service, and emission free vehicles will bring.

Linking People to land: the framework for effective land administration

This session addressed the urgent need to develop a framework on effective land administration. This included an overview on the works that are being conducted by the UN-GGIM Expert Group on Land Administration and Management and the Global Framework on Land Administration which describes key principles for a sustainable and interoperable land administration and management system that can efficiently and effectively document, record and recognize people to land relationship in all its forms. It was stressed that the SDGs call for all people-to-land relationships to be documented, as such the need to develop a framework for effective land administration and will elaborate on the strategic pathways of the Integrated Geospatial Information Framework, with an ultimate objective being to share experiences and knowledge for taking strategic decisions on land administration, so that implementing countries can be better prepared for future disruptive changes. The formalization of informal real estate was subsequently discussed, highlighting that a solution to informal development is the most important step towards formalization in the real property market. Finally, it was discussed that land valuation and effective land transfer/acquisition is essential for emerging economies and informal markets with geospatial information inherently underpinning standards for classifying, defining, measuring, analysing, presenting and reporting land information.

African action plan on geospatial information for sustainable development

This session introduced the African Action Plan on Geospatial Information for Sustainable Development to share experiences in its development and to engage in discussion on both policy and technical issues on how to establish an effective national leadership to steer and contribute to the implementation process of the activities outlined in the Action Plan of UN-GGIM: Africa. This plan establishes a continued vision consisting of a coordinated approach for cooperative management of geospatial information that adopts common regional standards, frameworks and tools; Management of global geospatial information to address key global challenges including Sustainable development, climate change, disaster management, peace and security, and environmental stresses; Intergovernmental process where the Member States play the key role. According to the action plan, the priority issues and challenges for the region are Leadership (Governance & Management); Framework (Data, Information, Services); Capabilities; Resources Mobilisation; Partnership; and, Communication. The Action Plan is the implementation tool of UN-GGIM: Africa with each priority issue detailed with specific objectives, expected results, estimated budget figures and related activities, with a total provisional budget of $154,300,000. The fundamental goals of the Action Plan are leaving no one behind, this is more active participation of Member States and Executive Board Members; mobilizing resources for Implementation through the involvement of the private sector and translating the action plan into concrete projects.

Strengthening national geospatial information management in the Americas

This session shared the progress ongoing within the Americas region to implement national geospatial information frameworks. This included speakers assessing the current situation of the region on the progress of national geospatial information initiatives and guidance for the implementation of the Integrated Geospatial Information Framework and other geospatial information strengthening activities. Among the conclusions, it is stated that integrating geospatial and statistical information is a key pillar within any regional or national effort to strengthen the geospatial information management, and, that the Integrated Geospatial Information Framework is a key resource to support the development of geospatial information in the countries of the region.

Sustainable Development in Action

This session reviewed the critical role of partnerships as key to achieving global sustainable development and underlined the opportunity afforded by the sharing of experiences and good practices with each other. The opportunity of digital transformation can bring and integrate geospatial information, across all sectors, whether government, private industry, and academia. As such, cartographic design and principles are very important to understanding the impact of Sustainable Development and to communicate the progression and global attainment of the goals. Other sessions noted the need for a global geospatial information dataset that can identify and differentiate between urban and rural areas. With open data being key to providing free-to-use sub-national, national, and global datasets. Ultimately, the abundance of data needs to inform the development of public policy and there is still a need to connect data makers and the decision makers together.

