

# The Italian Space Agency Hyperspectral data exploitation programmes: PRISMA SCIENZA

Giorgio Licciardi

# Space 4.0

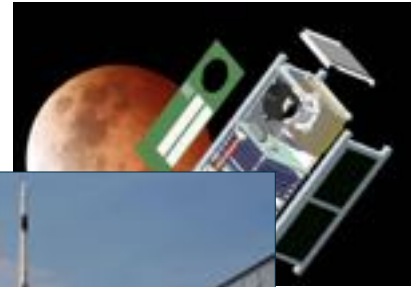
The commercialization of space is now rapidly emerging through the increasing **commoditization of space data**.

**Commercialization** favoured by the rapidly dropping costs of:

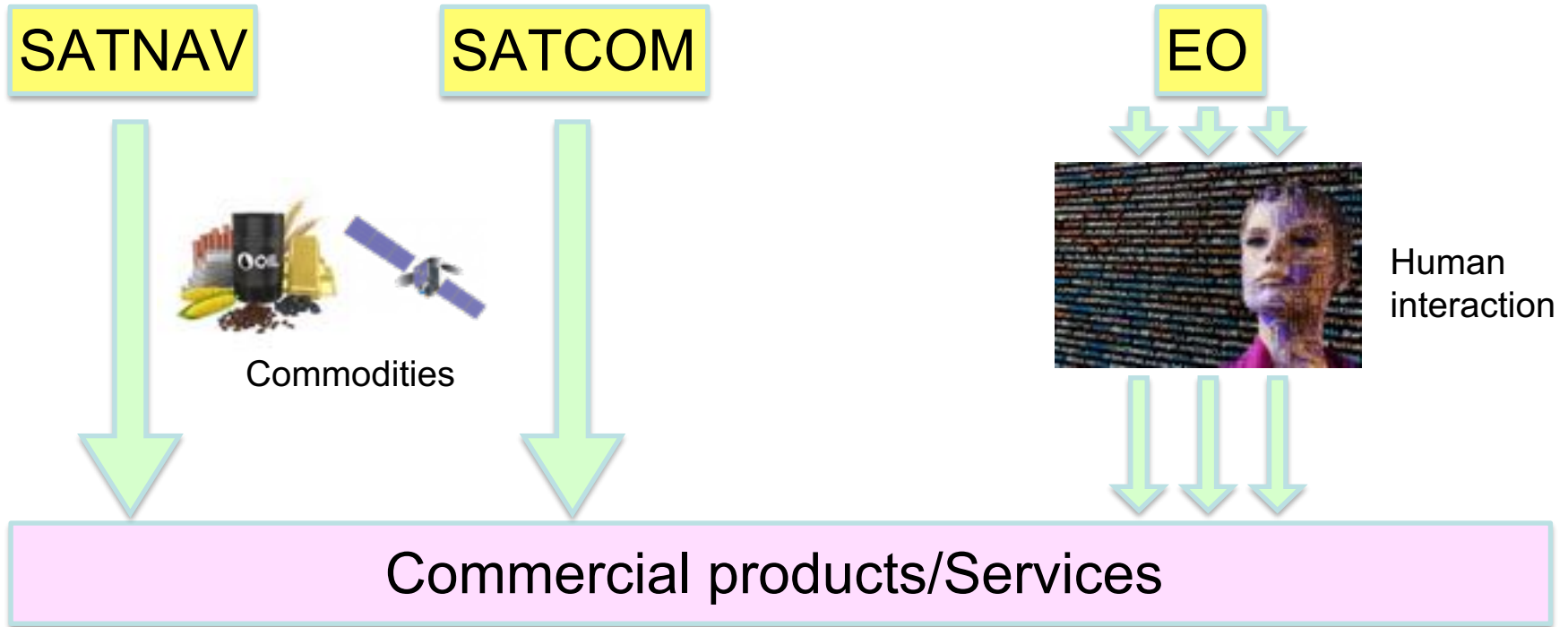
- Small sat
- Launching
- Storage
- Processing

