Towards a results-based management approach for capacity-building in space science, technology and applications to support the implementation of the 2030 agenda for sustainable development☆

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ABSTRACT

The United Nations Office for Outer Space Affairs (UNOOSA) has the mandate to assist Member States with building capacity in using space science, technology and their applications in support of sustainable economic, social and environmental development. From 20 to 21 June 2018 the international community will gather in Vienna for UNISPACE + 50, a special segment of the 61st session of the Committee on the Peaceful Uses of Outer Space (COPUOS), to celebrate the 50th anniversary of the first UNISPACE conference and to reach consensus on a global space agenda for the next two decades. "Capacity-building for the twenty-first century" is one of the seven thematic priorities of UNISPACE + 50, identified and agreed upon by COPUOS. The Committee has tasked UNOOSA with undertaking the work under this thematic priority and with reporting regularly to the Committee and its Subcommittees on the progress of its work. It is therefore appropriate, in this context, to take stock of the achievements of the capacity-building activities of the Office, to review the relevant mandates and activities and to consider the necessity to strengthen and better align them with the future needs of the World and in particular with the 2030 Agenda for Sustainable Development. This paper describes the efforts on-going at UNOOSA, building on its experiences with implementing the United Nations Programme on Space Applications and the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) and working with Member States and other United Nations entities, to develop a results-based management approach, based on an indicator framework and a database with space solutions, for promoting the use of space-based solutions to help Member States achieve the Sustainable Development Goals (SDGs) and successfully implement the 2030 Agenda for Sustainable Development.

1. Introduction

On 25 September 2015, with the adoption of General Assembly Resolution 70/1, the Member States of the United Nations committed to implement the 2030 Agenda for Sustainable Development [1].

The Agenda is a call and plan for action for people, planet, prosperity and peace to be achieved in partnership with no one left behind. Taking into account the lessons learned in the implementation of the Millennium Development Goals (MDGs) in the 2000–2015 period [2], the 2030 Agenda encompasses the three dimensions of sustainable development, namely, economic, social and environmental development.

It is based on 17 universal Sustainable Development Goals (SDGs) covering a wide range of global issues, including the elimination of poverty and hunger, providing education and health services for all,

maintaining our environment and ensuring decent work and living conditions on the basis of a just society and strong institutions (see Fig. 1) [3]. Through the SDG on climate action the Agenda is linked to the Paris Climate Change Agreement, the outcome of the 21st Conference of the Parties (COP21) of the United Nations Conference on Climate Change. Several of the SDGs also link the Agenda to the implementation of the Sendai Framework for Disaster Risk Reduction. The SDGs are integrated and indivisible and linked to 169 concrete targets that should be achieved by 2030. Success is measured through an intricate set of global indicators, quantifying our progress towards achieving these targets. This example of goal-based planning constitutes a "globally shared normative framework that fosters collaboration among countries, mobilizes all stakeholders and inspires action." [4].

The 2030 Agenda is applicable to countries at all levels of

Fig. 1. Sustainable development goals.

development. Its successful implementation will require all stakeholders to contribute, national and international institutions and organizations as well as the individual citizens of this World [5]. Achieving the SDGs will be essential for the future of our planet and its inhabitants.

However, the challenges are substantial, considering the increasing pressure on environment and resources due to the growth of the population, which is projected to increase from currently 7.5 billion to reach 8.5 billion by 2030, 9.7 billion by 2050 and 11.2 billion in the year 2100 [6]. Implementing the 2030 Agenda will not only require further strengthening of the relevant institutional frameworks but will not be possible without making use of new technologies to address the global challenges enshrined in the SDGs. Even with the most moderate projections for future population growth we will soon reach planetary boundaries unless we succeed in utilizing new technologies that will enable us to overcome existing limitations. Sustainable Development requires a long-term transformation. Successful implementation of the 2030 Agenda will not be possible with a "business as usual" trajectory but will have to be based on a technology-driven sustainable development trajectory.

This paper addresses the important role that space technology and its applications will play in this process and how the Office for Outer Space Affairs (UNOOSA) is preparing to support Member States in building capacity to ensure that they can make full use of the contributions of space technology solutions.

2. Implementing the 2030 agenda

The task of implementing the 2030 Agenda for Sustainable Development is in the hands of all stakeholders. The Member States of the United Nations have established a High-Level Political Forum on Sustainable Development (HLPF), which convenes annually under the auspices of the Economic and Social Council to oversee the follow-up and review processes and the implementation status of the Agenda at the global level [7].

HLPF will be informed by the annual Sustainable Development Goals progress report, which will be prepared by the United Nations Secretariat, in cooperation with the United Nations system and which is based on the SDG indicator framework, data produced by national statistical systems and information collected at the regional level [8]. In addition, every four years an independent group of scientists will prepare a Global

Sustainable Development Report, focused on the science-policy interface, to inform the HLPF [9]. Regional and national implementation mechanisms, based on regional and national sustainable development strategies, will support the review mechanism at the global level. Various other organizations have launched efforts to support the implementation process, such as the "Sustainable Development Goal Index and Dashboard", prepared by the Sustainable Development Solutions Network and the Bertelsmann Stiftung, which provides SDG base data at the country level [10].

3. Space solutions supporting the 2030 agenda

Space technology is one of the technologies that will be essential for successfully implementing the 2030 Agenda. Several space-related organizations have published documents or undertaken studies that assess how space applications can contribute to achieving the SDGs. Among them are the European Space Agency (ESA) [11], the European Space Policy Institute (ESPI) [12], the Group on Earth Observations (GEO) [13], the Committee on Earth Observation Satellites (CEOS) [14] and DigitalGlobe, in collaboration with UNOOSA, GEO and the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) [15]. Information and Communications Technology (ICTs) is also making use of space technology, satellite telecommunications and space-based positioning, navigation and timing services [16].

Space technology can support the 2030 Agenda implementation in two ways:

a) By providing data, information and services that directly or indirectly contribute to achieving particular SDGs.
b) By providing data and information on particular SDG indicators that allow us to assess and measure the status of the implementation progress.

One of the key lessons learned from implementing the MDGs was the lack of availability and access to reliable data. The new SDG framework is addressing this issue, by stressing that the 2030 Agenda will mobilise the data revolution for sustainable development [17].

However, as of today, there is no coordinated effort among space-related organizations to systematically integrate space-based solutions into the implementation mechanisms of the 2030 Agenda.

4. UNOOSA, UNISPACE + 50 and the 2030 agenda

The Committee on the Peaceful Uses of Outer Space (COPUOS) was established in the year following the launch of Sputnik-1 in 1957. To support the work of the Committee, an expert unit within the United Nations Secretariat was established, which today is known as the United Nations Office for Outer Space Affairs (UNOOSA). The Office supports the work of the Committee to promote international cooperation in outer space activities. Three United Nations Conferences on the Exploration and Peaceful Uses of Outer Space (UNISPACE) held in 1968, 1982 and 1999 set the agenda for global space governance and also mandated UNOOSA to conduct certain activities.

At the first United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE′68), held in Vienna in 1968, Member States recommended the creation of a dedicated programme in the framework of the United Nations to assist countries with building capacity for the use of space science, technology and their applications [19]. In response to this recommendation, the United Nations Programme on Space Applications was established in 1971 and UNOOSA was assigned the responsibility for implementing the Programme [18].

Following the second UNISPACE conference (UNISPACE′82), held in 1982, the mandate of the programme was broadened and the Regional Centres for Space Science and Technology Education, affiliated to the United Nations, were established [20]. The goal of the centres is to develop, through in-depth education, capabilities for research and applications of space science and technology.

The third and most recent UNISPACE conference (UNISPACE III), held in 1999, aimed to further increase the benefits that can be derived from space technology and its applications [21]. Among several other achievements, it led to the establishment of the International Committee on Global Navigation Satellite Systems (ICG), a forum of providers and user communities of global navigation satellite systems (GNSS), and to the creation of the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER).

With the 2030 Agenda now constituting the common framework for achieving sustainable development, this is an opportunity for UNOOSA to review past accomplishments and to consider how future capacity-building activities could be streamlined to optimize its contributions to achieve the SDGs. In particular, there is a need to better harmonise the activities of space agencies and other space-related entities and organizations under this framework to promote the use of space solutions, make use of synergies and avoid duplication of efforts.

The decision of COPUOS to hold in 2018 the UNISPACE+50 event also makes this a timely effort [22,23]. The UNISPACE+50 roadmap is aimed at defining concrete deliverables of space activities for the development of nations under the four pillars space economy, space society, space accessibility and space diplomacy. It is built around seven thematic priorities [24]:

1. Global partnership in space exploration and innovation;
2. Legal regime of outer space and global space governance: current and future perspectives;
3. Enhanced information exchange on space objects and events;
4. International framework for space weather services;
5. Strengthened space cooperation for global health;
6. International cooperation towards low-emission and resilient societies; and
7. Capacity-building for the twenty-first century.

These thematic priorities are linked to the 2030 Agenda. Thematic priority 7 on "Capacity-building for the twenty-first century" has the objective to "define new innovative and effective approaches to overall capacity-building and development needs as a fundamental pillar of global space governance. Strengthen comprehensive capacity-building and outreach activities of the Office for Outer Space Affairs. Develop infrastructure for cross-sectoral and integrated applications, with combined scientific, technical, legal and policy outputs. Enhance existing partnerships and forge new ones to strengthen and deliver targeted capacity-building and technical advisory activities based on needs assessments. Promote efforts to encourage science, technology, engineering and mathematics education, especially for women in developing countries.".

In line with its mandate to support space capacity-building, UNOOSA has been tasked to undertake the work under this thematic priority and to report regularly to the Committee and its Subcommittees on its work. The Office has the responsibility to propose new avenues for capacity-building and to consult with Member States during the preparation of UNISPACE + 50, with the aim to arrive in June 2018 with a final proposal for approval.

To implement this task, UNOOSA has created an Office-internal project team, which meets frequently to discuss the way forward.

5. Results-based management of space capacity-building

An immediate need addressed by the project team is the alignment of the Office's capacity-building activities with the philosophy of results-based management, grounded on a diagnostic space capacity-building approach [25].

UNOOSA's work plan is based on the biannual Strategic Framework of the United Nations [26,27] and is assessed through biannual Programme Performance Reports [28]. The Strategic Framework includes indicators to measure the impact of the work.

However, the present indicator framework does not allow to assess the progress made by Member States in building space capacity and in making use of space-based solutions for sustainable development. While the Office has been using a range of evaluation mechanisms in the past, including questionnaires, follow-up conferences, and individual feedback as well as feedback from Member States, they are not based on a results-based management approach. Consequently, the existing indicator framework does neither allow to measure the outcome of the capacity-building activities of the Office nor does it enable Member States to measure, how well they are doing.

UNOOSA has been well aware that there is a need to update the present indicator framework. It was therefore considering the development of a results-based management approach for space capacity-building, based on a Space Solutions Database (SSD) and a Space Capacity Index (SCI).

5.1. The Space Solutions Database

For nearly five decades, UNOOSA has contributed to space capacity-building through a range of activities, including the organization of conferences, the conduct of technical assistance missions, the delivery of fellowship programmes and through the work of the Regional Centres and other support frameworks. Reports, proceedings and other publications have been prepared for all these activities, including recommendations and observations on space capacity-building and the use of a wide range of space applications.

As a first step towards developing a comprehensive Space Solutions Database (SSD) – a catalogue of solutions – which could include expertise, projects, best practices, standard operation procedures and expert (contacts) for the use of space science, technology and its applications in support of sustainable development, the existing reports of UNOOSA's past activities could be reviewed for relevant data. Lessons-learned in the development of the UN-SPIDER Knowledge Portal could be applied [29].

The SSD could be structured or indexed according to the SDGs and their targets and indicator framework. UNOOSA as well as Member States will access and use the SSD to help with the planning of capacity-building activities and with the implementation of space solutions.

In order to measure the impact of these activities, it will be necessary to develop a suitable indicator framework that can be used by UNOOSA and Member States.

5.2. The Space Capacity Index

Many organizations around the World are making use of indicator frameworks to assess the impact of their activities. To develop the Space Capacity Index (SCI) it will be beneficial to review relevant similar existing indicator frameworks, such as the

a) Human Development Index of the United Nations Development Programme (UNDP) [30]
b) Information and Communication Technology (ICT) Index of the International Telecommunication Union (ITU) [31] and
c) Global Innovation Index of Cornell University [32]

Many organizations with experience in developing relevant indicator frameworks, such as the Organization for Economic Co-operation and Development (OECD), may also be able to contribute to the development of the SCI [33].

The SCI could be structured or indexed according to different categories, such as the 17 SDGs, different aspects of space use (space economy, space society, space diplomacy, space accessibility) or specific space technology categories (Earth Observations, GNSS, satellite communications) or application categories, such as the thematic priorities of the United Nations Programme on Space Applications [34].

The SCI must be simple to evaluate and measure and relevant for Member States at all levels of space development and reflect a Member States' space capacity.

The indicator framework should enable Member States to evaluate themselves, as well as provide the possibility for independent, external evaluation, which could be conducted through the United Nations. By comparing and, if necessary, aligning the results of the Member State's initial self-evaluation and the results of the independent, external evaluation a Member States' SCI base data could be established. Similar to the approach taken with ITU's ICT Index, the SCI ranking results of all Member States could be made public and updated annually. If desired, it would also be possible to publicly publish results which do not allow to identify individual Member States, but which would allow each Member States to know its own ranking position within the SCI.

The Space Solutions Database and the Space Capacity Index together will allow UNOOSA and Member States to apply goal-based planning and results based management to space capacity-building (as shown in Table 1).

Using this approach, many stakeholders can work towards the same goal to improve SCI ranking. It would also support backcasting, a best practice in long-term planning, starting with the projection of a desired outcome, such as a desired improvement in SCI ranking, and on this basis, plan the necessary steps to achieve that outcome.

Once a targeted capacity-building activity or an integrated Master Plan has been executed, its impact will be reflected in a change in the SCI

Table 1
Results-based management of space capacity-building.

Step	Action
1	Develop/update Space Solutions Database (SSD)
2	Develop/update Space Capacity Index (SCI)
3	Establish UNOOSA as "one-stop-shop" for space capacity-building
4	Receive support requests from Member States (MS);
5	Meet and consult with MS representatives to:
	a. Review MS capacity development needs (e.g. specific SDGs, specific situations, applications)
	b. Review MS SCI ranking and identify development needs
	c. Agree with MS on Master Plan (MP) for corrective actions (using SSD)
	d. Identify and address funding needs
6	Implement master MP activities
7	Measure impact using re-assessed SCI ranking
8	Discuss corrective actions, update MP, report and iterate process, if necessary
9	Report results and update MS SCI ranking
10	Iterate

indicators, and possibly in the SCI ranking. This will provide straight feedback to the Member State. The results can also be reported by UNOOSA in the biennial Strategic Framework and Programme Performance Report (PPR).

6. Implementation strategy

UNOOSA has developed a roadmap and strategy to implement the proposed results-based management approach. Its implementation is closely linked to UNISPACE+50 thematic priority 7. "Capacity-building for the twenty-first century", with the aim to obtain Member State approval for the proposed approach at UNISPACE + 50 in 2018 and to put it into operational use soon thereafter.

Since proposing the original concept of a Space Solutions Database and a Space Capacity Index in the Fall of 2016, the concept has further evolved into a Space for Development Profile and a Space Solutions Compendium [35].

Its development will be informed by dedicated expert meetings, bringing together space experts from space industry and space agencies, such as ESA, with results-based management experts, including representatives of ITU, UNDP, OECD, and other relevant organizations that already use such an approach, as well as with representatives of statistical institutions and relevant implementation mechanisms established under the 2030 Agenda for Sustainable Development.

A dedicated working session to present, discuss and further refine the proposes approach will be organized as part of the United Nations/ Austria Symposium on "Access to Space: Holistic Capacity-Building for the 21st Century", to be held in Graz, Austria, from 3 to 7 September 2017 [36]. This Symposium is the flagship event in preparation of UNISPACE+50 thematic priority 7.

It is anticipated that this effort will not require additional budgetary resources **initially**, but will require new dedicated staff resources within UNOOSA.

7. Conclusions

The present paper proposes the development of a results-based management approach for space capacity-building by 2020.

UNOOSA believes that such an approach will have measurable positive impact on Member States' capacity to use space, science, technology and their applications in support of economic, social and environmental sustainable development. It will also contribute to help Member States with achieving the goal of implementing the 2030 Agenda for Sustainable Development.

Making full use of the framework and opportunities provided by UNISPACE + 50, the Office for Outer Space Affairs stands ready to assist Member States with developing and implementing the capacity-building actions necessary to address the global challenges of our rapidly changing world in the 21st century.

UNOOSA will continue to consult with Member States and stakeholders on this proposed approach, with the aim to arrive with a final proposal for approval at UNISPACE + 50 in June 2018.

For the latest information on the work of the Office for Outer Space Affairs please consult the UNOOSA website at http://www.unoosa.org.

United Nations documents quoted in this paper are available from the website of the Office for Outer Space Affairs at http://www.unoosa.org and from the Official Document System of the United Nations at http://documents.un.org.

The views expressed herein are those of the authors and do not necessarily reflect the views of the United Nations.

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