Geospatial Information for Urban Sustainable Development

The session examined five case studies covering Urban SDG and Geospatial Information Needs and Challenges; The use of earth observations and geospatial information for monitoring urban SDG indicators; Steps towards measuring SDG Indicator 11.3.1, Ratio of land consumption rate to population growth rate; Global human settlement datasets; and, the research and application of targeted poverty alleviation using geospatial information. The ensuing discussion noted the need for global geospatial information to identifying needs and demands at both urban and rural levels and the ability to differentiate between these classifications - There needs to be a "*a harmonised global definition of identification and classification of what is urban and what is rural*". The role of open data was considered as being crucial by the session's speakers, as it is a mechanism that can harmonise other geospatially enabled data sources, such as Gross Domestic Product and socio-economic information to inform on urbanisation and urban growth. In summary, the session noted that in using novel technologies with different geospatial information sources, it is possible to support poverty alleviation measures and the identification of improved resources, employment, and other factors to support the improvement of the livelihoods of people in poverty and support urban sustainable development.

Natural Resources Management Underpinned by Geospatial Information

This session shared experiences of good practices within natural resources management. Speakers stressed that better understanding natural resources can inform decision making that provides an enabling environment for an improved economy and society that can balance the environmental and human demands on resources. This is a cross cutting field across agricultural, mineral, coastal, and other areas of natural resource concern. It is useful, not just to inform analysis, but also communication to inform stakeholders, decision makers, and citizens on the what and why. At the heart of improved decision making are the coordination of partnerships. As there is a need to coordinate and manage various datasets across ministries and government agencies, there is a strong need for an encompassing policy for natural resource management which takes a multi-agency/stakeholder approach. As such, an integrated approach is necessary. This necessitates countries to holistically consider the exploitation and exploration of natural resources in a sustainable manner, especially considering the balance between economic, environmental, and social needs - It should not matter which institution is hosting the geospatial information for natural resource management, if the information is standardised and shared. Open standards, such as those developed by the Open Geospatial Consortium can assist with information sharing and interoperability.

Effective Visualisation in Maps and Diagrams to Better Understand the SDGs

This session provided participants with a hands-on approach to support the understanding and communication of the SDGs through their visualisation. Maps and diagrams are analytical tools, used in decision-making in governance and in operational environments for day to day developments. This session demonstrated that while visualising the SDG indicator data seems trivial, experience shows that during this process many decisions related to the data and visualization must be made, which are all prone to errors. Another challenge is to deal with the defaults offered by software which already might steer your message or intent in an unwanted direction. As such, there is a need to look at maps critically and question the underlying data and how it is being designed and presented. Fundamental questions include: "Are you accounting for population?... How is no-data being represented". Ask yourselves "Are you providing the message that you need to send and being truthful with your outputs". This is to ensure that the resulting maps and diagrams can inform and support decision makers with making the 'right' decision.