**New players** are now entering the space business:

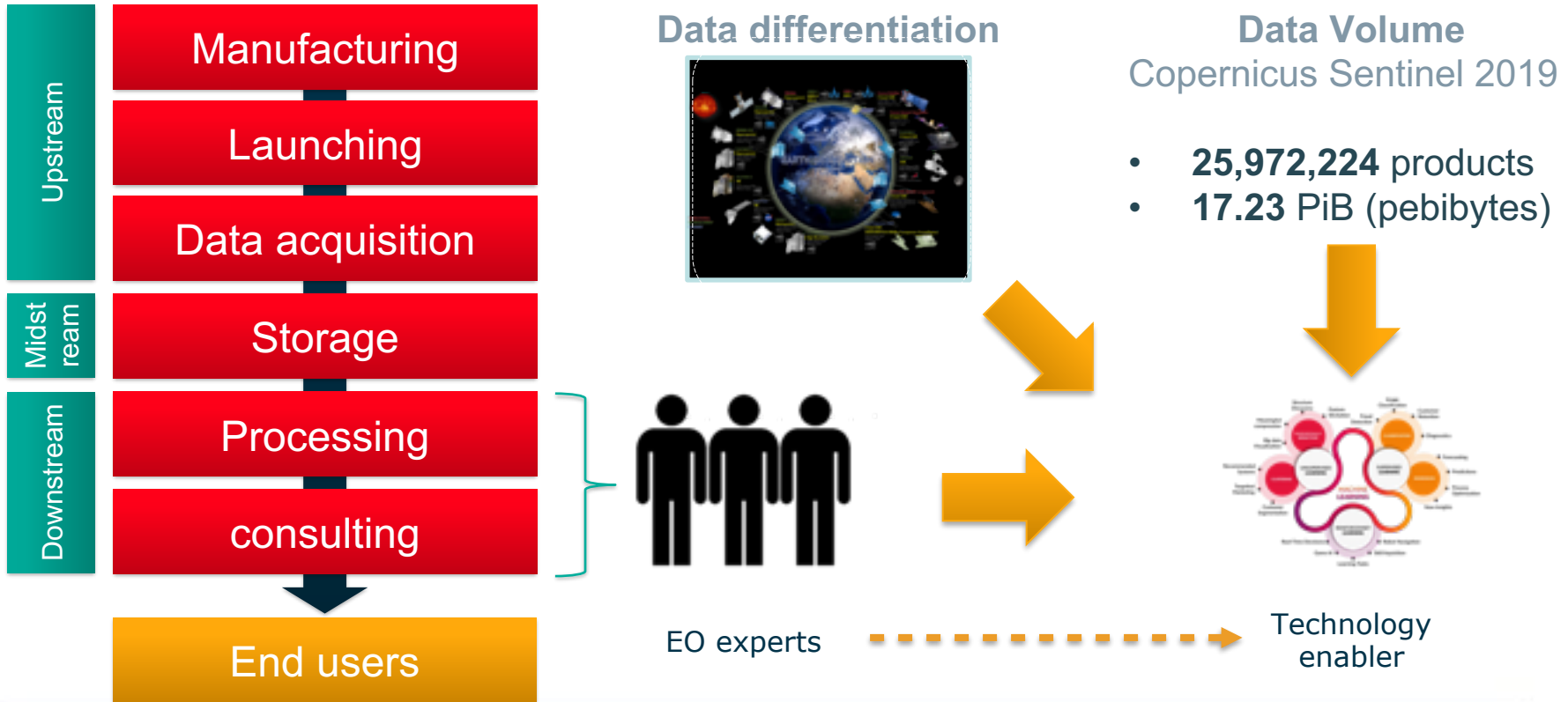
- Startups(e.g. Planet)
- Big players (e.g. SpaceX)
- ICT giants (e.g. Google, Amazon)



# Space 4.0 Commercialization of space data



# EO Value Chain



# Earth Observation a Priority Sector

Earth Observation is a **priority sector**, where Italy has consolidated its experience in the last decades. Nowadays EO infrastructures are permanent features of the Italian space system.

The Italian industry cover the whole value chain of the Space domain: upstream, midstream and downstream, fully part of the European industrial landscape; therefore, Italy is capable to develop several sensor typologies, small, medium and large satellites, as well as to operate constellation of satellites and to exploit EO data for the benefit of a wide range of users (institutional, scientific, defence and commercial).



