

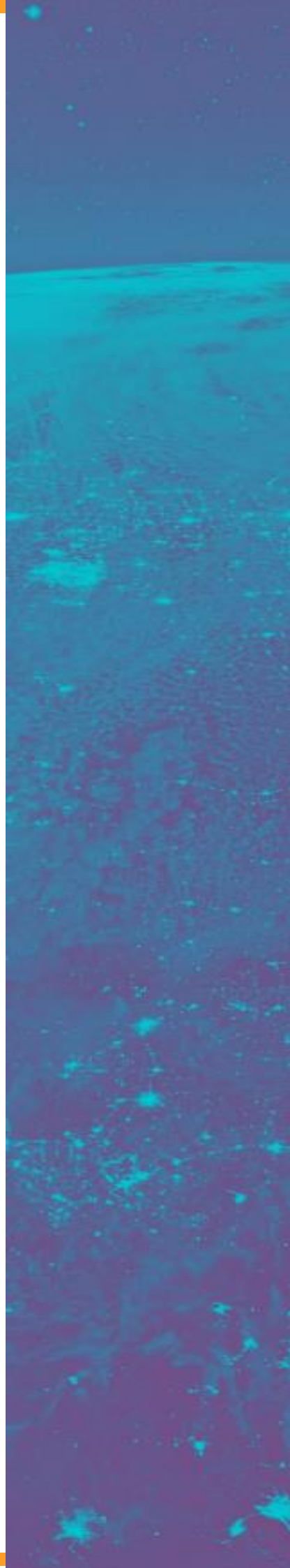
THE **SPACE ECONOMY** INITIATIVE

Innovation and growth in the Space ecosystem **Insights Report**

September 9, 2020



UNITED NATIONS
Office for Outer Space Affairs



INTRODUCING THE **SPACE ECONOMY**

The level of political and economic capital being invested in space is higher than ever. Estimates indicate the global space economy grew to \$ 414,75 billion in 2018. Space and satellite technology are pillars of modern society. They provide policymakers with invaluable data and information, helping make effective fact-based decisions across a range of policy areas – from urbanisation to national crisis response, with the COVID-19 pandemic being the most recent example of ‘space-enabled’ policy decisions being made at scale.

Expanding the global space economy, responsibly and sustainably, is a fundamental driver behind efforts to bring the benefits of space to everyone, everywhere. Further, these developments can support countries in efforts to ‘build back better’ using space services to face policy challenges, while contributing to innovation, job and revenue creation.

Around the world, many space activities at the national level include a role for a publicly funded ‘space agency’ or similar institution. This central public entity is often also part of a much broader stakeholder ecosystem including both private and other public sector entities, all contributing to the national space sector. Moreover, to truly identify and realise the socio-economic benefits of a strong space sector, we must look beyond just the immediate context; from agriculture to finance, from education to transport, space is making tangible contributions across a huge range of fields.

At the United Nations Office for Outer Space Affairs (UNOOSA), ‘Space Economy’ is a concept that captures, in the broadest sense, the role space is playing to support sustainable socio-economic development. Unpacking such a complex picture is what we aim to achieve with the Space Economy Initiative. We seek to spotlight insights, success stories and experiences from across the international space community. We want to identify the key elements of growing healthy, prosperous space economies and then share such building blocks with all stakeholders pursuing responsible and sustainable space economy growth.

THE WEBINAR SERIES

To unpack how different countries are strengthening their respective space sectors UNOOSA has established a webinar 'space economy' series to bring together space economy experts from across the international space community.

The sessions are designed to tackle this complex subject by focussing on some of the more fundamental elements of a healthy space economy. For example, we will provide a platform to share insights from commercial space entities on how to go from the 'start-up' phase to being well-established. Further, we will look at financing space activities, exploring success stories on how mixed public-private funding models are helping space economies thrive. The series will touch upon the nexus between government, industry and academia, and how to leverage this nexus to maximise innovation and growth in the space economy. We will also look at what this all means outside the immediate domestic context and the link between growing space economies at the national level and supporting responsible and sustainable space activities at the international level.

All these considerations will be taken in the context of the current developments with regards to how space economy can play a key role in supporting socio-economic development, as countries build-back-better in response to the COVID-19 crisis.

The series is composed of topic-specific sessions, touching upon the elements below:

- **Introducing 'Space Economy'**
- **Making the Case for Space:** building the policy case, public support and initial investment.
- **Scaling-Up:** Success stories from the scale-up to established phase.
- **Access to finance:** building a sustainable financial system for space
- **International cooperation to grow responsible and sustainable space activities:** bringing the international normative framework into the domestic context.
- **Innovation and growth in the Space ecosystem: the nexus between government, industry and universities.**
- **Using space to building back better:** supporting countries post-COVID 19 recoveries.