Geospatial Data to Improve Crop Yield Forecasting and Monitoring

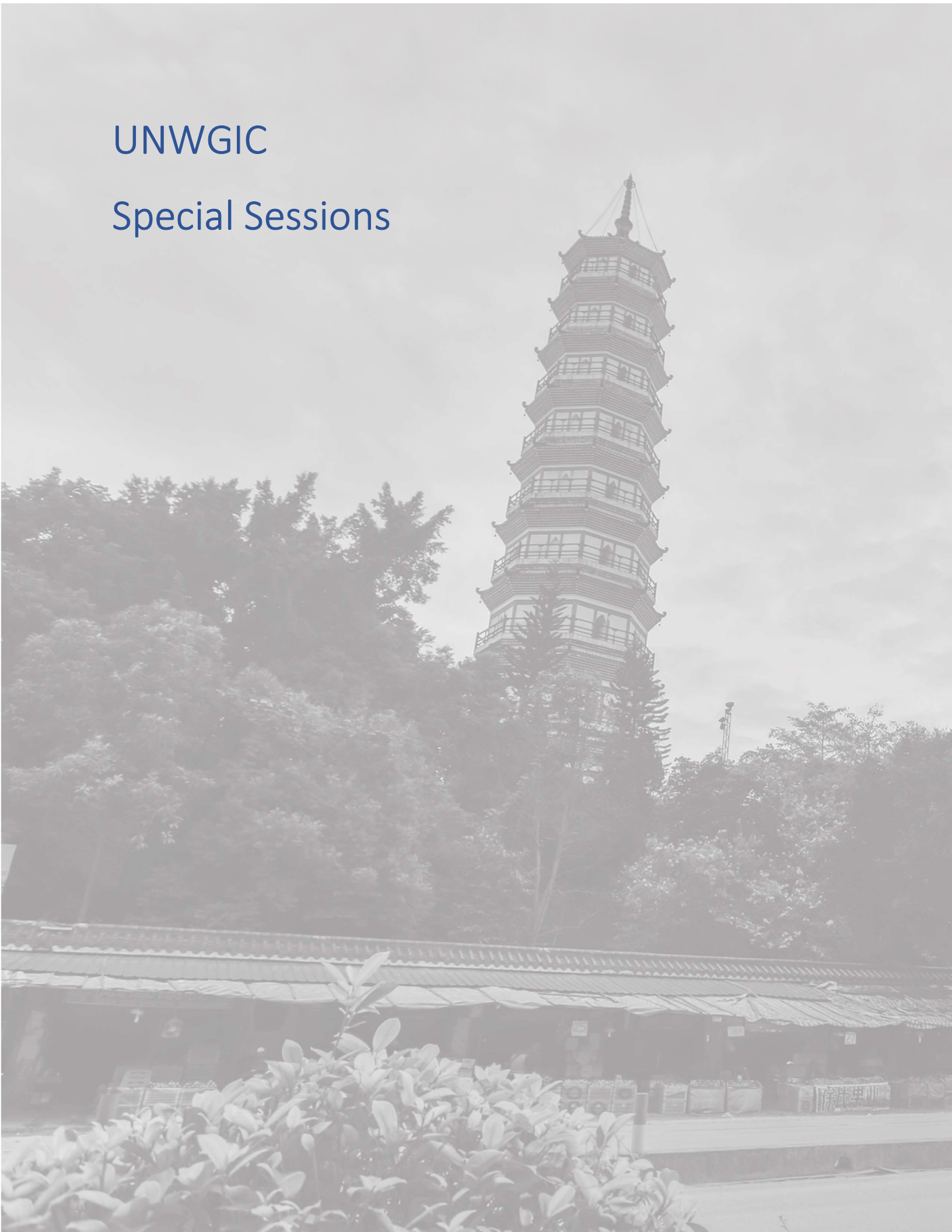
This session illustrated the importance of geospatial information in, calculations and indicators for agricultural and economic activity and demonstrated the important aspects of utilising geospatial data to improve statistics on crop production/yield forecasting and the System of Environmental Economic Accounting. Speakers noted that improving crop yields does not have to be difficult as there are many data sources, from drones and airborne sensors to satellites, including in-situ measurements. Combing these data sources leads to the maximises the utility of these data sources to support informed decision making, metrological information has a critical role in biomass estimation. There are numerous challenges in monitoring illicit cultivation, often small fields are distributed over large mountainous areas and poor accessibility, as such, creating datasets on illicit monitoring also requires the use of other forms of data, from village surveys, poverty maps, and other secondary data sources. This combined with forecasting, even if accuracy is not as high, is critical to making decisions that can mitigate risk. This forecast is based on historical data, a note of caution is that climate change is increasing the volatility and range of the forecast. Forecasting before planting is essential to mitigate the impact of extreme events. This will ultimately lead towards more sustainable crop production, especially in areas where crop production is critical to supporting the livelihoods. In summarising the session, it was noted that there is an abundance of available geospatial information, but it needs to be used to inform the development of public policy – there is an urgent need to connect data makers and the decision makers together.

A Sustainable and Resilient World: Research and Capacity Development for Implementing the SDGs

This session reviewed the multi-dimensional contributions of the UN-GGIM Academic Network as a critical tool to promote and share geospatial information integration approaches, develop legal and policy instruments, implement institutional management models, and support steps towards improving access to quality and timely data, among other research and capacity development initiatives, including a 'geospatial academy', which facilitates innovative and interdisciplinary means to involve experts from different domains in the geospatial realm. The session noted that what unites us is stronger than what divides us, especially considering the globalisation of the geospatial professional and the outstanding opportunity that exists within digital transformation, but there is a need to consider how we can support and foster partnerships to harness our experience to support global development, and to learn from each other. This ultimately underlines the importance of research and capacity building to achieve the SDGs and to foster collaboration between the UN-GGIM Academic and Thematic Networks.

UNWGIC

Special Sessions



Geospatially Enabled Industry Development

Geospatial information in the era of digital economy is not limited to the development of its own industry. Integration of geospatial information with other industries will be vital to transform and upgrade traditional industries realise the opportunities that exist. Moderated by Mr. Feng Shaojun of Qianxun Spatial Intelligence Inc, this special session focused on the development trends of geospatial enabled industries. Speakers included:

- Mr. Lior Sethon, Aftermarket of Mobileye Technology Co., Ltd;
- Mr. J. W. Chen, Hi-Target Surveying Instrument Co.,Ltd;
- Ms. Li Xiaofang, Beijing EarthView Image Inc.;
- Mr. Lu Jin, China Metallurgical Geology Bureau;
- Mr. Song Changqing, DigitalGlobe;
- Mr. Liu Xianghong, DiDi Chuxing;
- Mr. Feng Shaojun, Qianxun Spatial Intelligence Inc.; and,
- Mr. Zhandong Yang, Zhengyuan Geomatics.

These senior executives shared practices and experience of the intersection of geospatial information and industrial development. The session promoted the development of the geospatial industry and underscored the need for the industry to explore opportunities for cooperation among related industries around the world.

Operationationalising the Integrated Geospatial Information Framework

The Committee of Experts on Global Geospatial Information Management in August 2018 adopted the Integrated Geospatial Information Framework that provide a basis, a reference and a mechanism for countries to develop and strengthen their national and sub-national arrangements in geospatial information management and related infrastructures. The Framework aims to translate concepts to practical implementation guidance for use by Member States, leveraging *seven (7) underpinning principles, providing eight (8) goals and nine (9) strategic pathways* for governments *to establish more effective geospatial information management practices and policies*. Noting that geospatial information provides the integrative platform for all digital data with a location context, that all countries and all sectors need geospatial information for national development and decision-making, this Special Session will interact with the audience on operationalizing the Framework and supporting Member States to prepare and implement their own action plans according to their national circumstances. Geospatial information has the very real potential for forming a new and emerging "data ecosystem" for sustainable development. Moderated by Mr. Tim Trainor, IAC Member and ex Co-Chair of UN-GGIM, presenters included:

- Ms. Macarena Perez, Secretaria Ejecutiva SNIT - IDE de Chile;
- Ms. Meizyanne Hicks, Ministry of Lands and Mineral Resources, Fiji;
- Ms. Malgorzata Drewniak, Lantmateriet, Sweden;
- Ms. Clare Hadley, Ordnance Survey, United Kingdom;
- Mr. Wael Zakout, Social, Urban, Rural and Resilience, World Bank; and,
- Mr. Stefan Schweinfest, Director Statistics Division, United Nations.

The ensuing discussion noted how a geospatial information infrastructure is the basic infrastructure for making informed decisions that support the attainment of national sustainable development. The technology that is realising this infrastructure is additionally becoming the driving force of many applications and services within industrial and socio-economic development, offering a radically different way in which we produce and use information required to manage our communities and economic activities.

Implementing the Integrated Geospatial Information Framework is one step in the process of realising a foundation for sustainable development and there is a need to sensitise, harmonise and raise awareness of the Framework for decision-makers to see the value of integrated geospatial information as a critical component for national sustainable development. It was noted however that the development of geospatial technology, applications, and data can create new risks that unearth and identify gaps within legal and policy instruments - this can slow down the implementation, but it is critical to develop these instruments to fully realise the potential.