**OPERATIONAL**  
**IN DEVELOPMENT**  
**PLANNED**

**PRISMA**  
**Hyperspectral**  
Launch 2019  
Lifetime: 5 years

**CSES-2**  
**HEPD-2**  
**EFD-2**  
Launch 2022  
planned lifetime: 5 years

**CSES-1**  
**HEPD**  
Launch 2018  
planned lifetime: 5 years

**Cosmo SkyMed**  
**X band SAR**  
Launch 2007 - 2010  
planned lifetime: 7 years

**Cosmo Second Generation**  
**X band SAR**  
Launch 2019 (CSG 1)  
Lifetime: 7 years

**PLATINO-1**  
**X-band SAR**  
Launch planned 2022  
Lifetime: 5 years

**SAOCOM (SIASSE component)**  
**L band SAR**  
Launch 2018, SAOCOM 1A  
Launch 2020, SAOCOM 1B  
Lifetime: 5 years

**Low Frequency SAR**  
**L band SAR**  
**(SAOCOM FO & ROSE-L Companion Constellation)**  
Launch planned 2027  
Lifetime: 5 years

**PLATINO-3**  
**High Resolution**  
Launch planned 2024  
Lifetime: 5 years

**EAGLE**  
**Multispectral**  
Launch planned 2024  
Lifetime: 5 years

**Esca Flyer**  
**TIR**  
Launch planned 2026  
Lifetime: 5 years

**PLATINO-2**  
**TIR**  
Launch planned 2023  
Lifetime: 5 years

**PLATINO-4**  
**Hyperspectral**  
Launch planned 2024  
Lifetime: 5 years

**PRISMA SG**  
**Hyperspectral**  
Launch planned 2025  
Lifetime: 5 years

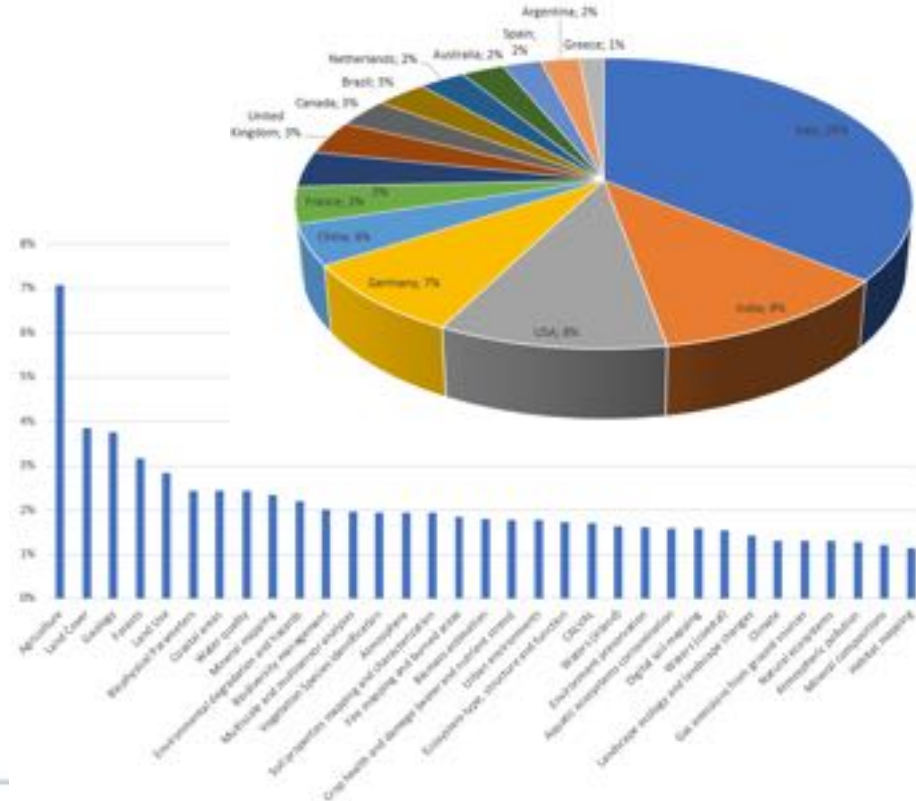
**SHALOM**  
**Hyperspectral**  
Launch planned 2025  
Lifetime: 5 years \*

# ASI Data access and user - PRISMA

1150 Licenses to Use activated @ 15.01.2022

Showing the (statistically) most representative part of the user population:

- 15 nations cover **80%** of the users
- the Italian users are only **1/3**
- India, USA & Germany together account for **1/4** of the users
- **63%** of the total users are scientists (**50%** of the users belongs to non-Italian Science and is the largest category)
- Institutional (**9%**) and commercial (**12%**) represents **21%** of total users
- Foreign commercial (**8%**) is two times the Italian commercial (**4%**)
- **6%** of users are still freelance!