During the series UNOOSA collates the experiences being shared by experts, to build insights of 'what works' with regards to building strong, responsible and sustainable space economies.

These success stories will play a key role towards publishing a set of 'building blocks' that can be used as a reference point in support of further growth in the global space economy and how this growth can help bring the benefits of space to everyone, everywhere. The following section includes the summary reports of each webinar, with "Introducing Space Economy" being the first one

INSIGHTS REPORT

Innovation and growth in the space ecosystem

This insights report captures the remarks and experiences shared during our sixth webinar session with space economy experts. This webinar addressed the importance of interlinkages between different stakeholders for innovation and growth in the space ecosystem.

In this session, we heard from experts from the Indonesian Space Agency, Surrey Satellite Technology, China Space Foundation and SDA Bocconi School of Management who delivered their perspectives on the current cooperative landscape between academia, governments and the commercial space sector and what is needed to further advance joint efforts in building a thriving space economy.

The recording of the webinar is available on oosa.org and can be viewed [here](#).

SPEAKERS

INSIGHTS

Space experts from across the international space sector were each give time for remarks on their personal experiences working in the field before switching into a moderated discussion to dig deeper into the topics and insights that had been shared.

- *Rokhis Khomarudin, Indonesian National Institute of Aeronautics and Space*
- *Kasia Clatworthy, Surrey Satellite Technology*
- *Michael Wang, China Space Foundation*
- *Mattia Pianorsi, SDA Bocconi School of Management*

Rokhis Khomarudin

Indonesian National Institute of Aeronautics and Space (LAPAN)

Mr Rokhis Khomarudin serves as Head of Remote Sensing Application for Environment and Disaster Mitigation Division at the Indonesian National Institute of Aeronautics and Space, LAPAN. Ms Khomarudin is Chief Editor of the International Journal Of Remote Sensing and Earth Science and has been coordinator of the Indonesian Regional Support office of UN-SPIDER.

Mr Khomarudin from the Remote Sensing Application Center of LAPAN spoke about successful examples of using remote sensing and joint work in its utilization by several stakeholders from different parts of the society – government, private sector, academia.

He began by describing the role of LAPAN in remote sensing that includes:

- collection of data and information;
- establishment of methodology guidelines;
- conduct of supervision.

LAPAN as an entity receives data through its Earth Stations from very high to low resolution from, among others, French Pleiades satellites, the US Landsat missions, multinational Terra and Aqua missions as well as German TerraSAR-X. LAPAN also has the availability to acquire data from Sentinel 1 & 2, ALOS PALSAR Data, Gaofen 1 Data without dedicated LAPAN Earth Stations.

Remote sensing techniques in Indonesia are applied to three different areas:

- natural resources;
- environment and disasters;
- other strategic areas such as security and defense, and illegal activities such cannabis identification.

Several collaborations are established within the country with different stakeholders including state and local governments and private companies. With the Ministry of Agriculture, LAPAN developed a platform for monitoring vegetation growth with information updated every 8 days. LAPAN also works with a private company on a platform for ‘crop insurance’ to help farmers cope with consequences of weather events such as floods and droughts. This platform helps to pinpoint the location and size of a farm as well as assess damages for an informed decision-making about the claims.

With the Ministry of Maritime Affairs and Fisheries, LAPAN developed a platform to provide information relevant for the fishing industry. Remote sensing data are also used in cooperation with the Ministry of Finance to identify buildings in dozens of villages in Papua to support sustainable management of electricity in the region.

Besides the above-mentioned, LAPAN also works with 34 provinces throughout the country to provide trainings and capacity building.

Mr Khomarudin's slides are [here](#).

His insights start at 4:40 in the recording [here](#).

Kasia Clatworthy

Surrey Satellite Technology

Ms Kasia Clatworthy is Head of Know-how Transfer and Training at Surrey Satellite Technology Ltd. where she started as Business Development and Sales Manager in 2014. She previously worked at a daughter company DMC International Imaging (currently Airbus CIS), first as Satellite Campaign Manager and later as Business Development Manager. Ms Clatworthy has been in the company group for more than a decade.

Ms. Kasia Clatworthy spoke about the need for government, industry and academia to work together for the growth and sustainability of space programmes and provided some successful examples of cooperation between SSTL and other countries.

SSTL is a small satellite designer and manufacturer, and it also offers capacity-building known as know-how transfer programmes. SSTL is the result of a successful innovation born at a university, more specifically Surrey University in the mid 80s. The idea to design and build small satellites by using commercial off-the-shelf components was very innovative and transformed the space industry in the UK and globally, with fleets of satellites now using cost components.

She reasoned that for a successful space program a country must have the three key stakeholders – state, academia and commercial sector – working together. While innovation can be born through various means, pioneering it to be sustainable in the long-term requires interaction between the aforementioned.

Academia develops the future workforce suitable for bringing up new ideas and concepts as well as making them happen and is a great platform for cooperation with many innovations happening as a result of cooperation between universities. Skilled and educated staff are un-easy to find without a quality academic background and as a result, the industry struggles with their employment possibilities. With knowledgeable entry-level employee base, industry builds the capacity to produce capabilities and services to the government and other stakeholders, and at large, contributes to the national economy.

The role of the government goes beyond of being a mere customer and a recipient of the service or technology. Public funding for initial projects and ideas largely comes from governmental subsidies and programmes, a key for many new innovations to get a head-start. Additionally, certain conditions must be established by the government through regulatory frameworks to ensure that space economy can thrive. A well-defined and well understood regulatory enables the industry and academia to be fully devoted to

their specific roles and thus only through this symbiotic relationship between the three, successful space economies can be born.

A project with Thai space agency (GISTDA) was described. The aim was to build a high-resolution small satellite leading not only to the final product but through significant involvement of the local industry also to development of knowledge and skills in the country. Through these means, both local workforce and supply chains can be established for the future and Thailand will become much better equipped to lead future projects nationally.

Ms. Clatworthy also described an example of cooperation between SSTL and Algeria. Initially the country started working on a single spacecraft with a handful of people and has gradually grown ten-fold with over 150 people now employed in the Algeria Space Agency. Each programme is now focused on educating people either locally or externally, manufacturing satellites locally and building the national space economy. Through the involvement of students with University of Surrey cubesat project, alongside SSTL microsatellite project, the next generation of engineers was born and enabled students to take the next step and become more skilled to take on more ambitious projects.

She then closed by underlining the role of cooperation between and the existence itself of the well-functioning tripartite. Without one, the sustainability of space programme in the long-term is difficult.

Ms Clatworthy's slides are available [here](#).

His insights start at 10:20 in the recording [here](#).

Cheng Wang

China Space Foundation

Mr Cheng Wang is the Secretary-General of China Space Foundation, China's only non-profit charitable organization in the space area. Among its activities, the China Space Foundation promotes space entrepreneurship, provides education opportunities for youth and fosters international cooperation.

Mr. Wang talked in his presentation about the pathway that the space industry is undertaking in China. In the country, several cities have become regional centres for new space business and economy thanks to the deep interest in space exploration and a strong satellite manufacture industry.

In the satellite manufacture industry currently, companies focus on Earth Observation and LEO satcoms as well as satellite internet. China also has some typical

fresh companies in its market driven launch service industry and is developing solid and liquid engines with several small solid rockets are already in commercial operation such as Long-March 11 which is the result of both government and commercial investment.

China also aims at local, regional and global service for TTNC and strongly promotes the application of space technology in civil industries to encourage private capital to participate in the space industry. For the future, the country envisions more capital participation beyond government as traditionally most of the investments have been made from public resources. Gradually, however, social and market investments are growing.

It was also argued that more global participation is necessary especially in addressing some global challenges and novel realities, including space debris, security and regulation, as well as space travel, and exploration of satellite internet. One of the typical characteristics is the need for more web-based tech and application that goes beyond the traditional industry. All in all, these developments underline the expansion of space industry in China as a result of new stakeholders entering the market.

His insights start at 20:28 in the recording [here](#).

Mattia Pianorsi

SDA Bocconi School of Management

Mattia Pianorsi is a Research Fellow of Banking and Insurance at SDA Bocconi School of Management. Mr Pianorsi is teaching assistant of courses on financial management and markets at Bocconi University. Since 2018, he has been working as permanent researcher at SEE Lab (Space Economy Evolution Laboratory).

Mr. Mattia Pianorsi provided more insight into an existing research centre in the Bocconi School of Management - Space Economy Evolution Laboratory, as well as covered the importance of the interplay between a government, private sector and academia.

The research and studies are devoted to respond to questions such as: How to capitalize a product in the innovation process into the market? How to commercialize products and services which are supposed to be innovate?

Before these research questions can be answered, one needs to take time to analyse the market and take an economic perspective which is policy driven. The space market tends to be fragmented from the demand side and it generally depends on the size of a country's economy. Additionally, space technologies are often dual use – used for both military and civilian/commercial purposes, creating an additional layer of complexity of understanding the market.

Mr. Pianorsi spoke about the gradual shift from purely public investments towards a more dynamic and more diverse financial environment, however, highlighted that

government spending is still very critical. Naturally, countries with higher GDPs can afford to allocate more to different markets, including the space industry.

Historically, the well established major global aerospace companies have created a very concentrated market which is hard to penetrate for newcomers with new ideas. A careful consideration of both supply and demand side is critical to understand the market and the opportunities for innovation to break through. In order to succeed, one needs to acquire a competitive advantage over the peers and ensure that the product or service they offer is superior to that of the competition which in current space market is proving very difficult.