In terms of funding, the World Bank committed to support funding the implementation of the Integrated Geospatial Information Framework in at least thirty (30) countries within the next three years. This underscores the important of countries to develop national geospatial action plans and link geospatial information to core national development priorities.

Measuring Deqing's Progress Towards the SDGs with Geo-Statistical Information

Deqing County, the venue of the first United Nations World Geospatial Information Congress, has experienced significant economic and environmental changes over the past ten years. Its overall progress towards SDGs has been assessed through a comprehensive data-driven measurement and evidence-based analysis. Accordingly, this session examined the methodology and results of a case study for Deqing County in efforts to collect and report on SDGs. Moderated by Dr. Li Pengde, Co-Chair of UN-GGIM speakers included:

- Prof. Chen Jun, Chief Scientist, National Geomatics Center of China;
- Prof. Ge Yuejing, College of Geography, Beijing Normal University;
- Ms. Wang Qinying, Mayor of Deqing County;
- Mr. Liu Zhenming, Under-Secretary General, United Nations Department of Economic and Social Affairs;
- Mr Feng Fei, Vice Governor of Zhejiang Province;
- Mr. Steven Ramage, Director of International Relation, GEO
- Mr. Cheng Zhilin, Director, Department of Statistical Design and Management, National Bureau of Statistics of China;
- Mr. Kurexi Maihesuti, Vice Minister, Ministry of Natural Resources, PR China

The session provided discussion over three main issues:

1. The role of statistical and geospatial information for assessing the overall progress towards SDGs for an entire administrative entity;
2. The progression of Deqing County in achieving the SDGs and the identification of its most important SDG challenges; and,

3. Identifying the data and technology gaps which need to be filled to enable better monitoring and reporting over time.

The session considered 104 SDG indicators which were selected and measured by using statistical and geospatial information. Indicator-based quantitative and qualitative analysis were conducted at three levels (indicator, single goal and multi-goal). These results are now released and publicized on a publicly available web-based knowledge portal for use by all including the international community.

Young Geospatial Professionals Summit

Ms. Eva-Maria Unger, Kadaster Netherlands, providing remarks at the Young Geospatial Professionals Summit

Addressing global challenges requires energy and enthusiasm. From poverty to climate resilience to gender inequality and scarce natural resources, the Young Geospatial Professionals Summit provided a platform for the younger professionals within our global community to share observations and experiences. This was driven by the recognition that young geospatial professionals must be part of the sustainable future in leveraging geospatial information, technologies and services. Accordingly, the Summit provided participants of the UNWGIC, particularly the younger professionals, to engage and network with one another, exchanging ideas, experiences, and challenges within the realm of geographic information, along three broad aspects:

1. Effective governance and institutional arrangements;
2. Culture of sharing and partnerships; and
3. Developing trusts with geospatial data, technologies and innovation.

Closing Ceremony and Issuing the Moganshan Declaration

The closing ceremony, moderated by Mr. Kurexi Maihesuti, Vice Minister, Ministry of Natural Resources of China and Chair of the UNWGIC Bureau, convened the UNWGIC Bureau in summarising key messages from the UNWGIC's Plenary, Parallel, and Special Sessions. Mr. Yuan Jiajun, Governor of Zhejiang Province provided his observations and perspectives of the Congress with Vice Minister Kurexi and Mr. Liu Zhenmin, Under-Secretary-General for Economic and Social Affairs providing concluding remarks and issuing the Moganshan Declaration.

The Moganshan Declaration was issued on behalf of all participants at the end of the UNWGIC which resolved participants to create and support the construction of a human data and geography community for a shared and better future, to keep the promise to leave no one behind by fostering effective cross-sector and interdisciplinary international, regional and local collaboration and partnerships, and, to support national development priorities.