# Focus on integrated applications

In this framework, the Italian Space Agency plays an important role in the development of the Italian space industry and established the **Downstream and Integrated Application Unit** with the intent to assist national Small and Medium Enterprises (SMEs), industries and academia in enhancing their competitiveness by supporting the development of space-based innovative products and services.

Financial support for commercial and scientific products

Interface between space and traditional markets



# Focus on integrated applications

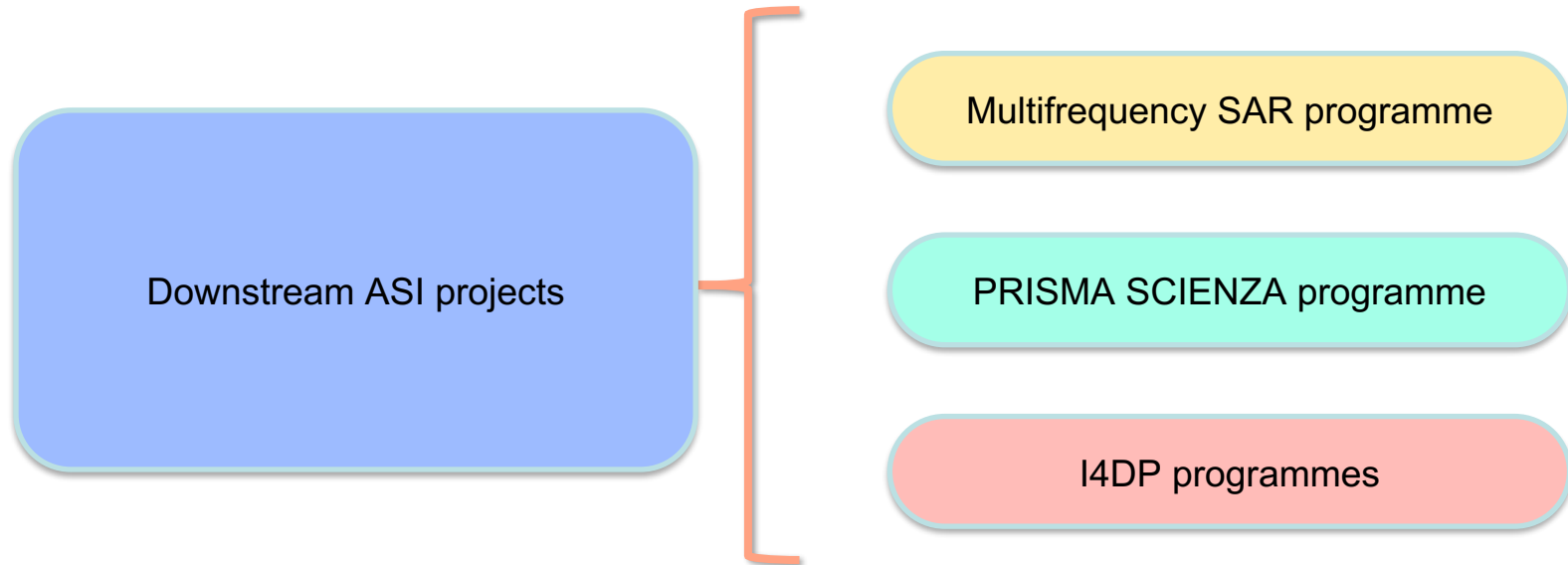
Encourage the use of **Italian, European and partner institutions Space infrastructures**

Promotion of the **use of space-derived products** and services among traditional market

Addressing **specific needs** from Industrial, Scientific and Public Administrations sectors

Focusing on specific **thematic areas of interest** for the Italian and European system

# ASI programmes in support of data exploitation

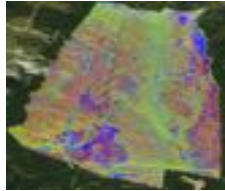


# PRISMA SCIENZA programme

- **R&D projects:** New techniques, methods and algorithms for the complete exploitation of Hyperspectral data
- **R&D activities:** supporting Italian public research and industry in the development of new solutions based on SAR data
- **Long term strategies:** analyze the state of the art on the Italian SAR community to define ASI long-term strategies in the field of new EO applications
- **Full data exploitation:** allow the development of advanced services based on hyperspectral data, in particular with other EO data
- **Functional analysis:** understanding the effectiveness of hyperspectral data in the study of the different aspects of Earth Science

