



SPACE ECONOMY EVOLUTION LAB ANNUAL REPORT 2023

SDA Bocconi
SCHOOL OF MANAGEMENT

SEE LAB
SPACE ECONOMY EVOLUTION



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FOREWORD



Stefano Caselli
Dean, SDA Bocconi School of Management

If the quest for creativity and new challenges is the deepest spirit of our School, to reflect on the space economy and to start an initiative like the SEE Lab best expresses the pioneering sense of this initiative. The comparison with "space" is by definition a combination of the unknown, technology, freedom, risk and research of new paradigms that can improve the life on our Earth. A deeper reflection is needed: if economics is born as a science of resource scarcity and management as a discipline of resource management and competition, the space bursts onto the scene as a factor that breaks up this established and unchanging game pattern. By its nature, space presents an extraordinarily additive and limitless logic, which allows to extend the playing field of scarce resources by opening up reflections and opportunities that until recently were unthinkable. This is the real revolutionary aspect of the space economy and its fascination in determining a clear discontinuity in the way we think and urge us to imagine new ways of interpreting our concept of management.

What we now define as a "space economy" has three fundamental areas of development and research. The first is that of innovation, the second is that of development and the third that of geopolitics. Innovation is the term that is immediately associated with the theme of space, because space more than any other human field requires to push technological progress and generates as a return effect further technological progress, thanks to an unstoppable dynamic. In this sense, the more the space economy becomes concrete, does not remain relegated to a world of professionals and is configured as main stream activity, the more this effect becomes powerful. Development must be understood in the deepest sense: from the creation of new trajectories of GDP growth to the search for better living conditions for mankind in the short and long term. Geopolitics: space opens a new playing field that can become an extraordinary place of cooperation or further conflict. The hope is that the complexity of the challenge will push different countries to promote cooperative games that will then bring benefits from space to Earth.

This complexity becomes an exciting playground for a management school that by its nature loves to face new challenges head-on, promoting the encounter of different cultures and skills. In space we still have to write everything, and write it perhaps better than we have done so far on Earth. The SEE Lab, thanks to the energy of Prof. Di Pippo and her researchers, wants to make a decisive contribution to this challenge, which has a very long perspective, almost infinite as the space itself. But the most important challenge is to use space as a privileged and unique laboratory to experiment, to identify new solutions - from technology to law - that generate positive effects on our Earth. If we venture into fascinating and perhaps imaginative hypotheses of life in other places of space is a reflection that I leave to other more competent people. Surely it is more concrete to bind space to the Earth to improve the way we exist and grow on our Earth.

If starting from a title of a successful movie like "The world is not enough", this time we can say it is true and that maybe we can say "the space is more than enough". Good research and good challenge at all.



Simonetta Di Pippo
Director, Space Economy Evolution Lab

When talking to the public, one of the most recurring questions is addressing the following issue: why we spend money for space activities when we have to face so many problems on Earth? Today, we know well that space-based data are embedded in our daily lives, and that without space technologies, which have a systematic impact on more than 50% of the 169 targets underpinning the 17 Sustainable Development Goals (SDGs) as per the 2030 agenda for sustainable development, it would not be possible even to think about a global socio-economic sustainable development. Let alone the role of satellites in monitoring the Essential Climate Variables (ECVs). We count 55 of them, as defined by WMO - World Meteorological Organization - and the strong link between space and green/circular economy.

What have we done in 2023 to address all the above? Sustainability is informing all our activities, all our events, all our researches. From debating about the upcoming commercial space stations in LEO, to addressing space 'In our hands', as per the book published by Hoepli as a result of joint effort with one of our members, Telespazio. From presenting the result of a joint study on space economy, space industry, space law, to the Italian Minister in charge of Space, to stimulating the debate around the need for a new national space law done together with Fondazione Leonardo on the basis of a draft 'legge delega' we have been putting together from an academic perspective. From attending COP28 to talk about space as a sustainable tool in all the economies of the future, to participating in Baku at the IAC2023 with a booth spreading around the importance of what we do, together with our members and partners, and to address the importance of preparing for IAC2024 to be held in Milan from 14th to 18th of October, which has sustainability in its core message. The international scenario is evolving, multilateralism is in danger, some polarization is perceived. Are we entering, or we entered already, in a new space race? And how we moved from the first space race between the Soviet Union and the United States of America, to the blooming of space economy, and now to a sort of a new space race, where we have more public players, including China which was not there decades ago, and private commercial players who dictate the rule of the game, or they may well do so soon. In a field where technology is running really fast, the multilateral platforms, and above all, the United Nations, have to find a way to speed up and even try to anticipate new developments, establishing rules of the road that all the players in the world have to follow to be able to maintain a safe, secure, predictable and sustainable outer space environment, and avoid conflicts, because the more orbits are congested, the more they become contested. The importance of regulatory framework at national level is also evident. While we put in place measures to develop a harmonious space ecosystem, we have also the duty to provide the rules to be followed, to allow the commercial operators and the new public players to have a follow-the-rules approach in their space activities, so that everyone can benefit from the peaceful uses of outer space. To take into consideration all the above, SEE Lab is also strictly following all the activities done in preparation of the UN Summit of the Future, to be held in September 2024, and its product, the Pact4Future.

As we, SEE Lab, are committed to work at the frontier of space economy research to foster excellence also in education, feeding in such a modern way the innovators of the future, we can only embrace what the Pact for the future is encompassing, because excellence is something we achieve because of our profound understanding of all the so diverse elements in the space economy field. 2024 will be a great year of innovation, again and again, for us and thanks to us. Let's continue working together towards these goals, for a more sustainable future.

1. SPACE ECONOMY EVOLUTION LAB

1.1 THE LAB

VISION

The vision of the SEE Lab is to 'Build up the economy of the future'. Since its establishment in 2018, the SEE Lab has positioned itself as a key player in both national and international arenas, focusing on understanding the socio-economic and environmental benefits of the space economy. In addition to assessing the impacts of space solutions on Earth, SEE Lab aims to lay the groundwork for future business opportunities and social impact deriving from space, particularly those driven by potential infrastructures in low Earth orbit and beyond.

Well anchored within the SDA Bocconi School of Management, the SEE Lab is a distinguished research laboratory dedicated to providing profound knowledge and strategic insights to various stakeholders, including space-oriented businesses, non-space industries, financial operators, and public institutions. These insights are crucial for these entities to capitalize on the emerging opportunities within the rapidly evolving Space Economy.

The activities of the SEE Lab are built on four key pillars.

Firstly, it employs a robust and comprehensive interdisciplinary research approach to delve into various aspects of the space economy.

Secondly, it maintains an international scope, ensuring a global perspective on space-related developments and trends.

Thirdly, the SEE Lab fosters out-of-the-box thinking, challenging conventional boundaries to foster innovation and creativity.

Lastly, it promotes synergies and collaborative linkages between space and non-space industries, recognizing the potential for cross-sectoral innovation and growth.

MISSION AND OBJECTIVES



The SEE Lab is dedicated to forming and supporting leaders and innovators with the ability to embrace disruptive approaches and unconventional viewpoints. The SEE Lab aspires to cultivate visionary leaders capable of navigating and leveraging the complexities of the evolving space economy, thereby driving innovation, collaboration, and sustainable growth on a global scale.



To achieve this objective, it actively involves itself in generating and disseminating comprehensive knowledge pertaining to the space economy. This endeavor encompasses a thorough examination of trends concerning demand, supply, and technological advancements across short, medium, and long-term horizons on a global scale.



Specifically, the SEE Lab endeavors to foster a profound comprehension of the space economy among both private enterprises and public institutions involved in space-related endeavors. It also aims to create synergies with non-space industries and

financial entities regarding the future potential inherent in the space economy, thus establishing a collaborative platform for engagement with the space sector.



Moreover, the SEE Lab acts as a central hub for academic and non-academic research organizations, facilitating the exchange of insights on market dynamics, political and regulatory environments, financial frameworks, and technological advancements within the space economy. It seeks to attain recognition as an international focal point for entrepreneurial minds and policymakers within the space sector.



Thanks to the strong international connections and diverse expertise of the team at the SEE Lab, it aspires to put into practice its multidisciplinary approach through training programs, and to be the reference point for government officials responsible for space, those not belonging to the space sector, professionals from space industries, professionals from non-space industries, and young professionals.

ACTIVITIES

At the SEE Lab, we believe in the power of combining in-depth and cutting-edge knowledge with pragmatic insights, to significantly enhance the impact of educational programs and the value brought by dissemination events, bolstering new ideas and perspectives in the context of the space economy. Consequently, applied research projects are at the core of our laboratory's endeavors, offering strategic insights to both private and public stakeholders.

The Laboratory generates and spreads knowledge across two principal thematic areas:

- **Space for Earth** – encompassing all the activities undertaken in space and aimed at yielding benefits for humanity on Earth, reflecting our commitment to leveraging space for non-space betterment;
- **Space for space** – including all efforts made in space to expand and enrich human presence and activities beyond the Earth's atmosphere.

The laboratory's core activities – applied research, ideas generation, dissemination and education – rely on a robust and continually updated proprietary dataset, the SEEData, and employs rigorous academic methods of analysis.

SEEData

The SEEData is a dataset representing one of the foundational and critical assets of SEE Lab, serving as the cornerstone for all its activities. This progressively innovating project is conceived to respond to the existing gaps for precise, standardized and consistent data and information regarding the space economy. The SEEData is planned to have a modular structure. This means it will be composed of different blocks, each released with separate timelines, but thematically and purposely complementary to one another. The dataset will be gradually extended to ultimately include economic and financial metrics of space economy related companies, particularly focusing on key performance indicators. It will also include data on investments, in the dual fashion of private capital investments and merger and acquisition (M&A) operations; as well as macroeconomic figures about countries engaged in the space industry.

As a result, the SEEData will allow the laboratory to perform comprehensive analysis using proprietary and exclusive data, providing its Members with meaningful and trustworthy information. Our mission is to establish a space economy-oriented database meticulously tailored to the needs of space, as well as non-space, companies, but also agencies, institutions and policy makers.

Applied research

The SEE Lab carries out independent, multidisciplinary and scientifically robust research. Adopting such an approach implies analyzing space-related themes through various lenses and fitting them all in academically reliable methodologies. To achieve this, the SEE Lab synthesizes economic, technical, political, and regulatory viewpoints, thereby holistically embracing the space industry's inherently multi-faceted nature. At the same time, the laboratory leverages on the SDA Bocconi School of Management and the Bocconi University faculties' know-how and expertise concerning academically accredited research methodologies, ensuring its stakeholders scientific integrity and rigor.

With the goal of offering tangible support to private and public players, the SEE Lab conducts commissioned studies, offering ad hoc analysis. Thanks to its far-reaching network, the lab substantiates its findings not only with academic evidence, but also with insights from international industry experts and professionals. This approach renders the laboratory's perspective exceptionally practical and application-oriented. Other than commissioned projects, the laboratory will supply to its Members Strategic Insights and Outputs, namely SEEData data elaborations and key analyses of topics that capture their interest.