From the perspective of sustainable growth, cost advantage or product differentiation are the key to success, however, this again requires a considerable understanding of the market which a company seeks to enter with a new entry. A partial understanding might prove as a setback as without comprehension of the market conditions, a company may fail to identify proper demand for a product making it difficult to attract investors. Institutions which provide private capital are driven by the prospect of return of investment in 5-7 years and hence getting from invention to innovation through these means indeed requires thorough knowledge of market conditions in the process.

According to Mr. Pianorsi, academia therefore plays a critical role, and it is especially business schools that contribute to the success. Business schools nowadays employ an evidence-based approach in educating the next-generation of entrepreneurs which contributes to enhanced flexibility. Through such process, inventions can be fine-tuned to respond to the rapidly changing market to ensure that the product is viable and interesting and that potential customers exist for that innovation. Educating technically skilled individuals can, with a proper guidance from the academia, help avoid surprises from the market, long technological development cycles, the need to re-design products in the later stage of development, and the high-cost of recognizing the customer only after the product is already at the end of the process.

Mr Pianorsi's slides are available [here](#).

His insights start at 27:48 in the recording [here](#).

QUESTIONS and ANSWERS

What efforts are being made to attract and support new companies and entrepreneurs to participate in space economy?

Ms Clatworthy: It is true that often space agencies and governments select established space actors for their contracts, and this is due to the fact that these customers are risk averse and the public investment requires a high degree of reliability and quality. As a result, companies with track records and proven technology are more likely to be selected. New stakeholders are generally required to prove themselves. In order to support new ideas and innovation, either governments become more flexible in terms of results and open to risk or as an alternative, new technologies must be proven before a bid to government contract is made. Investments in new technologies must continue and academia is a great source of new ideas especially when one looks ahead 5-10 years to seek what innovations might be the song of the future.

What are the examples of institutional arrangements that can be put in place to support that governments, academia and industry work together?

Mr Wang: We must encourage the government and the market to give more resources – both financial and policy – to new technology development, and the development process must include also universities and research institutes.

What is the great barrier to spatial development in some countries?

Mr Pianorsi: The main challenges to a successful development of space programs are: a) the need for industrial base, b) public expenditures to fund space programmes to be implemented by the private sector, c) believe that the private equity funds and venture capitals can contribute to investing the industry. Capacity-building and international cooperation are critical in this regard, allowing non-spacefaring and emerging nations to learn from established space actors, not only limited to the governments but also other relevant stakeholders, as well as supporting access of a new country to the market. Privatization of LEO and cis-lunar space by NASA is a great example of creating an enabling environment which spurs innovation, better efficiency and lower costs, and establishment of new companies. This allows the industry to compete thanks to a certain intervention from a policy perspective.

CONCLUSIONS and NEXT STEPS

A variety of actors are involved in the creation and diffusion of knowledge in the space sector. Governments are the main funders as well as customers for many space-related products and services. The industry plays a significant role in space programmes, and public research institutions and universities still lead space innovation. It is necessary to ensure that governments, industry and academia work with one another and create partnerships that spur innovation, and that they use their respective strengths to collectively enhance their national space sector.

All speakers highlighted how the cooperation among these three stakeholders is crucial and how space programmes need this tripartite model for sustainability in the long-term. Some examples were presented. LAPAN works with a private company on crop insurance to help farmers dealing with consequences of natural hazards; SSTL worked with Algeria and supported improving the capabilities of the Algerian Space Agency and creating a new generation of national engineers. Commercial operations such as Long-March 11 in China is the result of both government and commercial investment. In this context, academia plays a critical role to educate technically skilled individuals who bring up innovation, which is essential to contribute to the national economy.

It is this very same innovation and technically skilled individuals that are key in the context of current global developments, where COVID-19 has strongly affected the entire world. The next webinar look at how space economies can play a key role in responses to COVID-19 and supporting socio-economic development as countries seek to 'build-back-better'.

THANK YOU

The webinar was made possible with time, support and expertise of our speakers; Rokhis Khomarudin, Kasia Clatworthy, Cheng Wang and Mattia Pianorsi.

Thank you to all UNOOSA colleagues who supported the webinar's delivery, including Martin Stasko for his assistance in drafting this report.

Moving forward, the Space Economy Initiative aims to support healthy space economies in both theory and practice. For an initiative funded entirely by voluntary contributions, donor support is crucial to realising this vision. Should you be interested in contributing to this work to build responsible and dynamic space economies that accelerate sustainable socio-economic development, please get in touch with Ian Freeman at ian.freeman@un.org or Veronica Cesco at veronica.cesco@un.org.