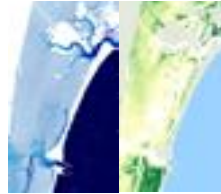


# PRISMA SCIENZA programme



**Agriculture  
Forestry**

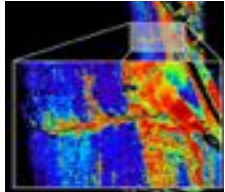
&



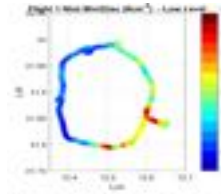
**Inland and coastal  
water**



**Cryosphere**



**Raw Materials**



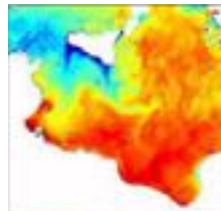
**Air quality**



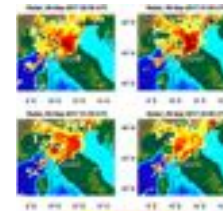
**Soil properties**



**Cultural heritage**



**Open air activity**



**Natural disasters**

# Thematics

Precision agriculture (4 proposals)

Forestry (4 proposals)

Air quality monitoring (2 proposals)

Extreme events damage assessment (2 proposals)

Water ecosystems analysis (2 proposals)

Cultural heritage detection

Soil properties

Cryosphere

open-air activity

Hydrocarbon detection

Raw material detection

Asbestos detection

Soil and air pollutants

**pollutants** precision asbestos raw material  
activity monitoring **air** heritage cryosphere  
cultural events water quality **and** hydrocarbon  
ecosystems forestry open identification  
agriculture **SOil** extreme properties **detection**

# Technological solutions

## Modelling

- Biophysical modelling, inversion, etc.

## Artificial Intelligence/Deep learning

- NN, GAN

## Machine Learning

- SVM, random forest, classification, clustering, etc.

## Resolution/quality enhancement

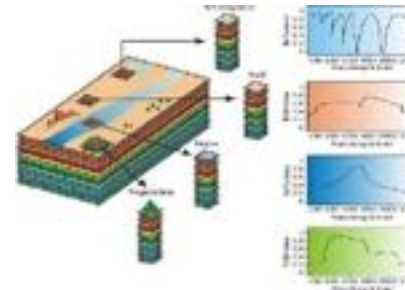
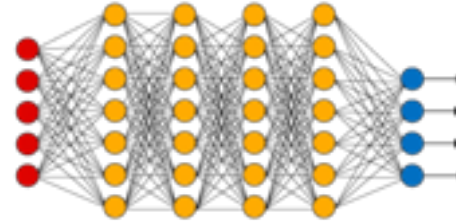
- Pan-sharpening, Super-resolution, denoising, destriping

## Spectral unmixing

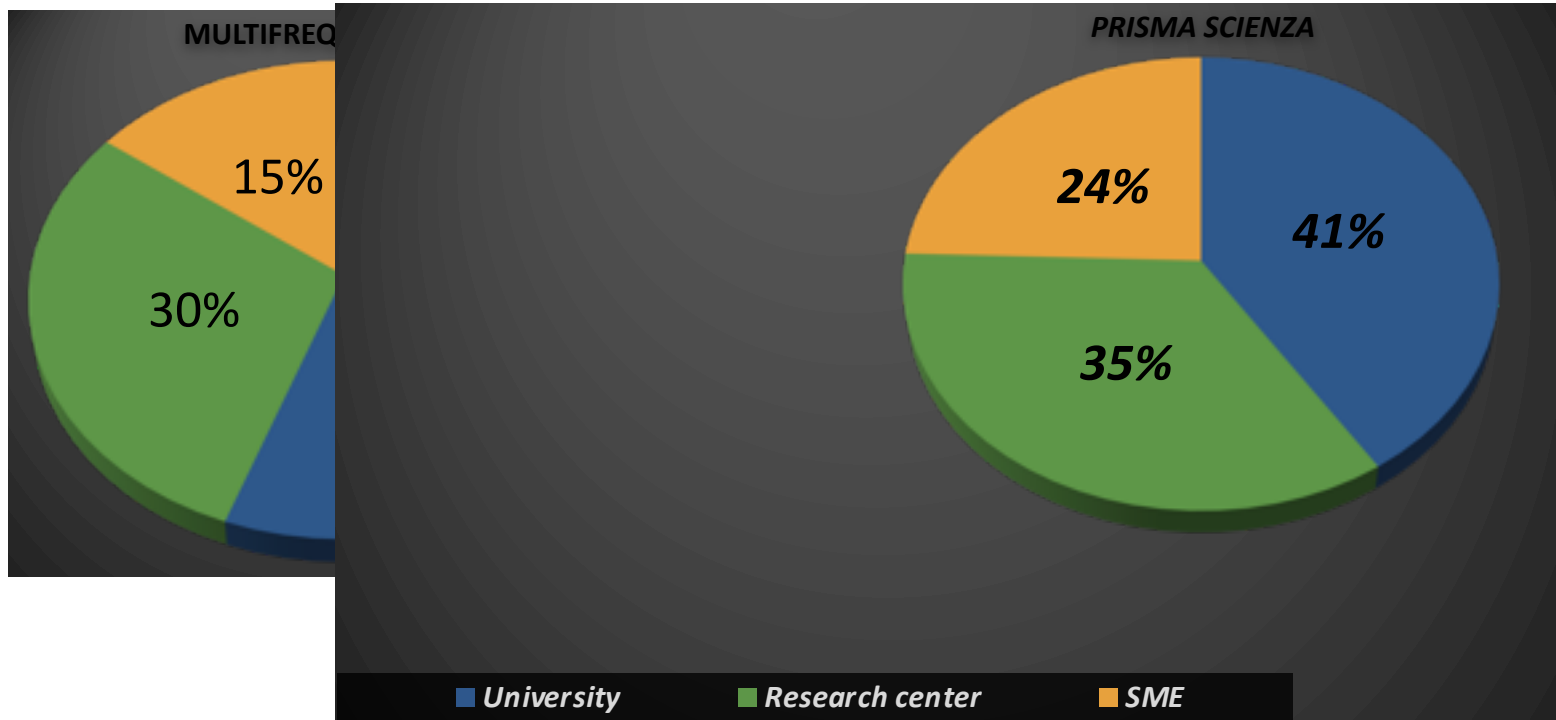
- Linear, bilinear, nonlinear

## Data fusion

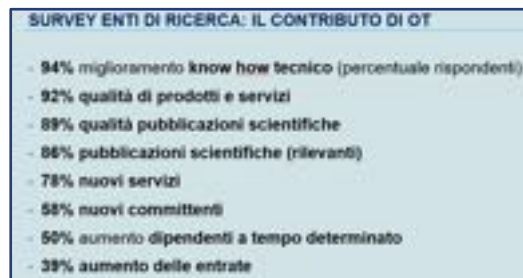
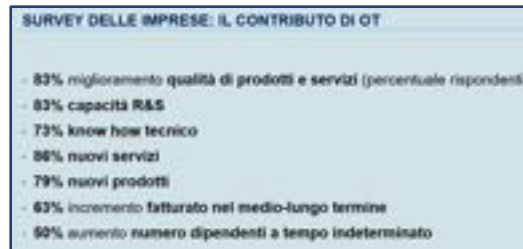
- Sensor fusion



# Proposing entities



## Study on the economical benefits derived from the space economy in Italy





# FUTURE CHALLENGES

In the coming years new challenges, such as EO market development, fostering the evolution and continuation of the European and national programmes, will come and they will be fully part of the national strategy already encompassing a wide variety of EO Programmes at national and European level.

## **General objectives:**

In this context, among the others, the following general objectives will be pursued:

- Encouraging the market development of applications and services;
- Supporting and promoting national and European initiatives, highlighting the benefits of space technology & services and increasing the integration among different sectors of economy;
- Fostering the evolution and continuation of programmes such as Copernicus and the development of its complementary programmes;
- Favouring the optimisation of the different European programmes, avoiding duplications and pursuing synergies;
- Sustaining the direct involvement of Large System Integrators and Small & Medium Enterprises.

**Thanks you for your attention**

ASI  
Agenzia Spaziale Italiana  
Via del Politecnico snc  
00133 Roma, Italia

[www.asi.it](http://www.asi.it)