The Moganshan Declaration

We, the participants of the first United Nations World Geospatial Information Congress held in Deqing, Zhejiang Province, China from 19 to 21 November 2018, having met under the purview of the United Nations to substantively improve and strengthen the role of geospatial information management, innovation and related technologies towards implementing the 2030 Agenda for Sustainable Development, thereby increasing the capacities, capabilities and opportunities for all countries, hereby issue this Moganshan Declaration on The Geospatial Way to a Better World;

Recalling Economic and Social Council resolution 2011/24, of 27 July 2011 which established the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) to provide a forum for coordination and dialogue among Member States, and to hold regular high-level, multi-stakeholder discussions on global geospatial information, including through the convening of global forums, with a view to promoting a comprehensive dialogue with all relevant actors;

Recalling also Economic and Social Council resolution 2016/27 entitled 'Strengthening institutional arrangements on geospatial information management' of 27 July 2016, in which the Council acknowledged the considerable achievements of the Committee of Experts including: its contribution to the strengthening of geospatial information management capacities and utilization in developing countries; the efforts to streamline the work of the subsidiary bodies of the Council in the field of geospatial information management; and its role in the implementation of the 2030 Agenda for Sustainable Development, the Sendai Framework, and other global development agendas within the purview of the United Nations;

Recalling further General Assembly resolution 70/1 entitled 'Transforming our World: The 2030 Agenda for Sustainable Development' of 25 September 2015, which recognizes the need for new data acquisition and integration approaches to improve the availability, quality, timeliness and disaggregation of data, and the use of a wide range of data, including earth observations and

geospatial information, to support the implementation of the new development agenda at all levels, while ensuring national ownership in supporting and tracking progress;

Recognizing decision 7/109 of the Seventh Session of the Committee of Experts on UN-GGIM, in which the Committee acknowledged that the global geospatial information environment was dynamic and innovative, with the emergence of new technologies, methods and processes, and agreed that data availability and quality remained one of the biggest challenges for Member States and that data, when available, must also be accessible, consistent and sustainable for the production of indicators to provide information on the agreed goals and targets, in accordance with national priorities and needs;

Recognizing further decision 8/113 of the Eighth Session of the Committee of Experts on UN-GGIM, in which the Committee adopted the overarching strategic framework of the Integrated Geospatial Information Framework as a forward-looking and practical global guide for countries to reference when developing and strengthening their national and subnational geospatial information management systems and capabilities, and supported the approach that the Framework should serve as a living document, to be further refined as technologies, processes and knowledge evolved;

Noting the opening statement of the Secretary-General at this Congress, in which he emphasized that our expertise and guidance in geospatial data, methods, frameworks, tools, and platforms is urgently needed, and that reliable, timely, accessible and disaggregated geospatial information must be brought to bear to measure progress, inform decision-making and ensure effective and inclusive national and subnational programs that will chart the path towards the 'Geospatial Way to a Better World', to assist in the implementation of the SDGs, and transform our world for the better;

Noting also that this United Nations World Geospatial Information Congress (UNWGIC) has provided a convening, participatory and inclusive environment to intensify collaboration at the regional and global level; enhance the communication, understanding, knowledge and application of geospatial information management; discuss the policy relevance and challenges to advance geospatial science and technology; promote the creation and sharing of more reliable geospatial data; and to enhance value-added applications and services to address local, regional and global challenges; and,

Noting further Ministers' statements at the UNWGIC which stressed the importance of working together across borders, pointing to the benefits of partnerships and cooperation in sharing of good practices and transfer of technology in order to meet the growing national, regional and global demand for geospatial information;

We therefore resolve to:

1. Take up the challenge by Ministers and other high-level decision-makers to ensure that geospatial information and location enablement is able to be recognized and underpin the SDGs at national levels through the Integrated Geospatial Information Framework as a fundamental and enabling methodological framework and infrastructure for creating greater social, economic and environmental understanding, evidenced based decision making, design and delivery of projects and services, and implementing and achieving the 2030 Agenda for Sustainable Development;

2. Affirm that geospatial technologies and innovation have been unequally adopted, and that there is an urgent need to effectively bridge the geospatial digital divide to achieve 'digital transformation', to democratize and transfer these technologies and associated data through

the enabling global mechanism of the 2030 Agenda and Integrated Geospatial Information Framework, noting that innovative technologies such as the cloud, big geospatial data analytics, machine learning, geospatial knowledge services and integrated information systems can ensure such capabilities are easily reachable and useable by developing countries;

3. Call upon all Member States, institutions, academia, industry and individuals including the United Nations system to explicitly connect geospatial information to national development agendas; to shape and develop data-driven and location-enabled smarter, resilient and sustainable societies; to continue to advocate and communicate to political decision-makers the importance of investment in geospatial data and enabling technologies to deliver policy; and that technically aware, flexible and open leadership is fundamental to establishing and sustaining data innovation, systems, sharing and management to support the measurement and monitoring of the SDGs;

4. Work together to build a human data and geography community for a shared and better future, to reduce the geospatial information divide by fostering effective cross-sector and interdisciplinary international, regional and local collaboration and partnerships, in support of national development priorities, providing technical support and capacity building to developing countries, including the countries of the Belt and Road region, and improving partnership among governments, academia, industry, the private sector, and civil society;

5. Confirm that all international stakeholders engaged in geospatial data, technologies and innovation will continue to collaborate and engage across professional domains to effectively democratize and transfer these technologies and share data through the enabling global mechanism of the SDGs utilizing the various integrative systems and solutions now available; and urged countries to build upon the good practices, excellent results, and continuous improvement, as demonstrated by Deqing's implementation of the SDGs;

6. Support the establishment of Global Centers of Excellence on Geospatial Knowledge, including in Deqing, to promote and build global geospatial capacity and capability, develop collaborative knowledge and innovation hubs for harnessing contemporary methods, technologies and analytics in geospatial information, facilitate access to regional and global information and data sources including earth observations, and to improve and strengthen national geospatial information management to assist developing countries to implement the SDGs;

7. Call upon UN-GGIM, its regional committees, thematic groups and private sector partners to provide guidance and support to developing countries, particularly the least developed countries, small island developing States and landlocked developing countries, in strengthening the capacity of national geospatial and mapping agencies and data systems to ensure access to high-quality, timely, reliable and disaggregated data; and to reach out to the wider social, economic and environmental development communities and donors to promote and contribute to the value of geospatial information in achieving the global development agendas;

8. Appreciate the bold efforts made at this UNWGIC to bring together the diversity of nations, cultures, gender and age in a unified global community, and call upon similar approaches across the UN-GGIM and geospatial community in the future to engage, especially with more young professionals and advocates within the geospatial information domain; as it is they whom will carry the implementation of the SDGs towards their conclusion and ultimate realization;

9. Recognizing the immense value that this UNWGIC brings to common understanding, building geospatial capacity and innovation within governments and institutions, and in galvanizing the global geospatial community to further the utilization of trusted geospatial information and location enabled decision-making in realization of the 2030 Agenda, request that a second UNWGIC be convened in four years' time to consider and stimulate global geospatial development progress; and,

10. Commend Zhejiang Province's commitment to growing the geospatial information industry ecosystem, inclusive of the impressive facilities provided by Deqing for the convening of the first UNWGIC, and congratulate our hosts, the Government of China through the Ministry of Natural Resources in collaboration with the Government of Zhejiang Province, for their dedication and vision for convening the UNWGIC, especially for organizing the venue, administration and logistics, for the tremendous work of local volunteers and for exposing the international geospatial community to local culture in such a warm and engaging fashion.

Issued on 21 November 2018

Deqing, Zhejiang Province, China