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Space Big Data Policy: criticalities and perspectives

Maria Cristina Falvella

Head of Strategy and Industrial Policy

Agenzia Spaziale Italiana

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Big Data: an old issue

Understanding and preserving information is in our nature. Since humans started harvesting, storing and analyzing collections of items, **data have always been BIG.**

- Not a new concept only newly rediscovered and newly accessible to many not only in Business Intelligence (BI) but often and often in Remote Sensing (RS) domain too
  - > internet blogs
  - > workshops
  - > monographies

- **The ultimate goal? Recording, curating and analyzing data to extract as much hidden information as possible, with the least effort and ASAP**
  - i.e. data analysis (or data analytics, as per the Big Data jargon)

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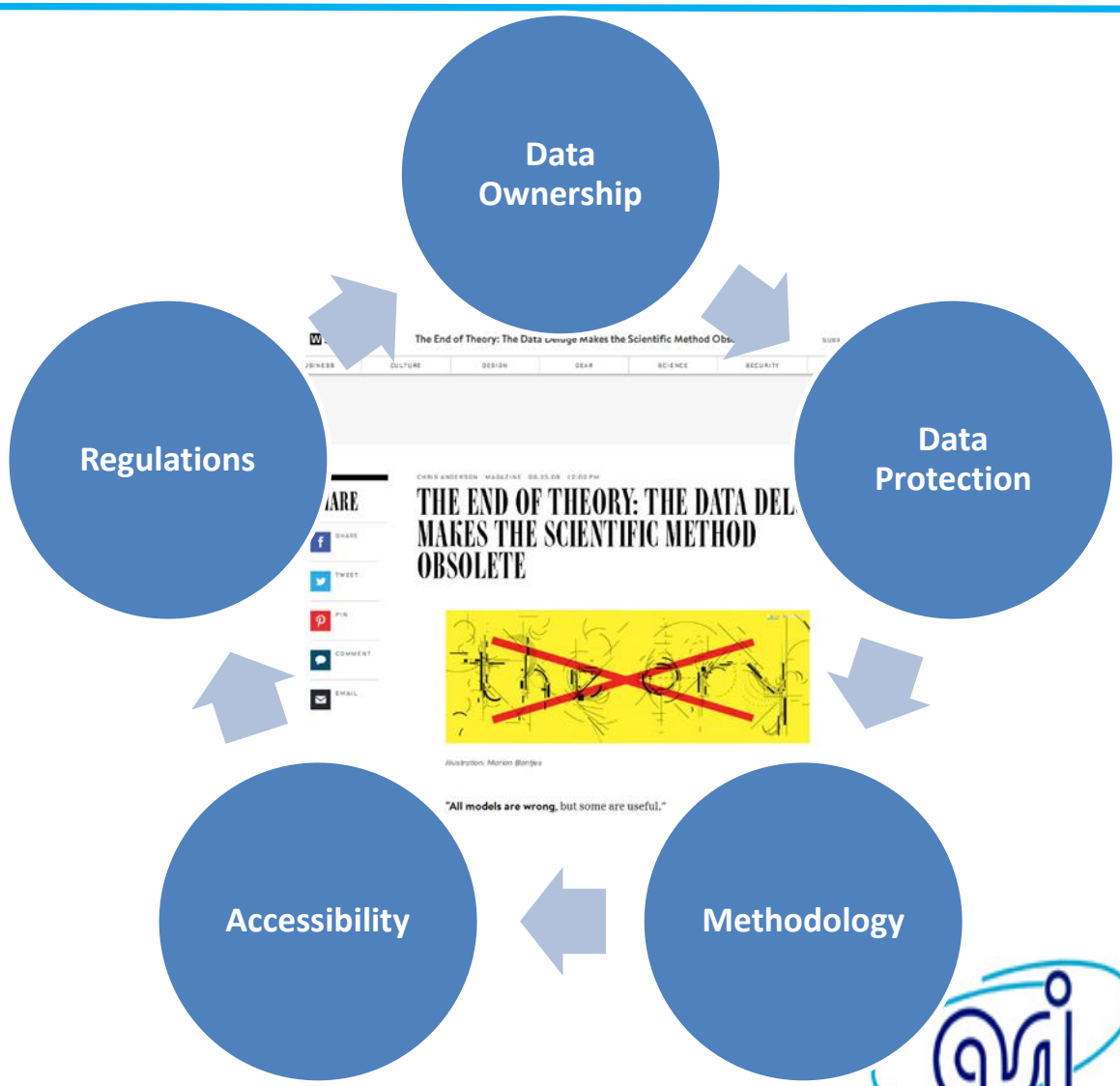
What is at stake?

A world of opportunities:

- Consistency & compatibility of data
- Investments & development: i.e. technological infrastructure
- Collaborations
- Highly skilled employment

New game, new rules:

- Establish new standards
- Clear protocols for data privatisation, governance and sharing
- Cultural change on data management



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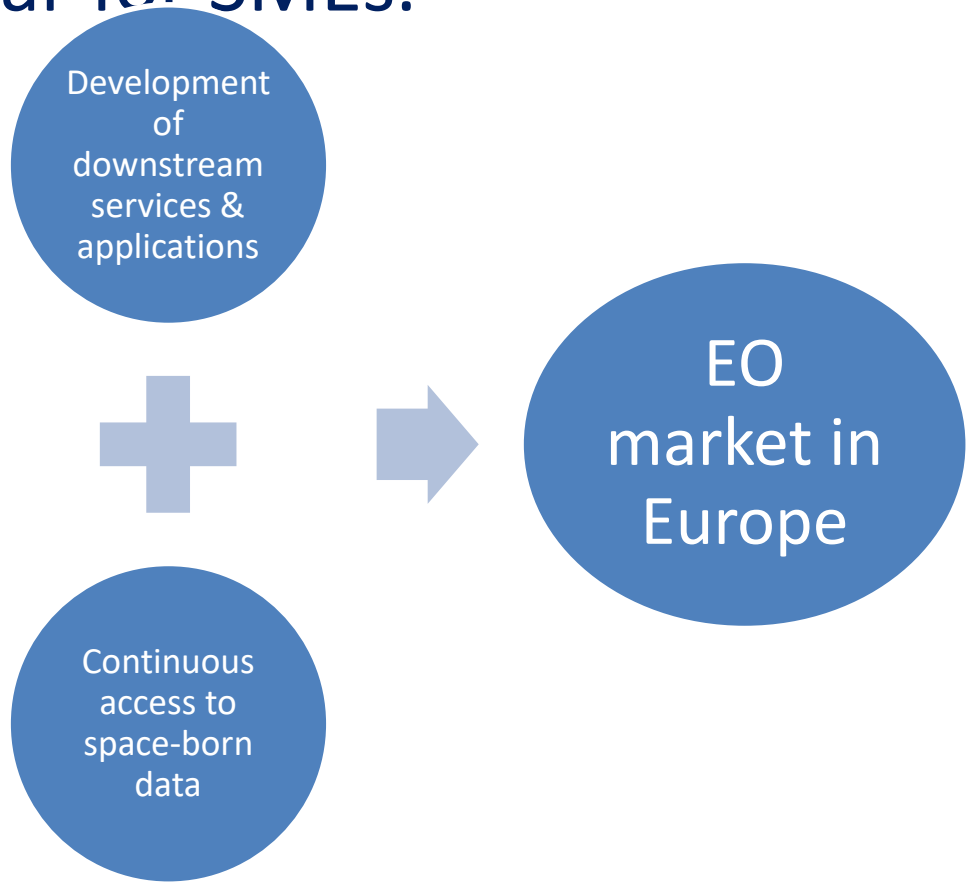
Big Space Data in Europe

Both EU and ESA (through the Sentinels of the Copernicus programme) are creating many opportunities to develop the EO market in Europe, in particular for SMEs.



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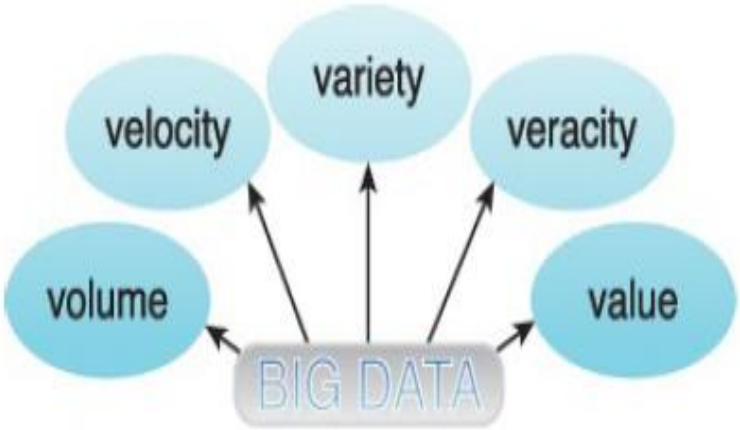
Big Data Definition

What is Big Data?

A term applied to data whose size, velocity or complexity is beyond the ability of commonly used software tools to capture, manage, and/or process within a tolerable elapsed time.

George O. Strawn (US NITRD Program)



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DRIVERS

- **Improvements in data quality and quantity** >>> new generation sensors, telecommunication (EDRS), computing and storage systems
- **Improvement in connectivity**>>>'Global Village' (M. McLuhan) is quite a reality in Europe but a big penetration gap constitutes the strongest barrier for BD exploitation
- **Cloud computing**>>> anytime,anywhere, access to IT resources delivered dynamically as a service
- **Data Mining techniques**>>> jointly exploitation through queries for long term archives, semantic annotations, images, etc.

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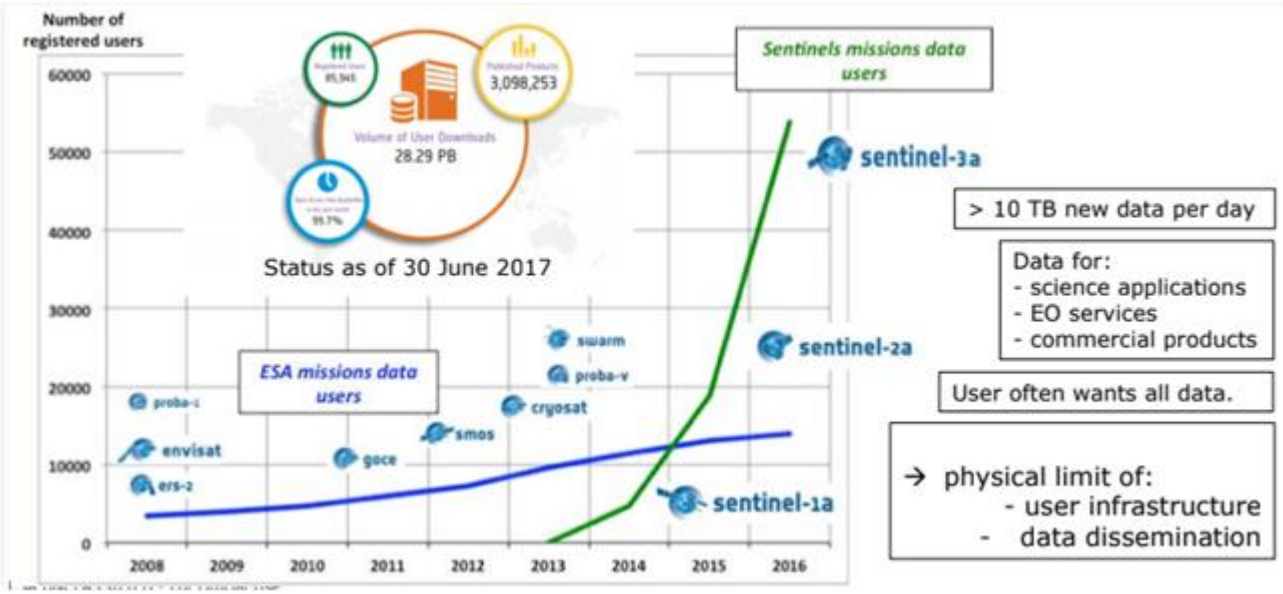
EO Data European market (assessment by ESA)

- Network evaluation suggests there is a strong demand for efficient and real time data interpretation and collection.

- The volume and complexity of data generated calls for advanced infrastructure and the adoption of the new standards to avoid data to become obsolete => craving competitive market



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EO Data Achives

NASA Earth Science Data and Information System(**ESDIS**) collects **7,5PB per day** with 1.5 million of users

The projected volume of **ESA's EO Data Archives in 2020** (estimated in 2013) will exceed **3 PB/day**.

The **ESA Sentinel data access system** provides a complete, open and free access for all potential users of the **Copernicus Sentinel missions** on a world-wide basis (Data Hub System – DhuS serving scientific users and each national collaborative product dissemination).

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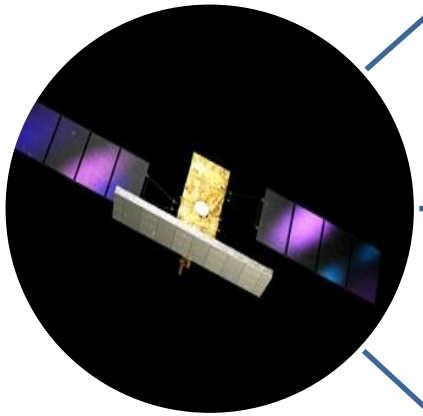
The Italian COSMO-SkyMed programme (1/2)



250 GB/day
- Acquires 500+ images/day
- Processes 120+ images/day

0.4 PB today
- