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Space as an Enabler of Sustainable Development

1. Abstract

The 2030 Agenda for Sustainable Development creates a framework for new approaches, both in terms of governance tools and of roadmaps for the implementation of technological innovations, geared towards the creation of better living conditions on this planet, with emphasis on the development of solutions that will have positive impacts on local economies and on society while preserving the environment.
Among the technological innovations that may significantly contribute to these solutions, the full exploitation of space assets for sustainable development purposes is considered highly relevant at this point in time. Therefore, the international actors involved in development activities need to be informed of the potential of space and should be in a position to voice their needs to the space community, in order to translate them into space programs and dedicated services. For this purpose, it is proposed to build a dedicated platform to ensure that a constant two-way dialogue takes place among stakeholders.
This dialogue between space actors and development stakeholders should start with requirements defined by the actors dealing with the definition, implementation and monitoring of the Sustainable Development Goals (e.g. United Nations, Governments, European Union and other institutions, local and regional stakeholders, and NGOs in the field), with space solutions being developed on the basis of these requirements.
There are already several cases of development actors employing space assets, and there are multiple on-going activities where new solutions are researched to fully exploit the potential that space can offer in implementing sustainable development on a global scale. A good example of cooperation between space actors is the International Charter on Space and Major Disasters, which has also recently been invoked to address a public health crisis, and is under revision to possibly expand its mandate to include development-related challenges.
Considering this it can be argued that, with the appropriate financial means and governance mechanisms in place, sustainable development programs which also make use of space assets can become rather successful in supporting the achievement of the SDGs in a shorter timeframe, thanks to a development based on technological leap-frogging, rather than on replicating the traditional steps that our societies went through in the past.
For example, both connectivity provided by drones linked to satellites, which enables innovative e-health and tele-education services, and localized production of energy using renewable sources, can be developed instead of more complex and expensive infrastructures based on traditional technologies. For the latter, space can play a crucial role, by supporting the exploitation of geothermal reservoirs and by allowing the precise determination of wind, water and solar energy potential of different sites.
In addition, such an approach underlines the fact that sustainable development, as expressed in the Agenda 2030, is closely linked with the COP21 targets achievement. Therefore, providing space based services to developing economies in the planning phase of new energy infrastructures, would create better living conditions also in Europe and in North America, by reducing CO2 emissions and the associated climate change effects all over the globe.
This gives us even more confidence that the potential embedded in space assets can be fully harvested in the near future, provided that financial means will be available to scale up individual projects and ad-hoc solutions to a structural provision of fully integrated sustainable development services to countries which need a high rate of development in a relatively short timeframe.

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2. Introduction

The 2030 Agenda for Sustainable Development (SD) creates a framework for new approaches, both in governance and technological innovations, towards better living conditions on this planet.
The strongest argument for the involvement of space in SD comes from the time in which it occurs. The year 2015 has been a departure point for international development, with the expiry of the Millennium Development Goals and the drafting of their successors, the Sustainable Development Goals (SDGs), signalling a readiness to embrace new solutions which bring momentum to international development.
The third United Nations Conference on SD called for goals within the United Nations Development Agenda beyond 2015 to be based on the principle of SD, that is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs, that respects the planet's limits and considers the interrelated nature of the economy, the environment, and society".[1]
The SDGs don't only adopt a broadened scope, more ambitious targets ("eliminating" rather than "reducing" issues), and place greater emphasis on the environment and governance, but integrate more fields into the Agenda[2]. The UN World Conference on Disaster Risk Reduction in Japan, and the 21st Conference of Parties on Climate Change in France were held in 2015 to produce new framework agreements on disaster risk reduction and climate change respectively, that have been referenced in the SDGs[3]. The Goals acknowledge that the conferences are the primary fora for negotiations in their respective fields, but note that the implementation of agreed frameworks should occur on a sustainable basis in conformity with the SDGs, creating a two-way interaction between fields that previously functioned largely in isolation from each other.[4]
The importance of the SDGs is thus that they formulate a new approach to development which has the potential to be more circumspect, but also more comprehensive in its actions. This emphasis on intelligent development solutions presents new challenges to current development actors, and is driving a search for improved solutions.
Space technologies are one avenue which is being explored by several organizations for its communications and service delivery capabilities, as well as its importance in developing holistic solutions that address the long-term economic, social and environmental requirements of beneficiaries. This aspect has already been recognized at the highest political level and, as outlined in the Space agencies resolution presented at COP21, a large consensus has been achieved.

3. The Role of Space in Sustainable Development

Among the many technological innovations that may significantly contribute to SD, the full exploitation of space assets is considered highly relevant at this point in time.

[1] Sachs, Jeffrey D. The Age of Sustainable Development. New York: Columbia University Press, 2015. p. 5.
[2] Veit, Elisabeth. "From MDGs to SDGs: why now is the time to further integrate space into development." ESPI Perspectives 74. 22 Jan. 2016 <http://www.espi.or.at/images/stories/dokumente/studies/Perspective_74.pdf>.
[3] Ibid.
[4] Ibid.

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The first step in order to address future challenges is an accurate assessment of societal needs and technological requirements. These challenges are both endogenous, such as societal ones, and exogenous, such as the ones associated to climate change and natural disasters.
In order to ensure a sustainable economic growth on this planet, it is important to develop solutions that avoid excessive consumption of resources. To achieve this goal, space is key with its fleets of Earth Observation satellites and the ever growing space based services, providing a large number of indicators for monitoring of the Earth's environment that can only be obtained from Space.
Technological progress, allowing for better living conditions for the most developed countries, also poses the question of how quickly developing countries will increase natural resources demands to equalize living standards. Space technology, particularly designed for human spaceflight missions, conceived for reusability which is necessary due to the long permanence of astronauts in Space, can provide lessons to create more sustainable living conditions as populations increase. Major space agencies have initiated technology transfer projects in various domains and it would be important to create policies that ensure the proper dissemination of the outcomes, so that they become more and more available to development actors.
In its multitude of facets and services, space can also represent a key factor in addressing societal challenges such as urbanisation. As engines of productivity, urban centres will stimulate economic growth and innovation, at the same time exercising serious pressures on the environment, creating an increasing need for enhancing and optimising urban planning, governance, infrastructure, resource-management, transportation systems and security services[5]. Smart cities will have the primary goal of minimising resource consumption and environmental degradation, while maximising citizens' quality of life and increasing economic productivity and competitiveness. Within the context of the future smart cities, ICT will play the pivotal role in many areas of applications. From households to organisations and industry, more and more networks (electricity, gas, heat, water, transport) and systems (e.g. buildings) will progressively become integrated within a system of systems. Space assets can, inter alia, support the operations of the future "city dashboard solutions", by integrating ground sensors and video data with EO, GNSS and telecommunications capabilities, enhancing the quality of the situational awareness of cities.
The potential of Space is wider than commonly expected and it is extremely important that the international actors involved with development activities are informed of the potentialities of space and are in a position to voice their needs up to the space community, in order to translate it into space programmes and dedicated services. If a state desires it, space technology can be channelled into terrestrial applications including development efforts. This has already been done, for example, by the Indian government, in the field of telemedicine.
The space sector thus has a strong potential not only to develop technologies that may be useful for SD, but also has multiple structures in place to coordinate and facilitate its use.
The **European Space Agency** (ESA) is established for the collective benefit of its Member States and should act as an enabler for industries of those states. This is a similar mandate to **national space agencies** such as NASA, ISRO, or ROSCOSMOS. Where ESA has been constrained by its mandate from engaging in activities outside of Europe not explicitly desired by Member States, the **European Union** has in recent years become a stakeholder with broader power to act. Through the Commission, the EU has initiated the Copernicus and Galileo programmes together with ESA, that are designed to monitor climate change, emergency

[5] National Intelligence Council. Global Trends 2030: Alternative Worlds. 2012: 86

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management and security, and while high-precision capabilities will be reserved for paying customers, basic services will be free and open.

While not directly supplying space technology, there are several international bodies which exercise a coordinating function for the peaceful uses of outer space. The **United Nations Office of Outer Space Affairs (UNOOSA)** serves as the secretariat for the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) and for the International Committee on Global Navigation Satellite Systems (ICG). UNOOSA also conducts activities that build human capacity in the fields of remote sensing, satellite navigation, meteorology and tele-education for the benefit of developing nations. Combined with its role as the manager of the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER), UNOOSA thus acts as a facilitator for the adoption of space technologies in developing countries and for their deployment in emergency situations.

The **International Telecommunication Union** conducts similar activities in the field of telecommunications. Its mission to connect all the world's people entails allocating the global radio spectrum and satellite orbits as well as improving access to ICTs.[6]

Other coordinating bodies, including the **Group on Earth Observations** (GEO)[7] and the **Committee on Earth Observation Satellites** (CEOS), as well as the **International Charter on Space and Major Disasters**, that have a mandate to extend use of, and access to, space technologies globally.

4. Dialogue Platforms around Sustainable Development

Beyond mapping space applications on to targets outlined under the SDGs, it is worth taking a look at the global development landscape, and at how the specific needs of recipient communities may be characterized. Overall, the emphasis on the adequate provision of water, food, energy, healthcare and education within the SDGs demonstrates that on the global level, the foremost issue in development continues to be the provision of essential services and resources.

On the regional level, however, more specific considerations prevail, shaped by climate, geography, and the historical development of state structures. In Africa, the delivery of basic services is low overall, and is made difficult by several factors. For one, the continent has the highest number of landlocked countries in the world, hindering access to international trade networks. For another, many areas of Africa are extremely remote, as well as inhospitable or arid. This leads to the wide and scarce distribution of populations, increasing the logistical challenge of serving rural communities, while encouraging the concentration of populations in urban areas, leading to the growth of informal settlements and overburdening existing transport, energy and sanitation infrastructures.

Other factors which exacerbate these issues include climate change, which is leading to growing water scarcity in arid areas, political instability, which has led to recurring insecurity in Central and East Africa and the Horn region, and rapid population growth. Together with Asia, Africa will be home to 76.6% of the global population by 2030, leading to a rapid growth in the need for basic services.

Population growth is also a major hurdle for development in Asia, and for China and India in particular, who will represent 34.6% of the world population by 2030. Rapidly rising populations

[6] "About ITU." International Telecommunications Union 10 Feb. 2016 <http://www.itu.int/en/about/Pages/default.aspx>.
[7] "GEO Vision." Group on Earth Observations 9 Feb. 2016 <https://www.earthobservations.org/vision.php>.

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in the region are fuelling demands for water, food and energy. China will be the biggest consumer of energy by 2035 according to the WEO, driving the intensification of oil and gas production, with detrimental environmental impacts. Security concerns, together with water scarcity, remain at the forefront of the development challenge in Central Asia and the Middle East, whereas South East Asia is contending with a rise of extreme weather events leading to widespread flooding and loss of life.

Security challenges are also a major issue in Central and South America, where illegal drugs and narcotics production for consumption in North America have led to high levels of corruption, violence and organized crime.

Lastly, Small Island Developing States in the Pacific and Caribbean are facing an existential threat over rising sea levels caused by global warming.

Such a cursory summary at the global level may give us a broad indicator of how specific needs are distributed, but does not do justice to the high level of local, national, and regional differentiation of development challenges. Rather than attempting to capture the full complexity of the challenge, it is worth looking instead to institutions which exercise a coordinating function between states and provide a channel for expressing specific development needs.

A prevailing trend of the last half century has been the creation of multiple regional organisations across the world based on geographical or geopolitical (in particularly economic) characteristics. The defining goal of most of these organisations is to deepen economic integration as well as to foster political cooperation on the international sphere. As such, many of these organisations have mandates to encourage development, either as a foreign policy (such as the European Union), or as domestic policy. These organisations are thus well equipped to define the development needs of a specific community, as well as to execute development programmes.

The largest regional organisation in Africa is the **African Union**, which encompasses all continental and neighbouring island states (with the exception of Morocco). Among its objectives is listed the promotion "of SD at the economic, social and cultural levels as well as the integration of African economies."[8] In 2001, the Union adopted the New Partnership for Africa's Development (NEPAD), an economic development programme whose four primary objectives are the eradication of poverty, the promotion of sustainable growth and development, the integration of Africa into the world economy, and the acceleration of empowerment of women. NEPAD has entered into partnerships with the World Bank, the European Commission and the G8 to accelerate the achievement of these goals, and has developed two projects targeting ICT specifically: the Programme for Infrastructure Development in Africa, which aims to interconnect the continent, and the "e-schools programme" which aims to equip all schools with IT equipment and internet access.

The main regional organisation in Latin America is CELAC, the Community of Latin American and Caribbean States. However, the high number of regional organisations within the region has so far prevented one superordinate organisation from developing, and CELAC currently does not have a secretariat, meeting only during summits.[9] Smaller organisations such as CARICOM have developed standing bodies that have a stronger focus on development, including a Caribbean Telecommunications Union and a Disaster Emergency Response Agency, however the focus of these organisations remains primarily on economic coordination and integration.[10]

[8] African Union Charter, < http://www.au.int/en/sites/default/files/treaties/7759-sl-oau_charter_1963_0.pdf>
[9] <http://www.sela.org/celac/quienes-somos/que-es-la-celac/>
[10]< http://www.caricom.org>

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There is a similar lack of overarching institutions in Asia, due to the high level of differentiation between states on the continent. Among the most well-known organisations is ASEAN, the Association of Southeast Asian Nations, whose aims include the acceleration of "economic growth, social progress, and cultural development in the region."[11] Its Narrowing the Development Gap (NDG) programme aims to address disparities among and within member states and to eliminate underdevelopment[11]. Other activities include the development of a University Network and an Engineering Education Development Network Project to foster human resource development in the region[11]. Another regional organisation, the South Asian Association for Regional Cooperation, SAARC, also includes the acceleration of socio-cultural development and the promotion of welfare economics as its aims.[12] Efforts are now in place under the Asia Cooperation Dialogue to integrate the separate regional organizations of Asia and to increase the coherence of economic cooperation, although so far its activities have been restricted to ministerial meetings.[12]

The Pacific Islands Forum is perhaps one of the smallest regional organisations, but has a division of its secretariat devoted exclusively to development and economic policy, which implements a range of programmes for capacity building and co-ordinates action on matters of common interest.[13] The Forum has committed financial support to member states for the improvement of infrastructure.[13]

Other actors which play a major role in defining development needs of communities and in executing programmes dedicated to development are non-governmental organisations (NGOs). Most importantly, NGOs are active in the development and operation of infrastructure and services in developing regions where these are not provided by the state. This includes the construction of housing, wells, sanitation facilities, schools and hospitals, as well as their operation and the wider provision of health and education services. Microfinance institutions also provide financial services. Relatedly, NGOs are also major sources of technical assistance, training and capacity building, by providing vocational training in underserviced job sectors. Many also act as channels for research, monitoring and evaluation and incubators for innovation through pilot projects employing new technologies or techniques. Another main function of NGOs, is to act as a facilitator for communication between local communities and state organisations. NGOs are able to communicate information about conditions in the field to the policy-making levels of government and vice versa, and thus operate in the space between the two levels. The reasons for this gap between the grass-roots and governmental levels are diverse, but may be down to limited resources, lack of human or institutional capacity, lack of funding, political instability or war.

The role of the international community is twofold. For one, it coordinates actions at the national level to find top-level political solutions to issues such as civil wars, disputes over territory or resources, and fosters cooperation between national actors. For another, the United Nations and International Financial Institutions play a major role in developing and implementing development programmes at national, regional, and international levels. In many of these instances, they work alongside NGOs but may have additional capacities and resources beyond their reach.

For this purpose, it is proposed that a dedicated platform should be built to ensure that a constant two-way dialogue takes place among the above mentioned stakeholders. In analysing the means by which such dialogue between space stakeholders and development actors might be put in place, it is underlined the importance that the requirements for space solutions need to

11 ASEAN Declaration, < http://asean.org/the-asean-declaration-bangkok-declaration-bangkok-8-august-1967/>
12 Charter of SAARC, < http://saarc-sec.org/saarc-charter/5/>
13< http://www.forumsec.org>

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come from the actors dealing with the definition, implementation and monitoring of the SDGs (e.g. United Nations, Governments, European Union and other institutions, local and regional stakeholders, and NGOs in the field).

5. Cooperation Mechanisms

Space technologies may be relevant to the development projects of multiple SDG actors. At the grass-roots level are **NGOs** such as SOS Children's Villages, provide basic services such as childcare and healthcare where governments cannot, especially in humanitarian crisis situations.

National governments may also find space technologies beneficial in the fields of health and education, improving both service quality and quantity. However, space technologies may also assist governments in changing national infrastructures for the provision of these services, as well as agricultural production. As demonstrated in the collaborative project between ESA and the World Bank, space technologies have a significant role to play in managing rural and urban environments, also in the sustainable use of natural resources, as well as in the preservation of the environment.[14] Space technology may thus provide useful impetus towards scaling efforts in these fields on a national level and building institutional capacity.

From a top-level perspective, **international financial institutions** (IFIs), **regional organizations** and **international organizations** (IOs) also stand to benefit from the coordinating functions of space technology use. IFIs such as the World Bank and regional actors such as the African Union, ASEAN, or IOs such as the United Nations all have a mission to help developing countries to develop by financing, advising or coordinating efforts. Regarding IOs, some Member States of the ESA have shown interest in topics such as Space for Africa, and ESA could design programs around development applications which may gain funding. ESA also currently has an avenue of dialogue with the development community through its collaboration with the World Bank. The UNOOSA, instead, have a worldwide network of regional training centres which may be used as channels to translate space into development.

Finally, **private or individual actors**, such as billionaires, have a history of engaging in charity, and recently several space ventures were funded by wealthy entrepreneurs. Altruism and technology are being combined by individuals like Zuckerberg with his internet.org campaign. However, the involvement of individual actors in development activities is not simple, requiring close coordination with local actors to avoid duplication of work and potential obstruction of activities without providing tangible benefits. Moreover, on the top level and from a long-term perspective, the involvement of private actors can result in the "endangerment of democracy"[15]. Therefore private actions need to be embedded into institutional dialogue mechanisms to ensure proper coordination with all actors, and that acting through governments may not always be the most appropriate channel, especially when these are not in total control of their territories.

14 European Space Agency, World Bank. "Earth Observation for Sustainable Development: Partnership Report: June 2013." European Space Agency 10 Feb. 2016 <http://esamultimedia.esa.int/multimedia/publications/ESA_WB_Partnership_Report_2013_complete/>.

15 See "A Dystopian Welfare State Funded by Clicks" < http://www.ft.com/cms/s/0/8cc05ef0-37ae-11e5-bdbb-35e55cbae175.html#axzz4HRYdplqf>

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5.1 NGOs, Coordination, and Dialogue Mechanisms

The fact that national governments may not always be the most appropriate channels for SD does not undermine the necessity for institutional dialogue mechanisms. Several UN organisations exercise coordinating functions with NGOs. The UN has a dedicated Non-Government Liaison Service in Geneva, and several UN organisations have NGO Focal Points. Moreover, the Inter-Agency Standing Committee engages in coordination of humanitarian assistance, involving key UN and non-UN humanitarian partners. It is noteworthy that the IASC has created the Emergency Telecommunications Cluster, involving both service providers and end users, which is embedded within the UN.

	ICG*	GEOSS*	CHARTER*	ETC*
EMBEDDED IN UN SYSTEM	✔	✔	✖	✔
MEMBERSHIP LEVEL	UN Member States	UN Member States	Space agencies	ETC standard service providing organisations
MEMBERSHIP SCOPE	Governments of GNSS holders	UN Member States, UN organisations, space-focused organisations	National Space Agencies and meteorological organisations, UN organisations, ESA	UN organisations, space-focused organisations, NGOs, ODA agencies
NGO INVOLVEMENT	✖	✖	✖	✔
OTHER STAKEHOLDERS	Space agencies hold observer status	Aviation actors		

* International Committee on Global Navigation Satellite Systems; Global Earth Observation System of Systems; International Charter on Space and Major Disasters; Emergency Telecommunications Cluster.

5.2 Monitoring SDGs

The process of creating a framework for measurement and monitoring of SDGs is ongoing. In March 2015, the United Nations Statistical Commission created an Inter-agency and Expert Group (IAEG-SDGs) to draft a global indicator framework on the SDGs that proposed 231 global indicators[16] and noted that the primary monitoring bodies will be the Member States, who will develop their own national indicators to complement the global indicators[17]. Communities of specific thematic areas such as health, agriculture or education will also mobilize and analyse

[16] Agenda of the United Nations Statistical Commission of the Economic and Social Council, 47th Session. Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators. UN Doc. E/CN.3/2016/2 of 17 December 2015. New York: United Nations.

17 Agenda of the United Nations Statistical Commission of the Economic and Social Council, 47th Session. Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators. UN Doc. E/CN.3/2016/2 of 17 December 2015. New York: United Nations. 3.

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progress toward the objectives.[18] Monitoring of the SDGs will thus involve governments, international organisations, NGOs and civil society. A good example of cooperation between space actors is the International Charter on Space and Major Disasters, which was also recently been invoked to address a public health crisis, and is under revision to possibly expand its mandate to include development related challenges.

6. Development Leapfrog with Space Technology

It can be argued that with the appropriate financial means and governance mechanisms in place, SD programs which also use of space assets, can become rather successful in supporting the achievement of the SDGs in a shorter timeframe, thanks to a development based on a technological leapfrog, rather than on the traditional steps that our societies went through in the past.

Both connectivity provided by drones linked to satellites, which enables innovative e-health and tele-education services, and localized production of energy by renewable sources, can be developed instead of more complex and expensive infrastructures based on traditional technologies.

Innovation shall enable better and faster access to basic information, via mobile devices and internet platforms, more efficient platforms for social security (i.e. job search, teleworking, etc..) and health care systems (i.e. faster process of diagnostic and remotely using data of the patient). The continuous aggregation of data related to health, education, transport and energy could, in the long run, expand so much as to become de-facto a replacement for the welfare state functions.

It is expected that the Internet of Things will reshape various sectors, such as: transportation, urbanization[19] and resource management. Space assets represented the first instrument allowing for broadband communication over long distances, and now research is tackling issues such as quantum communication, laser communication and cyber-security. Space could eventually represent the integrator among all these new services, providing earth observation, navigation and telecommunication capabilities.

Space can play a leapfrog role also in the energy and Infrastructures domains. For example it can support the exploitation of geothermal reservoirs and allow the precise determination of wind, water and solar energy potential. In fact SD, as expressed in the Agenda 2030, is closely linked with the COP21 targets achievement. Therefore providing space based services to developing economies in the planning phase of new energy infrastructures, could create better living conditions also in the western world, by reducing CO2 emissions and the associated climate-change effects all over the globe.

Both NASA and ESA are currently looking into the possibilities offered by Additive Layer Manufacturing, that range from building small components up to entire structures, starting from a variety of base materials, such as feedstock, metals, composites, glass and concrete. Tests are being conducted inside the Microgravity Science Glovebox of the International Space Station, and on Earth feasibility studies are under way for the construction of planetary bases

18 Agenda of the United Nations Statistical Commission of the Economic and Social Council, 47th Session. Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators. UN Doc. E/CN.3/2016/2 of 17 December 2015. New York: United Nations. 7.

19 IBM Connects “Internet of Things” to the Enterprise <http://www-03.ibm.com/press/us/en/pressrelease/46453.wss>

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making use of in-situ resources, such as Moon regolith[20]. Some advantages offered by this technology are that it allows the construction of large structures in situ, freeing them up from the constraints provided by the uplift mass and volumes of the launch vehicles, and by the structural requirements of gravity. The other key point is that robotic systems can entirely print such structures without the need of human intervention, opening up entire new business and technical opportunities associated with in-Space just-in-time production, such as new components, spare parts, cube-sat, antennas, truss structures, and habitats. Potential applications on Earth will provide sustainable and effective solutions in various environments, some of which are already being investigated like building houses in deserted areas of developing countries and reconstructing underwater coral barriers[21]. The benefits of these developments could significantly contribute to the manufacturing revolution on Earth in various fields, such as architecture and engineering, materials processing and nanotechnology, science and robotics, offering new shapes, new materials , new design solutions where they are needed at the time they are needed.

7. Conclusions

This paper started by outlining the distinctive features of space that are advantageous for SD, particularly for the SDGs, presenting different technologies and actors of the space community that are relevant in SD. It has outlined the previous involvement of space technologies in development, also highlighting the under-use of space in current efforts.
Some specific examples were provided, specifically focusing on Europe versus the global perspective, looking at how different policies work in practice.
Key recommendations include the importance for space to play a role in ultimately creating the right communication tools between the actors on the ground, which should provide the requirements for space solutions, and those who act as implementers, setting specific programmatic boundaries. Therefore it is necessary to bring both sides together to establish a proper dialogue, through both formal and informal mechanisms, some of which are already in place especially through the UN system and coordination bodies.
The paper also outlines how space technologies provide an opportunity for emerging countries to adopt a leapfrog approach in several sectors, from communications to tele-services to additive payer manufacturing, in order to ensure a sustainable development without passing through all the previous technology development stages of the western world.
The paper finally attempts the identification of a practical way forward, including objectives that should be met, which tools may be employed to achieve those objectives and how the tools can be leveraged
The discussion outlined above gives us confidence that the potential embedded in space assets could be fully harvested in the near future, provided that appropriate financial means will be available to scale up individual projects and ad hoc solutions to a structural provision of fully integrated SD services to countries which need a high rate of development in a relatively short time.

20 AW&ST Aug 24, 2015, p.23
21 Private conversation S. Ferretti with Mr. Dini, D-tech company, Sept 2015.