Ideas generation

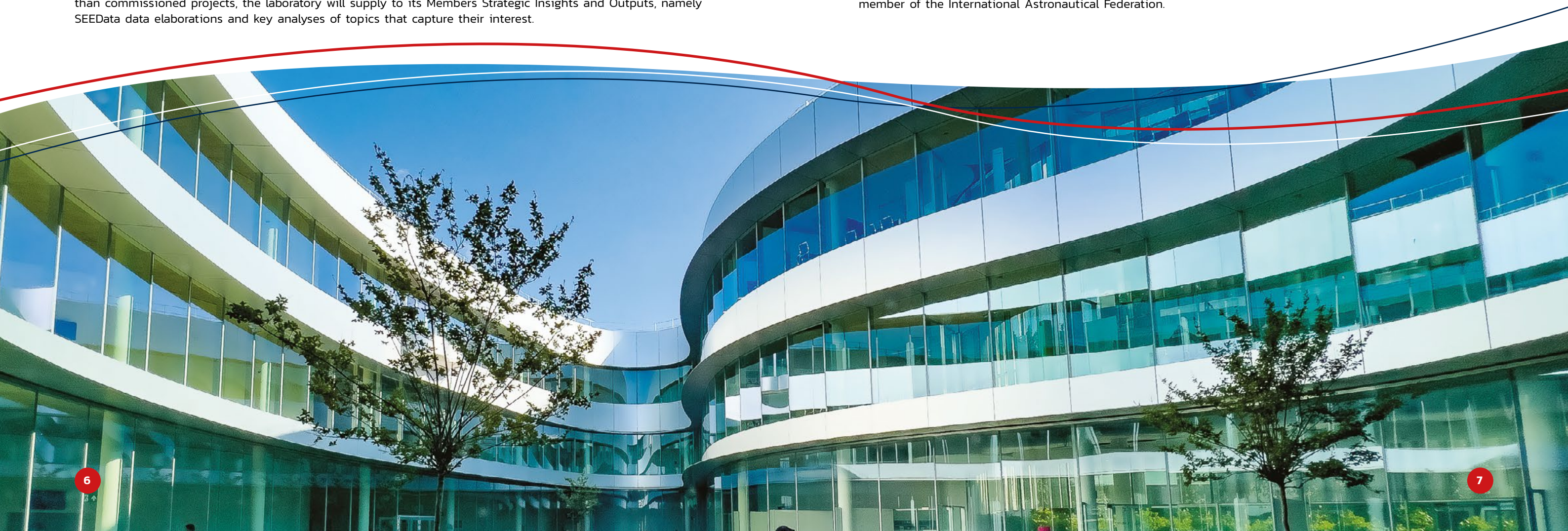
The SEE Lab strongly values open debates as a crucial conduit for the dissemination of knowledge, opinions and best practices. In an effort to foster the dialogue among its Members and stakeholders, and to expose them to inspirational perspectives, the laboratory taps into its expansive network of scientific partners, industry specialists, and professionals. It organizes events designed to ignite the spark of ideas generation and strategic thinking. More concretely, the SEE Lab's Members can take part to the Titan Brain Trusts – exclusive, high-level roundtables with external experts to discuss political dynamics, market trends, and technological advancements. Additionally, Members have the opportunity to attend the General Assembly. This event serves as a platform to showcase the center's accomplishments, ongoing activities, and future outlook to its stakeholders.

Dissemination and education

Dissemination and educational activities, including events and customized courses, are pivotal elements for advancing the SEE Lab's research projects. In an effort to maximize the resonance of our thinking, the SEE Lab actively seeks collaboration with its network of scientific partners and fostering discussions that are both forward-looking and grounded in future possibilities. Our featuring lectures, delivered by renowned leaders in the space sector, our events and courses are designed to provoke thoughtful debates, incubate innovative ideas and apply them pragmatically to the most pressing challenges in space commerce. They also offer invaluable networking prospects for space stakeholders, boosting academic alliances as well as business and institutional relations alike.

- **Education Programs:** SEE Lab aims to design and deliver customized courses and educational programs that merge the target organization's strategic objectives with individuals' professional and personal development.
- **Events:** SEE Lab is host of many significant gatherings, including Annual Conferences, webinars, workshops and seminars, featuring both national and international guests.

Moreover, the Lab actively participates in third-party organized conferences to spread its research outputs and to forge new connections with the scientific and the industrial community. The SEE Lab is also a member of the International Astronautical Federation.

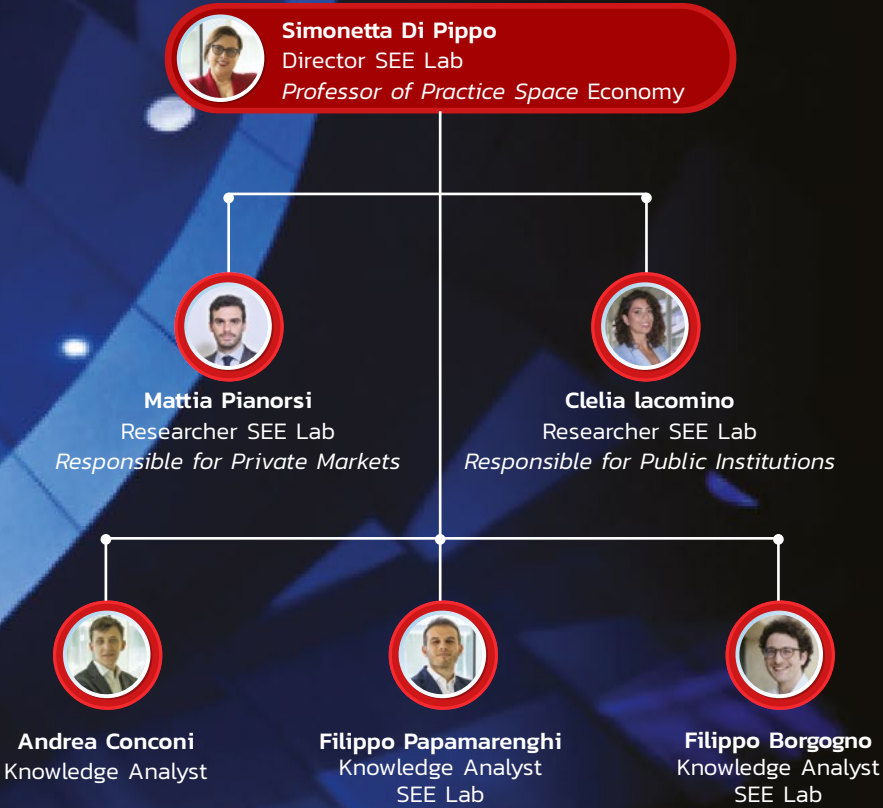


MANAGEMENT TEAM

The SEE Lab's team features the Director and the Core Space Team. As a whole, the group is composed of individuals with diverse backgrounds, spanning from policy to finance, business management, economics and astrophysics.

In addition to the core management team, the SEE Lab relies on the support of SDA Bocconi professors and researchers for vertical expertise on research projects. Furthermore, the SEE Lab is supported by interns from Bocconi University (Italy) and visiting researchers from New York University Abu Dhabi (UAE).

CORE TEAM



EXTERNAL CONSULTANT



INTERNS FROM:



VISITING RESEARCHERS :



The text that follows reports the resumes of the management team and external consultants:

Simonetta Di Pippo – Director SEE Lab, Professor of Practice Space Economy

Simonetta Di Pippo is Professor of Practice of Space Economy and Director of the Space Economy Evolution Lab (SEE Lab), SDA Bocconi, and visiting professor of practice at New York University Abu Dhabi (UAE). From 2014 to 2022 she was Director of UNOOSA (United Nations Office for Outer Space Affairs). Astrophysicist by training at La Sapienza University (Italy), she was awarded with two honoris causa degrees, in Environmental Studies and a PhD in International Affairs. Author of 'Space Economy – the new frontier for development' and 'The Moon, a lab for peace' – Bocconi University Press. She served as Director of Human Spaceflight at ESA, Director of the Observation of the Universe at the Italian Space Agency and led the European Space Policy Observatory at ASI-Brussels. She is an Academician of IAA (International Academy of Astronautics) and member of the World Economic Forum Global Future Council on space since 2016. In 2009, she founded Women in Aerospace Europe, and currently serves as its Honorary President, and in 2017 she became UN International Gender Champion. She is member of the governing committee of the Osservatorio Metropolitano of Milan, and from May 2023 she is a RINA SPA board member and chairs its ESG committee. From August 2023, she is member of the scientific committee of Criptaliae, aimed at developing the Grottaglie Italian spaceport. In 2008, the International Astronomical Union named asteroid 21887 'dipippo', and in 2022, she entered the IAF Hall of Fame. In January 2024, she has been included by Forbes in the 50 over 50 list of top female leaders.

Mattia Pianorsi – Researcher and Responsible for Private Markets

Mattia Pianorsi is a researcher in the Knowledge Area of Finance at SDA Bocconi School of Management. Since 2018, he has worked as a space economy researcher at the Space Economy Evolution (SEE) Lab, where he studies the application of project financing to space infrastructure, venture capital financing for start-ups, and business model innovation. Between 2021 and 2022, Mattia served as a Space Economy Expert at the Ministry of Technological Innovation and Digital Transformation (MITD). Mattia obtained his master's degree in Management from Bocconi University (Italy). Currently, he is pursuing a PhD in Management at the University of St. Gallen (Switzerland). Mattia's doctoral research focuses on business model innovation in the space sector.

Clelia Iacomino – Lecturer and Responsible for Public Institutions

Clelia Iacomino is a Lecturer in the government, health and not for profit. Her research interests and scientific publications focus on topics related to management, innovation policies, governance, and the role of public institutions in the space sector. Between 2021 and 2022, she served as a Space Economy Expert collaborating with the Department for Digital Transformation of the Presidency of the Council of Ministers, focusing on issues related to expenditure on space projects under the PNRR (National Recovery and Resilience Plan). Clelia earned her Master's degree in Political Science – International Relations from La Sapienza University (Italy) and a Master's in Institutions and Space Policies from the SIOI (Italian Society for International Organization), in Rome. She is currently a PhD Candidate in Management & Innovation at Cattolica del Sacro Cuore University (Italy).

* Filippo Borgogno and Matteo Nori joined the team in January 2024, while Andrea Conconi left the core team in January 2024.

Andrea Conconi – Knowledge Analyst

At SDA Bocconi School of Management, Andrea Conconi is a Knowledge Analyst and a SEE Lab researcher. Before his graduation, he worked at the SEE Lab within the SES-Italy (Socioeconomic Study) research project for the European Space Agency, investigating the socioeconomic impacts of satellite services in non-space industries. After this first experience, he worked as a Junior Economist in a financial intermediary, conducting research on the macroeconomic stability of emerging markets, and eventually came back to the SEE Lab. Andrea holds an MSc in Economics and Social Sciences from Bocconi University (Italy), with a Major in Macroeconomics and Economic Policy.

Filippo Papamarengi – Knowledge Analyst

At SDA Bocconi School of Management, Filippo Papamarengi is a Knowledge Analyst and a SEE Lab researcher. The writing of his degree thesis led him to study business models in the space economy, investigating the correlation between business structure and financials values. Filippo holds an MSc in Business Administration from Cattolica del Sacro Cuore University (Italy), with a Major in Management. He also earned a Master in Space Institutions and Policies at SIOI (Italian Society for International Organization), in Rome.

Filippo Borgogno – Knowledge Analyst

At SDA Bocconi School of Management, Filippo Borgogno is a Knowledge Analyst and a SEE Lab researcher. Astrophysicist and theoretical cosmologist from University of Torino (Italy), Filippo earned a Master in Space Institutions and Policies at SIOI (Italian Society for International Organization), in Rome, with a thesis on space exploration.

Matteo Nori – External consultant

Matteo Nori is an astrophysicist with extensive expertise in data science and analysis, specialized in the physical and statistical modelling of complex systems. He holds a double MSc from Sorbonne University (France) and Politecnico di Torino (Italy), earned in July 2015, and completed his PhD in Astrophysics at Alma Mater Studiorum University of Bologna (Italy) in March 2019. From 2019 to 2023, Dr. Nori served as a researcher at Alma Mater Studiorum University of Bologna (Italy) and as a Postdoctoral Associate at New York University Abu Dhabi (UAE). During these years, he pursued in his investigation of the physical models of Dark Matter and Dark Energy and their implications for galaxy formation and evolution through numerical means. Matteo Nori is collaborating with the SEE Lab since February 2024. Thanks to his scientific and technical skills, he is involved both in the research efforts, in particular revolving around numerical simulations and projections of present and future satellite populations, as well as in the design, development and automatization of the data analysis of the SEEData dataset.

1.2 ACTIVITIES IN 2023

The research activities are divided into three main categories:

> Applied research:

Applied research is centered around addressing the particular requirements and challenges faced by companies and public institutions. It emphasizes the practical utilization of scientific knowledge and methodologies to devise solutions that can bring about tangible improvements. This may entail various activities such as enhancing existing processes within organizations to make them more efficient and effective, or developing entirely new technologies that meet emerging needs or solve pressing problems. In this context, the SEE Lab plays a supportive role for such activities, particularly concerning economic analysis, leveraging the expertise of individuals with technical and scientific backgrounds.

> Academic research:

It is geared towards advancing theoretical understanding of specific phenomena and formulating research questions and methods to investigate those phenomena, with the aim of engaging in existing academic debates with new analyses. It aims to contribute to the existing body of literature by identifying and filling gaps in knowledge, thereby enhancing the overall understanding of the subject. Academic research can take various analytical angles, such as finance, policy, economics, strategy, and more

> Database:

Construction of proprietary database that map companies operating in the field of the space economy through categorization based on various business activities and positioning within the value chain. Additionally, the SEE Lab has access to databases containing financial data for each private company at the international level, utilizing resources such as Moody's Orbis database.

APPLIED RESEARCH



Report 'Space Economy, Space Industry, Space Law'

- In collaboration with Fondazione Leonardo and La Sapienza University

In April 2022, the working group composed by Fondazione Leonardo – Civiltà delle Macchine, the Space Economy Evolution (SEE) Lab at SDA Bocconi School of Management, and La Sapienza University (Italy) set up working tables aimed at drafting an Italian space law. The work was accompanied by different sessions of discussion with the main stakeholders of the national space system, aimed at collecting opinions and proposals regarding an Italian space law. The discussions led to the preparation of recommendations with the intention of guiding the underlying chapters of the draft law. The outcome of the work has led to the development of the first Report on 'Space Economy, Space Industry, Space Law'. The Report, a copy of which was presented to the Minister Adolfo Urso, Minister of Enterprises and Made in Italy in September 2023, has been prepared based on consultations over the past 3 years with approximately 150 stakeholders. It proposes an economic and industrial analysis of the space situation at both the Italian and global levels, as well as potential legislative interventions to support the country's space industry, research, and policies. The output was presented at the Italian Chamber of Deputies and it registered the presence of the Minister of Enterprises and Made in Italy, and was concluded in December 2023. Following the drafting of the report 'Space Economy, Space Industry, Space

Law' in collaboration with Fondazione Leonardo and La Sapienza University (Italy), the SEE Lab authored a white paper that revisits the topics previously presented in the Chamber of Deputies. The SEE Lab was responsible for the space economy chapter, while the industry and law chapters were developed by Fondazione Leonardo and La Sapienza University (Italy). The SEE Lab conducted an analysis of the prospects within the Italian space sector and the characteristics of space ecosystems in Europe and the United States, aiming to formulate a series of recommendations to support the proposed new Italian space law.

Business Plan Development on TESLA VISION Program De-Risking Phase and Cluster Tecnologico Aerospaziale Alpe-Adria (CT3A)

- In collaboration with Space for Life s.r.l. & Camera di Commercio Venezia-Giulia

These research projects involved applying methodologies to evaluate the robustness of assumptions underpinning business plans of organizations in the space sector, including conducting scenario simulations. Specifically,

- A project involved the deployment of a constellation of satellites aimed at detecting radio frequencies originating from the Earth, with the purpose of conducting asset tracking (vessels, boats, trucks, and trains) and border and customs control. Applications include environmental monitoring (radio frequency pollution), surveillance, RF spectrum monitoring, and data for GEO marketing and analytics.
- A project focused on examining the current and potential benefits, including business opportunities, of establishing a new aerospace and technology cluster located in northern Italy.

ACADEMIC RESEARCH

A transformative leading State for a blooming space economy (Iacomino, Di Pippo)

The paper focuses on the space economy, which is a particularly fascinating research setting in the light of the substantial transformation that the State has experienced in recent years. Indeed, private actors are playing an increasingly noticeable role in the space economy in progress, driven by their commercial interests which can benefit from the use of space infrastructures. This paper explores the above context through three illustrative cases of companies active in different domains of the space economy: constellations of small satellites for telecommunication, commercial space stations, and Moon mining activities. Grounding on the analysis of these business cases, we develop an analytical framework that categorizes the various roles assumed by the State, identifying the influencing factors that derived from the actions of both private and public actors, which together constitute the State's role, and the related outcomes emerging from a specific role.

Funding new space companies in equity markets. Assessing the risk and uncertainty of newly listed public companies (Di Pippo, Gori, Pianorsi, Iacomino, Lorusso, Latino)

The paper applies the techniques of risk assessment to the space sector through the analysis of the compared risk and return features for publicly listed space-related businesses primarily in the United States. The goal of this study is to analyze the volatility embedded in the stock offerings to understand the potential returns and compare volatility with the comparative risk characterizing other benchmark portfolio companies. This study is particularly interesting for understanding risk from the perspective of the enterprises themselves. High volatility shown by stock prices is relevant information not only for the investors but also for the feasibility of creating effective development strategies by the companies. The possible misalignment between the trend of stock prices and the value of equity creates useful hypotheses that the financial markets are not yet ready to host the securities issues by many companies in the space sector or that the companies themselves are not yet prepared to meet the expectations expressed by the markets.

Towards a bottom-up approach to space debris removal: on the economic convenience behind debris mitigation strategies (Di Pippo, Iacomino, Rossi, Nori, Saputo, Ventre)

The paper presents a cost model assessing satellite operators' economic convenience of adopting mitigation measures to reduce the risk of collision between their active satellites and space debris. The cost model, building on a statistical analysis of the relationship between the mitigation measures' adoption rate and the number of future collisions, describes the impact of the mitigation measures' costs on the (active) removal of assets by space operators. The paper aims at furthering the qualitative definition and quantitative assessment of mitigation measures' cost items also through interviews with industry experts. At the same time, it aims at providing quantitative demonstrations that might guide satellite operators' future choices about mitigation measures' adoption, and public actors' decisions regarding the deployment of policies and economic incentives to enable the removal of some satellite classes. Moreover, it aims to give strategic takeaways to the suppliers who are developing innovative technologies for satellites removal, and at becoming an important tool for satellite industry and operators for better defining the economics of their business models and system developments.

Is the lunar economy solely for the space industry? Opportunities for non-space companies in lunar infrastructure leveraging technological synergies

(Di Pippo, Conconi, Pianorsi, Vittori, Bosquillon, Cujko,
Gautel, Webber, Papamarengi)

This paper aims to support involvement of terrestrial sectors in cis-lunar infrastructure projects, by providing evidence-based management frameworks. The study between the SDA Bocconi Space Economy Evolution Lab and the Moon Village Association Lunar Commerce and Economics Working Group supports joint work on the Lunar Commerce Portfolio – a study on the lunar economy, whose first edition was published in November 2022. This paper therefore brings evidence on how non-space companies can contribute to the realization of lunar infrastructure through exploiting technological synergies. While the paper focuses on the lunar economy as an emerging area of interest, its findings carry broadly applicable lessons to other areas of space technology.

Space sustainability in LEO: a multidisciplinary approach to identify and mitigate economic, operational and technological risks of active debris removal solutions

(Di Pippo, Romano, Iacomino, Conconi, Giacomini, Matonti)

The launch traffic to Low Earth Orbit (LEO) is experiencing a significant increase, since LEO is enabling common use infrastructure critical for the ascent of the space economy. The intensifying commercial use of LEO and the space environment sustainability are a growing discussion among policy makers. Moreover, the rapid increasing of space debris is becoming of primary importance not only for international institutions but also for private companies. Considering the future scenarios, this paper aims to evaluate the risks associated with identified technologies, and their consequent level of attractiveness. First of all, the analysis assesses the current and under-development solutions for debris removal and monitoring. Second, it evaluates the economic, political, and security risks that affect attractiveness of those technologies. To conclude, building on previous evidences, this paper will dwell on public recommendations on how to guarantee the implementation of the identified technologies while mitigating the associated risks, so to ensure safety, security and sustainability of the space environment.

New Space, The Journal of Space Entrepreneurship and Innovation

– New York – Dec. 2023

For the journal 'New Space: The Journal of Space Entrepreneurship and Innovation', the SEE Lab has the opportunity to curate and manage a Special Issue for the 2024 edition, starting from December 2023. 'New Space' is an international peer-reviewed journal dedicated to various contributions in the field of space entrepreneurship and innovation. The SEE Lab's Special Issue, titled 'Space Economy Evolution', is guest-edited by Simonetta Di Pippo. The scope of this Special Issue is to collect papers that:

- Analyze companies' business model innovation, highlighting financial challenges and global-level competition.
- Investigate the impact of public policies on technological innovation and the related socio-economic benefits.
- Collect direct experiences from practitioners.

SEEDATA

In recent years, the SEE Lab team embarked on the SEEData journey, initially focusing on acquiring reliable financial data concerning Italian firms within the space industry value chain. Although initially confined geographically and thematically, this initial phase is paving the way for subsequent sections of SEEData, addressing the most challenging aspects of constructing a unique database. Activities such as defining the boundaries of the space sector value chain, identifying every company within it, understanding their business lines for classification along the supply chain, and exploring multiple information sources to ensure reliability are currently underway at the SEE Lab. These activities will serve as the foundation for the entire structure of SEEData.

While the goal for 2022 was the development of the Italian sample, in 2023 the SEE Lab expanded its focus to include the European sample, which benefits from the same structure as the Italian sample. Specifically, during this phase, attention has been directed towards the French and German space industries. By 2024, our aim is to complete the European sample, which will be available by March 2025. Subsequently, we will shift our focus to creating a global sample. Upon completion, SEEData will comprehensively represent the global space economy and the entire space sector, which are key areas of study for the SEE Lab.

1.3 EDUCATION

The New Commercial Frontiers in the Space Sector and its Influence on the Space Economies: Fundamentals of the Space Economy

- In collaboration with Collegio di Milano
- Milan – Mar.–Apr. 2023

The SEE Lab developed the course 'The New Commercial Frontiers in the Space Sector and its Influence on Other Economies: Fundamentals of the Space Economy' for the Collegio di Milano, an inter-university campus recognized and validated by the Italian Ministry of University and Research, involving all the universities of Milan. The main objective of the course was to educate students on the fundamentals of the space economy, with specific verticals covering topics such as sustainability and diplomacy, policy instruments and governance models, and financial aspects. The course concluded with a final presentation by students related to the development of a research project.

Space for Business Programme

- In collaboration with NOVA SBE
- Lisbon – Jun. 1st 2023

The SEE Lab has contributed to the course in the module held by Nova Business School, addressing the topic of Space Sustainability.

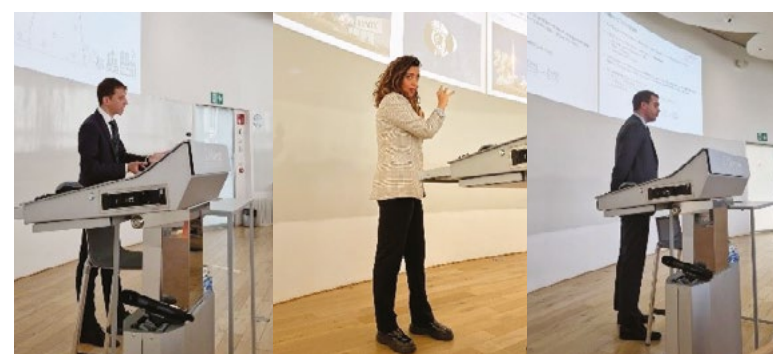
Space Economy Ecosystem Programme – NOVA SBE

- In collaboration with European Space Agency
- Milan – Oct. 9th – 13th 2023

Organized by the European Space Agency, the 'Space Economy Ecosystem Programme' is an important international program aimed at democratizing education in the space economy. The SEE Lab participated as an author of a session within this program. The sessions were conducted by leading European business schools, including NOVA SBE (Portugal), Erasmus University (Netherlands), University of St. Gallen (Switzerland), ESADE (Spain), and SDA Bocconi (Italy). The SEE Lab was responsible for the module titled 'Space Economy, Space Sustainability, and New Frontiers', which included an online masterclass and a private workshop.

In particular, the SEE Lab instructors focused on the following topics:

- **Simonetta Di Pippo:**
Space Sustainability and Space Diplomacy
- **Andrea Conconi:**
Fundamentals of the Space Economy
- **Clelia Iacomino:**
Policy Instruments and the Role of Public Institutions
- **Mattia Pianorsi:**
Elements of Finance Related to Private Investors and Companies



EMMIO executive master course

- In collaboration with SDA Bocconi School of Management
- Milan – 2023

EMMIO is the Executive Master in Management of International Organizations by SDA Bocconi School of Management. During the 2023 edition, SEE Lab hold an executive lecture on space economy.

1.4 SEE LAB'S PARTICIPATIONS IN EVENTS AND COLLABORATIONS

TAS-I visiting

- Turin – Jan. 23rd 2023

The SEE Lab team visited Thales Alenia Space Italy in Turin to discuss the carrying out of activities of common interest. During this discussion, the workshop on private space stations was born; it was also an important opportunity to visit Thales Alenia Space plants and Axiom space modules.

UNIDROIT MoU

- Rome – Feb. 15th 2023

On 15 February 2023, the International Institute for the Unification of Private Law (UNIDROIT) signed a Memorandum of Understanding (MoU) with the SEE Lab. The MoU was signed at a ceremony in Rome which included participation from UNIDROIT Professor Ignacio Tirado (Secretary-General), and from SEE Lab director Simonetta Di Pippo. Under the MoU, UNIDROIT and SEE Lab will explore issues related to space finance and law, with a focus on private investment into the global space industry.



Towards new Government directions on space

- Rome – Feb. 28th 2023

Within the Ministry of Enterprises and Made in Italy, the SEE Lab participated in a workshop organized by the Office for Space and Aerospace Policies. The objective of the workshop was to discuss the new government guidelines on space. On this occasion, the SEE Lab discussed what aspects to focus on in order to achieve sustained, sustainable, and competitive development through the use of space technologies and data. The space economy is an area in full evolution but also increasingly competitive at the international level. For this

reason, it is important to keep pace with new challenges through a paradigm shift in research and development activities, space management and utilization, and the creation of new business models. In this regard, the SEE Lab emphasized the need to create public value through strategic and sophisticated public procurement tools to innovate business models, thereby attracting capital, attracting non-space industries, and stimulating commercialization. SEE Lab attended the event with a speech by Clelia Iacomino.



Festival dell'Economia

- Trento – May 27th 2023

During the Festival dell'Economia in Trento, Professor Di Pippo attended the session named 'New Borders of Space' on May 27th 2023. That was an important occasion to talk about Space Economy during the main Italian event about economy and finance.

Space2connect

- In collaboration with European Space Agency
- Matera – Jun. 7th – 9th 2023

The SEE Lab was invited as panelist at the European Space Agency's (ESA) Space2Connect Conference 2023, taking place in Matera, Italy. Specifically, the SEE lab contributed to the roundtable discussion on Strategic Investment in the European Space Sector, titled 'Space Strategies and Unlocking Growth Capital'. This session delved into the present state of space financing and outline the strategies being developed by institutional investors to support and leverage the capabilities of space companies effectively. The SEE Lab attended the event with a speech by Mattia Pianorsi.

Primo Reggimento Trasmissioni MoU

– Milan – Jul. 10th 2023

The SEE Lab and the Primo Reggimento Trasmissioni of the Italian Army have signed an Agreement regarding collaborations in the field of satellite telecommunications. The agreement was signed by Colonel Giuseppe Mario Di Stefano, as Commander of the Primo Reggimento Trasmissioni of Milan, by Professor Stefano Caselli in his quality of Dean of SDA Bocconi School of Management, and by Professor Simonetta Di Pippo in her quality of Director of SEE Lab.



Space Economy – una sfida per l'Italia

– Rome – Jul. 19th 2023

On the occasion of the Space Parliamentary Intergroup inauguration press conference, SEE Lab attended the event with a leading role and with a speech by Professor Di Pippo.

School on Suborbital Flight

– Taranto – Sep. 11th 2023

The School on Suborbital Flight in Taranto aims to fostering development in suborbital flights by providing an overview of the scientific, commercial, operational, and regulatory aspects of through seminars and panels by institutional representatives, experts, and companies in the sector. Professor Di Pippo has been guest speaker with a speech titled 'Space Economy: new Frontier for a Sustainable Development'.

Towards A Big Data Revolution for the Planet

– Vienna – Sep. 11th – 13th 2023

The SEE Lab contributed to the Second Expert Meeting 'Towards A Big Data Revolution for the Planet' hosted by the Data for the Environment Alliance (DEAL) and the United Nations Science-Policy-Business Forum on the Environment (UNSPBF). More than 100 experts from finance, government, international organizations, business, Big Tech, the Earth observation community, research, citizen science, and various other sectors convened in Vienna, Austria, to address the hurdles related to leveraging data for sustainable decision-making. The SEE Lab attended the event with the participation of Mattia Pianorsi.

XXXI Pontignano Conference, Adapting to Technological Change

– Pontignano – Sep. 15th 2023

Every year, the Pontignano Conference brings together delegates to celebrate UK-Italy bilateral relations, address common challenges, and develop networks and mutual friendship between Great Britain and Italy. Held at the Certosa of Pontignano, the XXXI Pontignano Conference, organized by the British Embassy in Italy, saw Professor Di Pippo attend and deliver a speech on space and innovation topics.

The Pontignano Conference is one of the most important annual events in the UK-Italy bilateral relationship, aiming to bring together influential delegates from various sectors including education and academia, technology and innovation, culture and society, business and finance, politics, foreign and security policy, government, and media.

Scientific Committee of Grottaglie Spaceport

– Taranto – Sep. 2023

Professor Simonetta Di Pippo has joined on September 2023 the scientific committee of Grottaglie Spaceport in Taranto, futuristic important spaceport for Italy and Europe.



International Astronautical Congress (IAC)

– Baku – Oct. 2nd-6th, 2023

At the international level, the International Astronautical Congress (IAC) stands as the most important and widely attended event in the space industry. The Congress comprises an exhibition area where participants showcase their business features, engage in networking events, and host business meetings and presentations. Additionally, there is a conference area where selected research studies spanning disciplines from physics and engineering to space policy and economics are presented to the Congress' audience.

In 2023, the SEE Lab participated in the International Astronautical Congress in Baku, not only through the presentation of academic papers but also by having a booth in the exhibition area. This booth served as an ideal location for lively debates between the Lab and the industry's most relevant stakeholders.

The future of the aerospace industry

– Dubai – Nov. 13th – 17th 2023

Professor Di Pippo was present at Dubai Air Show attending two panels. The first one, called 'Combatting climate change through space science', discussed the critical role of space data in understanding and addressing climate change, the innovations in space-based services and applications, how new age communication satellites

and emerging space tech can enhance monitoring and help suggest methods to limit climate change. The second panel, called 'What are we doing about space junk removal?', discussed space debris and what is being done to clean up orbital space debris, how countries can collaborate to minimize debris and promote more sustainable operations in orbit and the solutions that help to avoid creating new debris and removing the debris already in space.

INNOVIT Space Economy Demo Day

– San Francisco – Nov. 28th 2023

INNOVIT is the premier Italian Innovation and Culture Hub coordinated by the Consulate General of Italy in San Francisco and the Embassy of Italy in Washington DC and promoted by Italy's Ministry of Foreign Affairs and International Cooperation. On November 2023 Professor Di Pippo attended the INNOVIT Space Economy Demo Day in a panel on the business opportunities and challenges in space.

IAC 2024, 75th edition organization board

– Milan – Nov.-Mar. 2024

As important and competent actor in the global space economy scenario and as relevant and historical attendant at the International Astronautical Congress, SEE Lab joined the working groups to help organizing the 75th edition of the International Astronautical Congress that will be held in Milan next October.

A Framework for the Future: Reducing the carbon footprint of humanitarian aid. A call to action for key partnerships toward sustainable humanitarian supply chains at COP28

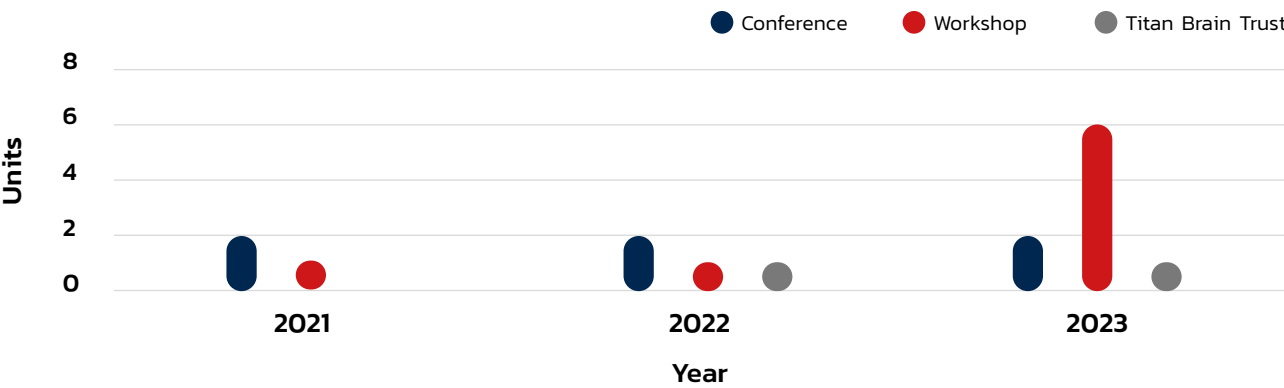
– Dubai – Dec 6th 2023

Humanitarian supply chain stakeholders have voiced the need for common actions to reduce the negative impact of humanitarian operations on the environment. Humanitarian organizations, host governments, private sector, and donors have been asked to commit to collaboration through a Call to Action and will come together to debate the commitments and way forward. During this event, Professor Di Pippo intervened with a speech focused on the use of space to increase the sustainability of humanitarian aid.

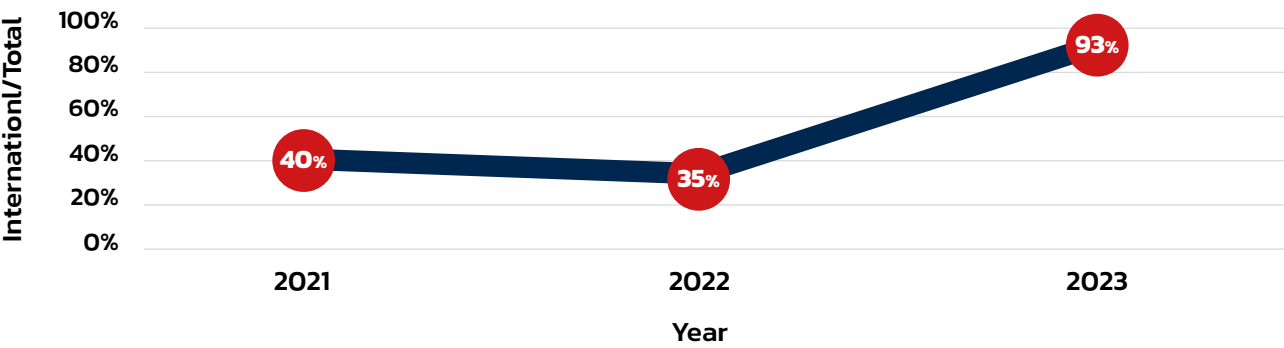
1.5 EVENTS

Over the years, SEE Lab has diversified the nature of its events and increased the presence of international speakers. This strategic decision has been pivotal for enriching the content and expanding the scope of discussions within our events. By inviting speakers from diverse backgrounds and regions, we aim to foster a more comprehensive understanding of the space economy and related topics.

INSTITUTIONAL EVENTS, 2021-2023



INTERNATIONAL SPEAKERS, 2021-2023



Space Exploration Investments: Turning Uncertainty into Measurable Risk and Benefits

- In collaboration with Space Policy Institute and Secure World Foundation
- Milan - Feb. 9th 2023

The workshop focused on ways to evaluate and measure the risks associated with investments in space exploration ventures and on the need to better define viable and affordable options for investors to seize uncertainties. The basic question of whether investments in space exploration activities are 'unique' and distinct from more traditional ones needs to be fully addressed and understood to identify the right tools to translate associated uncertainties into measurable risks and create a favorable environment to stimulate investments. Relevant questions for this workshop to explore were:



- What uncertainties are commonly related to investments and specifically what are the additional uncertainties that are inherent to investments in space activities?
- How are these space investment uncertainties currently addressed by investors and how are they translated into measurable risks? Do different types of space activities require dedicated analytical techniques, or do they call for only minor adaptations to standard practices of investment analysis?
- Have other analogous non-space industries encountered similar questions of uncertainties and how have they dealt with them? How have those uncertainties been translated into measurable risks?
- What lessons might be learned from other industries' experiences?

Speakers:

Tejpaal Bhatia (Axiom Space), **Chris Blackerby** (Astroscale), **Ian Christensen** (SWF), **Alex Chonet** (ESA), **Matteo Di Castelnuovo** (SDA Bocconi), **Simonetta Di Pippo** (SEE Lab), **Henry Hertzfeld** (SPI), **Clelia Iacomino** (SEE Lab), **Chris Kunstadter** (AXA XL), **Pierpaolo Monti** (Intesa Sanpaolo), **Kevin O'Connell** (Space Economy Rising), **Scott Pace** (George Washington University), **Mattia Pianorsi** (SEE Lab), **Adriana Pierelli** (BNY Mellon), **Alexis Sainz** (Hogan Lovells), **Micah Walter-Range** (Community in Space LLC), **Nick Vonortas** (George Washington University).

Workshop Investor day for space

- Milan - Mar. 2nd 2023

At the 'Investor Day' event, the SEE Lab launched the of the first 'Knowledge Space Investments Platform' (KSIP) at the national level dedicated to the space sector. The KSIP aims to strategically assist private capital investors to enter the space sector and to facilitate their expansion within it. Angel investors, venture capitalists, private equity firms, and banks participated in the event. Additionally, the event presented two initiatives supported by the research center: a research project focused on space-based transmission of electrical energy (Space Solar Power) and a collaboration on a new lightweight launcher for addressing both commercial and strategic needs at the national level.

Speakers:

Andrea Biancardi (SDA Bocconi), **Simonetta Di Pippo** (SEE Lab), **Leonardo Gagliardi** (ASAS), **Clelia Iacomino** (SEE Lab), **Mattia Pianorsi** (SEE Lab).

Innovation Made in Space: the Case of Private Space Stations

- In collaboration with Thales Alenia Space
- Milan - Jun. 6th 2023

The forthcoming decommissioning of the International Space Station (ISS) and the evidence of a raising market for the development of innovative products and services made in space has opened up opportunities for the realization of commercial space stations in Low Earth Orbit (LEO) aimed to prepare the ground for the progressive transition to private service suppliers in space. Building on the experiences derived from the ISS, commercial space stations companies aim to offer multiple services for research and development activities of a variety of businesses such as life and physical science, leveraging on microgravity conditions of LEO. Italy has an outstanding expertise and competence in the field, and aims to establish itself as a primary partner globally for the development and operations of commercial space stations. The event organized by the Space Economy Evolution (SEE) Lab of the SDA Bocconi School of Management in collaboration with Thales Alenia Space aimed at discussing:

- The lessons learnt from the utilization of the ISS: What are the innovations accomplished by the business users of the ISS?
- The transition to the commercial space stations: What is the new value proposition for business users?
- The Italian leadership: What is doing Italy and what are the actions towards its strategic leadership?
- The business perspective: What is the value perception about doing innovation in space?

- **Speakers:**

Tejpal Bhatia (Axiom Space), **Lorenzo Ciapetti** (Cluster Mechatronic and Innovation of the Emilia Romagna High Technology Network and Technopole Network), **Vittorio Colao** (Former Minister for Technology Innovation and Digital Transition), **Massimo Comparini** (Thales Alenia Space), **Walter Cugno** (Thales Alenia Space), **Simonetta Di Pippo** (SEE Lab), **Clelia Iacomino** (SEE Lab), **Susanna Jean** (5G Vertical & IoT within TIM Enterprise), **Daniel Katz** (REV1 Space Cargo Unlimited), **Rick Mastracchio** (Northrop Grumman), **Josef Nierling** (Porsche Consulting), **Davide Petrillo** (Nanoracks Space Outpost Europe), **Mattia Pianorsi** (SEE Lab), **Tara Ruttely** (Blue Origin), **Riccardo Sotgiu** (Loson), **Claudio Vitalini** (IIT H2 Bolzano).

Annual Conference 2023 - Data commercialization in Europe: policy, security and regulatory challenges. The case of earth observation

- Milan – Jun. 19th 2023



The advent of the space economy unfolds highways for private space companies to leverage advanced technology for new business goals. Today in particular, the number of actors able to generate, manage and utilize multiple kinds of data coming from space is growing. The same is happening on the demand-side, especially regarding products and services that pertain to the field of Earth Observation. Often, business opportunities that may arise from a proficient and effective commercialization of space data

are instead hindered by a series of factors that create uncertainty around how such commercialization could actually be effective; in the case of Europe, one of these factors is data policy, security and regulation. To best assist the development of space data commercialization, and therefore of the space economy as a whole, European actors must urgently address the data policy issue, which is also more pressing for the space SMEs ecosystem widely based in Europe. The Space Economy Evolution Lab dedicated its Annual Conference to this theme, with a special focus on the following questions:

- What is the direction the policy maker should follow in structuring a new space data regulation for Europe?
- What are the most critical areas in which the European data policy, security and regulation should improve?
- What safeguards have to be guaranteed, and to who?

- **Speakers:**

Stefano Antonetti (D-Orbit), **Andrea Bersan** (HawKEYE360), **Ornella Bombaci** (Thales Alenia Space), **Marco Brancati** (Telespazio), **Paola Cillo** (SDA Bocconi), **Rodrigo Da Costa** (EUSPA), **Simonetta Di Pippo** (SEE Lab), **Angelo Fontana** (Avio), **Marina Geymonat** (Capgemini), **Clelia Iacomino** (SEE Lab), **Marco Molina** (Sitael), **Fabio Nichele** (Tyvak), **Mattia Pianorsi** (SEE Lab), **Luigi Ruggerone** (Intesa Sanpaolo), **Giovanni Sylos Labini** (AIPAS), **Alessandro Verni** (Airbus).

Titan Brain Trust 2023

- Baku – Oct. 3rd 2023

Building on the success of 2022 event with Pamela Melroy, Deputy Administrator of NASA, the Space Economy Evolution (SEE) Lab continues the tradition of convening high-level discussions concerning paramount space-related matters with the Titan Brain Trust (TBT). The TBT series remains a distinguished platform for engaging with external subject experts, diving into political, market, legal, and technological aspects of the space economy. The 2023 TBT, held at the International Astronautical Congress in Baku, features Victoria Samson, the Washington Office Director of Secure World Foundation, as the distinguished guest speaker. Specifically, Ms. Samson will lead a stimulating discussion focused on space security and stability.

- **Guest speaker:**

Victoria Samson (Secure World Foundation).



Giornata Nazionale dello Spazio

- Rome - Washington DC
- Dec. 15th-16th 2023.

On the occasion of the National Space Day, the SEE Lab attended and co-organized the celebrations in various Italian locations and abroad.

The 'Industry and Start-ups for Space' event was held at the Chamber of Deputies in Rome together with Fondazione Leonardo and La Sapienza University (Italy). The event has been the final step of the works on this theme after another event held in May. Also, numerous meetings at the Chamber of Deputies in Rome have been attended by SEE Lab in the months before this important event.

In Washington DC, the SEE Lab with the participation of Mattia Pianorsi, supported the organization of the National Space Days. The event, held in collaboration with the Italian Trade Agency, the Italian Space Agency, and key institutional and commercial partners, including the Space Foundation, SEE Lab-SDA Bocconi, ITI Space Enterprise Council, and CNR-

IIA, brought together experts, businesses, and enthusiasts, providing insights into the latest technologies and innovations in the space sector. In addition, the SEE Lab contributed with a speech on Innovative business models in space and market creation.

1.6 PUBLICATIONS

The New Frontier of Development

– Milan – Feb. 1st 2023

On the occasion of the presentation of the new Simonetta Di Pippo's book, titled 'Space Economy: La nuova frontiera dello sviluppo', many students of SEDS association had the important opportunity to attend the presentation. Bocconi SEDS is the first Italian chapter of the Students for the Exploration and Development of Space association. Furthermore, on February 2023 the book 'Space Economy: The New Frontier of Development' by Simonetta Di Pippo was published in its English version.



Ritratte, Donne di Arte e di Scienza

– Roma – Jul. 13th 2023

Professor Simonetta Di Pippo was quoted inside the book "Ritratte, Donne di Arte e di Scienza" by Fondazione Bracco, which aims to enhance women in the various areas of social, economic, political and cultural life.

Preliminary analyses on technical and economic viability of moon-mined propellant for on-orbit refueling, ACTA Astronautica

– Milan – Jul. 28th 2023

SEE Lab researcher, Mattia Pianorsi, was co-author in a study published by ACTA astronautica. The paper analysed the technical feasibility and economic sustainability of Moon-mined propellant transportation, storage, and distribution to final users.

Europe in the global space economy

– Amsterdam – Mar. 2023



The book 'Europe in the global space economy', by SEE Lab's researcher Clelia Iacomino, analyzes global developments in the space economy and offers new perspectives on European space economy and policy. In particular, this book analyzes the policies and space economy programs of major space-faring nations and explores whether

the present institutional set-up in Europe is adequate to address the challenges. At the core of the discussion are the relative roles of governments and markets in a highly dynamic panorama that involves advancements in science, modifications in technology and organization, and the introduction of new rules of behavior.

Strategic Leadership Journal, Spazio per sicurezza, sostenibilità e difesa: un nuovo paradigma europeo

– Rome – Sep. 2023



For the Strategic Leadership Journal, SEE Lab's director, Simonetta Di Pippo, wrote an article titled 'Spazio per sicurezza, sostenibilità e difesa: un nuovo paradigma europeo'.

Space: In our Hands

– In collaboration with Telespazio

– Milan – Oct. 13th 2023



The SEE Lab and Telespazio, a joint venture between Leonardo (67%) and Thales (33%), curated the book 'Space: In our Hands' written by the American author and journalist David W. Brown and published by Hoepli. The volume is dedicated to the theme of sustainability, both in space and on

Earth. Exploring the deep connections between space and Earth and through the voices of the numerous experts who have participated in the project, the book indicates how preserving and protecting space can contribute to building a better world for future generations. The interviews, curated by the SEE Lab team, gather the voices of Paolo Nespoli, John C. Mankins, Paolo Gaudenzi, Simonetta Di Pippo, Waltraut Hoheneder, Barbara Imhof, René Wacławicek, Angel Abbud-Madrid, Kevin O'Connell, Moriba Jah, Cynda Collins Arsenault, and Victoria Samson. The interviews were curated by: Mattia Pianorsi, Clelia Iacomino, Andrea Biancardi, and Aristea Saputo.

Le piattaforme tecno-scientifiche in Europa. Ricerca, economia, innovazione

– Milan – Oct. 13th 2023



For the book 'Le piattaforme tecno-scientifiche in Europa. Ricerca, economia, innovazione', Professor Di Pippo make her contribution with the writing of a chapter titled 'Lo spazio per anticipare il futuro'.

Luna, laboratorio di pace

– Milan – Feb. 2nd 2024



India becomes the fourth nation in the world to land on lunar soil; the Russian Federation narrowly misses landing with Luna-25; China successfully brings back rocky samples to Earth with Chang'e 5 in search of precious unknown minerals; a Japanese private

probe, carrying the first rover from the United Arab Emirates, fails to land in a controlled manner; the United States successfully resumes with the first Artemis missions: the Moon, and more broadly space, is becoming crowded with actors, effectively becoming a new ground for geopolitical and economic competition among the powers of planet Earth. This book by Simonetta Di Pippo discusses how lunar exploration can become a tool for promoting peaceful coexistence and sustainable development on Earth. Addressing the future of space exploration and the creation of associated markets today requires a cooperative and inclusive approach.

1.7 THE SEE LAB’S MEMBERS

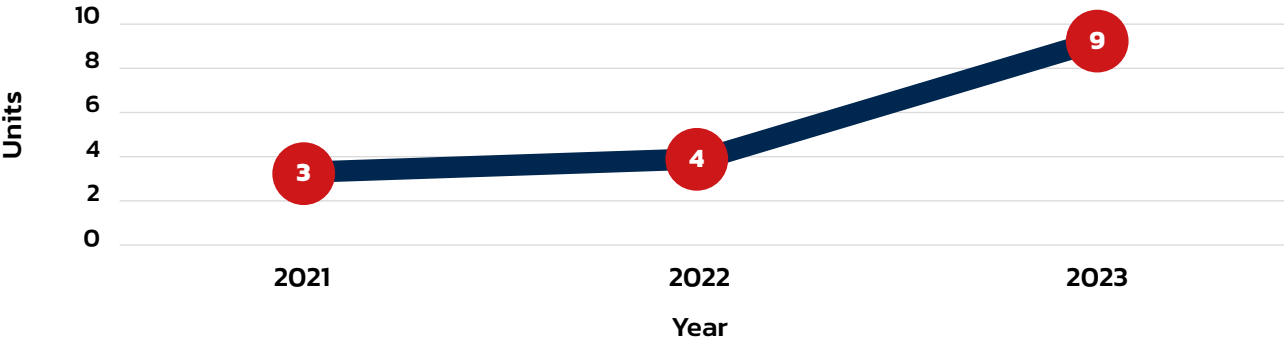
Inside the SEE Lab’s machine, the most important core component is its Members. Members are companies involved in the industrial, commercial and financial private sector, both space and non-space, that have a peculiar interest in collaborating with the SEE Lab and in making its research, education and dissemination activities expand.

By providing funds to the Laboratory, Members engage in such collaboration in several different ways. Joint studies, research ventures, events’ organization and management, special meetings with the sector’s top-level experts, networking activities, knowledge dissemination and business relations promotion are some examples of what one can possibly gain by becoming a SEE Lab Member.

As one of the first strategic interventions under Director Di Pippo’s tenure, the Laboratory has improved its Governance system by modifying the Membership scheme, so to guarantee for a greater arena of actors the possibility to join. Moreover, the Lab chose to differentiate the Membership alternatives according to different levels, both in terms of contribution and of associated benefits; in fact, it is now possible to join the SEE Lab according to the following four categories: Silver, Gold, Platinum and Diamond.

The Lab seeks and promotes a constant, close relation with any and each of its Members and considers their market-oriented views’ as strategically fundamental for the development of its orientation and positioning in the national, regional and global perspectives.

MEMBERS, 2021-2023



DIAMOND MEMBER



PLATINUM MEMBERS



GOLD MEMBERS



SILVER MEMBERS





INTESA SANPAOLO – Diamond Member

Intesa Sanpaolo Group is one of the leading banking groups in Europe, with a strong commitment to ESG, a top-ranking position for social impact and a strong focus on climate. As the largest banking group in Italy, with 13.6 million customers and more than 3,300 branches, it is a leader in financial activities for families and businesses in the country. It has a 18% market share in loans and a 22% share in deposits, as well as being a leader in managed savings (24%), pension funds (25%) and factoring (27%). The Group also has a strategic international presence, with over 900 branches and 7.2 million customers. It is among the main banking groups in several Central-East European and Middle Eastern and North African countries, thanks to its local subsidiaries. It ranks first in Serbia, second in Croatia and Slovakia, fourth in Albania and Slovenia, sixth in Bosnia and Herzegovina and Egypt, seventh in Moldova and eighth in Hungary. Moreover, the Group has an international network specialized in supporting corporate clients, with a presence in 25 countries, particularly in areas where Italian companies are most dynamic. The Group supports the development of small and medium-sized enterprises and large companies, both locally and globally, also supporting their ecological transition, digital transformation and innovation of processes, products and services. Innovation is a fundamental pillar in the strategy of Intesa Sanpaolo Group. To learn about new technologies and continuously incubate new ideas, the Group has initiated an open dialogue with industrial leaders, FinTech and academic excellence. It also develops models of offer and investment and financing solutions dedicated to startups and innovative companies. The development of the Space Economy is a crucial element for the competitiveness and economic and social growth of the country. In this context, the Intesa Sanpaolo Group has launched an acceleration and valorization program for innovative startups, with the aim of identifying the most promising realities operating in the Space Economy and in the related technological sectors, to guide and support them in the various phases of their business development. In addition, to support investments in R&D, the Group has developed an innovative financing tool, unique in the banking landscape, capable of financing intangible assets, i.e. disruptive ideas and projects in the Space Economy sector, in line with the objectives of the European Space Strategy and the National Space Economy Plan, taking into account the specific characteristics of the sector, the development phase in which the company finds itself, and the investment projects that it intends to carry out. Furthermore Intesa Sanpaolo Innovation Center, the Intesa Sanpaolo Group company dedicated to frontier innovation, explores future trends and scenarios, develops multidisciplinary applied research projects, supports startups, accelerates business transformation for companies according to the criteria of Open Innovation and the Circular Economy, facilitates the development of innovative ecosystems and disseminates innovation culture, in order to make Intesa Sanpaolo the driving force behind a better informed, inclusive and sustainable economy. Collaboration with SEE Lab allows Intesa Sanpaolo Group to participate in a dialogue with experts in the sector, academics, companies, research centers, public and private institutions, to understand trends and seize the opportunities offered by the space sector.

AIRBUS

AIRBUS ITALY – Platinum Member

Airbus Italia is the local industrial footprint of Airbus Defence and Space since 2015. It is a renowned expert in satellite communications, specializing in both the space and ground segments. The company's main focus is on the development of enabling technologies for satellite communications on the move, Internet of Things (IoT), RF components, as well as signal processing. The company has a highly skilled workforce that is dedicated to providing cutting-edge solutions and technologies. Airbus Italia has extensive experience in design, integration, and testing, which has enabled the company to contribute significantly to key European programs such as METOP-Second Generation, QUANTUM, BIOMASS, Galileo, Pléiades NEO, and LEO satellite equipment for EDRS ISL. Over the years, Airbus Italia has also made significant contributions to ARTEMIS, Radarsat 2, COSMO-SkyMed, Alphasat TDP#5, and major Italian programs such as SICRAL, PLATiNO, and ItalGovSatCom. The collaboration between Airbus Italia and SEE Lab points towards the steady and constant advancement of research regarding frontier topics in the space field, which Airbus Italia monitors with growing interest. The company aims to favor the advent of the space economy both from its commercial, industrial and academic sides, to be a leading actor in the innovation development of the field.



SPACE ALLIANCE – Platinum Member

Founded in 2005, the Space Alliance is a strategic partnership between two major industrial groups, Leonardo and Thales. With more than 10 thousand employees worldwide, the Space Alliance combines the capabilities of two joint ventures, Telespazio (Leonardo 67%, Thales 33%) and Thales Alenia Space (Thales 67%, Leonardo 33%). Leveraging Telespazio's and Thales Alenia Space's combined expertise, the Space Alliance offers a unique range of end-to-end solutions to operators, governments, institutions and space agencies, from satellite manufacturing to services. The Space Alliance addresses numerous space applications, including telecommunications, navigation, Earth observation, exploration, robotics, transportation systems and orbital infrastructures. It relies on this unique joint legacy to shape the future of the space sector, a future where innovation goes hand in hand with sustainability.



CAPGEMINI – Gold Member

Capgemini is a global leader in partnering with companies to transform and manage their business by harnessing the power of technology. The Group is guided everyday by its purpose of unleashing human energy through technology for an inclusive and sustainable future. It is a responsible and diverse organization of nearly 350,000 team members in more than 50 countries. With its strong 55-year heritage and deep industry expertise, Capgemini is trusted by its clients to address the entire breadth of their business needs, from strategy and design to operations, fueled by the fast evolving and innovative world of cloud, data, AI, connectivity, software, digital engineering and platforms. The Group reported in 2022 global revenues of €22 billion. Moving from its strong know-how on the most advanced IT technologies and counting on its sound engineering experience, Capgemini is supporting the European Space Agency and the key industrial players in the evolution of the space sector, where the exploitation of the big amount of data and the need of digital transformation is an increasing demand, that will foster the development of the new space economy.

**AVIO – Gold Member**

Avio is a leading international group engaged in the design, manufacturing, testing and integration of space launchers and solid and liquid propulsion systems for space travel. As a result of the ESA Council held in November, 2023 setting the rules for the new European governance for the space sector, in the upcoming future Avio will become also Launch Service Provider and Operator. The experience and know-how built up over more than 55 years puts Avio at the cutting-edge of the space launcher sector, solid, liquid and cryogenic propulsion and tactical propulsion. Avio operates in Italy, France and French Guyana with 6 facilities, employing more than 1,300 highly-qualified personnel, of which approx. 30% involved in research and development. Avio is a prime contractor for the Vega and Vega C programmes and a sub-contractor for the Ariane programme, both financed by the European Space Agency (ESA), placing Italy among the limited number of countries capable of producing a complete spacecraft.

**TYVAK INTERNATIONAL – Gold Member**

Established in 2015, Tyvak International has completed numerous space missions at an international level. These have ranged from developing and integrating Nano and Micro satellites to providing launch integration services, to on-orbit operations for both commercial and institutional customers. The company has also formed partnerships with key players in the aerospace industry, including SMEs, Large System Integrators, universities and research centers, and the SEE Lab now becomes a special one. Tyvak International is actively engaged in multiple R&D programs with its partners, with a particular focus on developing breakthrough technologies that will help drive the company's future growth. The company's range of capabilities covers mission and system design, software and hardware manufacturing, assembly, integration and testing, mission services, launch integration and insurance services, and on-orbit operations for institutional, government and commercial partners worldwide.

**SITAEL – Silver Member**

Sitael is one of the most important Italian players in the space field, and a worldwide leader in the small satellites sector.

**D-ORBIT – Silver Member**

D-Orbit is a global leader in the space logistics and transportation industry, thanks to the development of proprietary technologies and solutions.

1.8 THE SEE LAB'S SPONSOR

Sponsorship for the SEE Lab serves a multifaceted purpose, enabling the research center to:

- Gain access to a wellspring of academics, nurturing an environment ripe for groundbreaking scientific discoveries.
- Organize and host a diverse array of enriching events, ranging from symposiums and conferences to workshops and seminars, fostering the exchange of knowledge, ideas, and best practices among experts, researchers, and enthusiasts.
- Develop and deliver educational courses that empower aspiring students and professionals with specialized skills to contribute to the ever-evolving landscape of space sector

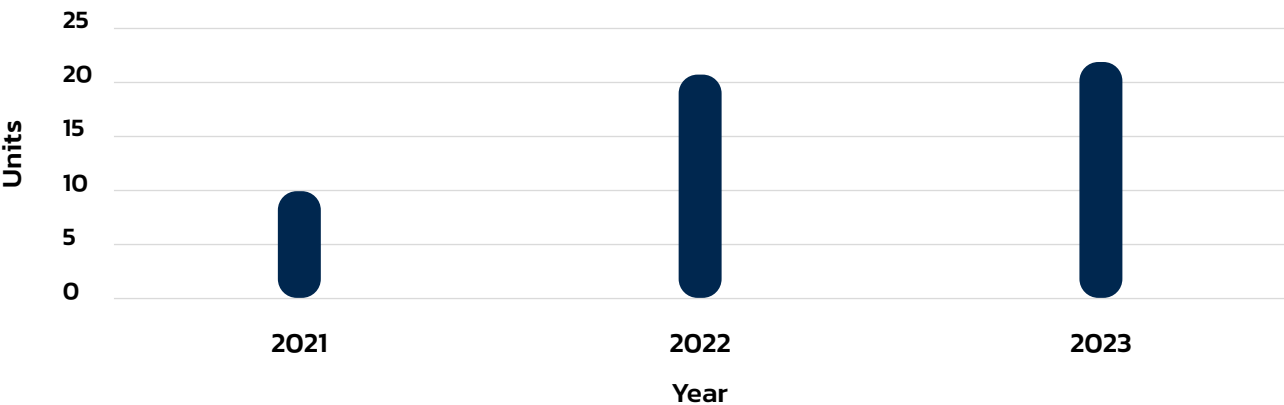
**Allianz MiC – Sponsor**

Allianz MiCo is the congress center in Milan managed by Fiera Milano Congressi, the leading company in Italy in the management of congress spaces and events. Allianz MiCo, operational since 1994, is home to the most important international association and corporate events that choose it for its features (18.000 seats, 65 conference rooms and 50,000 square meters of exhibition space), organizational skills and the expertise, the cutting-edge technology, the variety and flexibility of the offer and the services (operational assistance, catering, logistics).

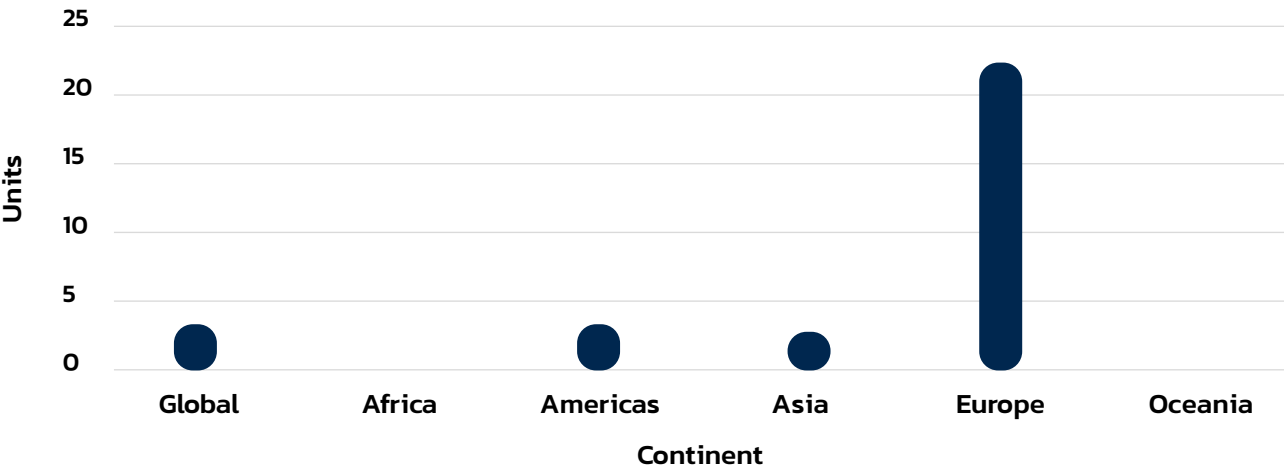
1.9 THE SEE LAB’S PARTNERS

The SEE Lab has the advantage of having developed strategic and international collaborations with various types of partners that provide support from a technical, scientific, legal, and engineering standpoint. Below, we present historical descriptive statistics analyzing the number of agreements signed, geographical distribution, and the type of entity.

PARTNERS, 2021-2023



PARTNERS GEOGRAPHICAL DISTRIBUTION, 2023



PARTNER TYPE, 2023



Associazione Delle Imprese Per Le Attività Spaziali (AIPAS)

– Rome, Italy

AIPAS is a non-profit association of Italian private companies operating in the manufacturing and services sectors of the space industry. AIPAS’ goal is to represent its member companies on national and international level, to support their growth, as well as to promote initiatives for supporting space industrial policy development.

Association for Space-based ICT Technologies, Applications and Services (ASAS)

– Rome, Italy

ASAS is an Italian industrial association developing and enhancing applications and services based on space to bring technologies and capacity from Space to Earth. ASAS’ members are small, medium, and micro enterprises, all focused on Space-based Services and Applications.

The EU-Japan Centre for Industrial Collaboration

– Tokyo, Japan

The Eu-Japan Centre was established by the European Commission and the Japanese Ministry of Economy, Trade and Industry to promote all forms of industrial, trade and investment cooperation between the European Union (EU) and Japan.

The European Space Resources Innovation Centre (ESRIC)

– Luxembourg, Luxembourg

Based in Luxembourg, the European Space Resources Innovation Centre (ESRIC) is the world’s first innovation centre entirely dedicated to space resources. Launched in 2020, ESRIC is an initiative of the Luxembourg Space Agency (LSA) and the Luxembourg Institute of Science and Technology (LIST) in strategic partnership with the European Space Agency (ESA).

The Moon Village Association (MVA)

– Vienna, Austria

MVA is a non-governmental organization with the goal of fostering the creation of the Moon Village, which includes the element of lunar commerce as an integral part of a sustainable presence of humans on the Moon.

New York University In Abu Dhabi Corporation

– Abu Dhabi, UAE

NYUAD is a liberal arts college that is part of the global network of New York University campuses and offers the highest quality education on its Saadiyat Island campus. The Abu Dhabi campus offers undergraduate, graduate as well as research careers in the fields of Arts and Humanities, Science, Engineering and Social Sciences.

The Secure World Foundation (SWF)

– Washington DC, USA

SWF is an organization working with governments, industry, international organizations, and civil society to develop and promote ideas and actions to achieve the secure, sustainable, and peaceful use of outer space.

The Board of Trustees of the Colorado School of Mines

– Golden (CO), USA

Mines is a public research university focused on science and engineering and its Center for Space Resources is a multi-disciplinary research program focused on educating scientists, engineers, economists, entrepreneurs, and policy makers in the developing field of space resources.

Polispace – Politecnico di Milano

– Milan, Italy

Polispace is an association with the objective to fill the gap between industry and academia in Italy and to provide students with the opportunity to participate in real hands-on engineering projects.

Space Policy Institute at the George Washington University

– Washington DC, USA

The George Washington University Elliott School of International Affairs is a world leader in research, graduate study, and informed discussion related to issues of science, technology, and public policy. The Space Policy Institute conducts research, offers graduate courses and organizes seminars, symposia, and conferences on topics related to domestic and international space policy.

University of Franche-Comté

– Besancon, France

UFC is a public multidisciplinary teaching and research university, in which the Centre de Recherche sur les Strategies Economiques (CRESE) carries out studies in various sectors, including the space sector.

Politecnico di Torino

– Turin, Italy

PoliTo is a public University based in Turin, Italy specialized in engineering, architecture, urban planification, technology and design. Its engineering courses feature important specializations in space-related topics.

The International Institute for the Unification of Private Law (UNIDROIT)

– Rome, Italy

UNIDROIT is an independent intergovernmental organization with its seat in Rome, Italy. Its purpose is to study needs and methods for modernizing, harmonizing and coordinating private and commercial law as between States and groups of States and to formulate uniform law instruments, principles and rules to achieve those objectives.

Fondazione Nord Est

– Mestre, Italy

Fondazione Nord Est is an economic research center created by the Chambers of Commerce of the Northeast of Italy, together with confederations and private sector associations (Confindustria). It aims at studying and understanding the present and the economic future of the North-eastern Italian regions, including the data collection and analysis regarding the space economy market.

National Institute of Astrophysics (INAF)

– Rome, Italy

The National Institute of Astrophysics (INAF) is the main Italian public research institution for astronomy and astrophysics. The research carried out by INAF covers the entire range of Universe sciences from both an observational and experimental point of view as well as theoretical. INAF also maintains close collaboration with other organizations conducting astronomical research in Italy and abroad, in particular with the National Institute of Nuclear Physics (INFN) for particle astrophysics, ASI, ESA, and NASA.

Esercito Italiano – Primo Reggimento Trasmissioni

– Milan, Italy

Primo Reggimento Trasmissioni is the Italian-led NATO Rapid Reaction Corps' direct support transmission regiment. It is direct subordinate to the NATO Rapid Deployable Corps-Italy Support Brigade (NRDC-ITA) and responsible for ensuring C4 support to the multinational high command with high readiness and deployability, both in permanent bases and in operations/exercises or training activities.

Universidade Nova de Lisboa (UNL), NOVA SBA

– Lisboa, Portugal

Nova SBE, as an organic unit of UNL, is a reference in the areas of management, economics and finance. Its mission is to educate and prepare students for the global market, to develop internationally recognized research activities, to contribute to the formulation of public policies, to expand the international recognition of teaching and research in Economics and Management produced in Portugal.

European Space Agency (ESA)

– Paris, France

The European Space Agency (ESA) is Europe's gateway to space. Its mission is to shape the development of Europe's space capability and ensure that investment in space continues to deliver benefits to the citizens of Europe and the world.

United Nations Office for Outer Space Affairs (UNOOSA)

– Vienna, Austria

The United Nations Office for Outer Space Affairs (UNOOSA) works to promote international cooperation in the peaceful use and exploration of space, and in the utilisation of space science and technology for sustainable economic and social development. The Office assists any United Nations Member States to establish legal and regulatory frameworks to govern space activities and strengthens the capacity of developing countries to use space science technology and applications for development by helping to integrate space capabilities into national development programmes.

Stato Maggiore della Difesa

– Rome, Italy

Stato Maggiore della Difesa, indicated by the acronym SMD, is a body of the Italian Armed Forces which is part of the technical-operational area of the Ministry of Defense and is represented by the Capo di Stato Maggiore della Difesa and his staff.

Istituto Italiano di Tecnologia (IIT)

– Genoa, Italy

The Italian Institute of Technology is a scientific research institute. It is focused on advanced robotics, nanotechnology, materials, neuro, and computational sciences. Its mission is to promote scientific excellence and technological innovation for the benefit of society.

Università di Roma – La Sapienza

– Rome, Italy

Founded in 1303, Sapienza is the oldest university in Rome and the largest in Europe. Its mission is to contribute to the development of the knowledge society through research, excellent and quality training and international cooperation.

Fondazione Leonardo – Civiltà delle Macchine

– Rome, Italy

Founded in 2018, Fondazione Leonardo – Civiltà delle Macchine works to promote dialogue within civil society, to encourage collaboration with stakeholders, territories and their communities.

1.10 TESTIMONIALS & PRESS

MAGAZINES AND NEWSPAPERS

- Adnkronos.Com/Ign (We B2)
 - Affaritaliani.It
 - Air Press
 - Alto Adige
 - Ansa.It
 - Area Interior
 - Avvenire
 - Business People
 - Iass C/O Gruppo Edit. Class
 - Class Cnbc
 - Corriere Della Sera
 - Corriere Della Sera Magazine
 - Corriere.It
 - Daily Media C/O Ediforum
 - Daily Net
 - Domus C/O Editoriale Domus
 - Focus C/O Gruner Und Jahr-Mon-
 - Forbes Italia
 - Fortunaita.Com
 - Fox8.Com
 - giornale Radio
 - iorno/Resto/Nazione
 - Il Giorno - Edizione Milano
 - Il Mattino Di Padova
 - Il Piccolo (Al)
 - Il Sole 24 Ore
 - Il T
 - Ilgiornale.Ch (Web)
 - Italia Oggi
 - L' Eco Di Bergamo
 - La Lettura (Corriere Della Sera)
 - La Nazione Cronaca Di Firenze
 - La Provincia Di Como
 - La Provincia Pavese
- La Repubblica
 - La Repubblica - Edizione Firenze
 - La Repubblica - Inserto Affari&Finanza
 - La Repubblica - Inserto Tuttomilano
 - Libero - Edizione Milano
 - Luce
 - Mag By Legalcommunity .It
 - Menafn.Com
 - Mf - Milano Finanza
 - Porto & Diporto
 - Query La Scienza Indaga I
 - Rai Radio 3
 - Raitre
 - Raiuno
- Repubblica.It
 - Rid Rivista Italiana Difesa
 - Sanmarinofixing.Com
 - Sole24ore.Com
 - Spacenews.Com
 - Startupitalia.Eu (Web 2)
 - Tiscali.It
 - Wvntv.Com

56
TOTAL NUMBER OF
NEWSPAPERS/WEBSITES

87
TOTAL NUMBER OF
MENTIONS/INTERVIEWS/
ARTICLES

SIGNIFICATIVE QUOTES

- > Be careful not to stop, all it takes is one distraction in this sector, and you lose the strategic advantage built over decades.
(S. Di Pippo)
- > We often consider space as something far away, but it is closer than we think.
(M. Pianorsi)
- > We are witnessing a paradigm shift in public institutions, where the State is increasingly taking on the role of a facilitator rather than an entrepreneur.
(C. Iacomino)

NOTEWORTHY NEWS

1. “Una legge italiana per lo spazio”
RID Rivista Italiana Difesa
- 01st February 2023
2. “Clima: Di Pippo, 50% dei dati misurabili solo dallo spazio”
Ansa.it - 28th February 2023
3. “L’Italia scommette sullo spazio”
MF Milano Finanza - 14th September 2023
4. “Spazio, in un libro perché è “la sfida del presente””
ADNKRONOS.com - 28th October 2023
5. “Al via le giornate spaziali italiane a Washington”
Ansa.it - 13th December 2023

2. WHAT AWAITS US IN 2024?

Through research, events, and education, SEE Lab is dedicated to achieving broader knowledge, developing new methodologies, and fostering international interconnections to effectively address the challenges of the coming decades.

Applied and Academic Research activities:

SEE Lab is committed to empowering researchers to delve into strategic topics and fundamental future projects for the betterment of society. We aim to analyze key technologies to tackle global challenges such as energy transition, climate change, and the need for innovative experimentation platforms and materials. This includes examining space projects like commercial space stations, space debris management, lunar economy development, and solar energy collection in space. To realize these objectives, SEE Lab actively promotes collaboration among experts from various disciplines and sectors, fostering knowledge sharing and innovation. We closely collaborate with academic partners, government institutions, and private sector organizations to shape policies, develop technologies, and drive initiatives shaping the future of space and related activities.

Education:

This activity is at the core of SEE Lab's mission. We actively disseminate insights and knowledge through educational and training initiatives, significantly contributing to discussions on the space economy. Our educational offerings include executive programs and custom courses tailored to specific organizational needs. As we expand our educational endeavors, our goal is to offer a broader range of courses and lessons on the space economy in various formats, enriching

both Bocconi University (Italy) and SDA School of Management's academic environments and extending our impact beyond.

Events:

Furthermore, SEE Lab's **events** serve as central platforms to amplify our work's impact and foster deeper collaborations. We host workshops, conferences, and high-level events to engage our members and partners, providing added value to our collective efforts. In anticipation of IAC 2024 in Milan, where responsible space for sustainability is a critical theme, SEE Lab is gearing up to lead the conversation through a series of preliminary events focused on sustainability and the intersection of space with global challenges.

SEEData:

In conclusion, SEE Lab aims to be the reference point for the development of a **database** that can serve as a reference for stakeholders in the space economy. In particular, SEEData represents our primary research product, receiving significant attention and resources. We are dedicated to its ongoing enhancement, guided by strategic insights and substantial investments. Our focus is on technological improvement and geographical expansion of the sample. We aim to automate operations for more precise outputs and enrich our dataset to fully represent the European context. This expansion aligns with our commitment to provide comprehensive data for the upcoming general assembly.

SDA BOCCONI SCHOOL OF MANAGEMENT

For fifty years, we have been committed to fueling your educational experiences with our passion for knowledge and concrete know-how, creativity and scientific rigor, and cultural and international diversity. We were born to support the continuous growth, improvement and transformation of people, companies and institutions, and we will stand by your side through the toughest challenges.

Over the years, we have grown with our clients and students. We have learned to change and transform what we offer. We have gone from national to global leaders according to prestigious, international rankings. We have increased our commitment and the programs we offer to ensure we always have an answer to the needs of new skills. We have transformed our research in relevant and applied knowledge and embraced the challenge of the digital transformation. And we have designed and created a campus for the future, one of the most innovative in the world.

We are an international school with headquarters in Milan and Rome and a pan-Asian hub in Mumbai, India. Our classrooms reflect the globalization of modern society and the diversity of thought that cultivates progress and innovation.

Our strength lies in our ability to evolve, thanks to the contagious, innovative energy found at all levels of our community.

We do not fear the future. We want to play a leading role in the global market of higher education alongside small, medium and large companies and institutions. We are proud of our identity and the Italian creative ingenuity we represent, but we will always be open to the world.

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SCHOOL OF MANAGEMENT

SEE LAB
SPACE ECONOMY EVOLUTION

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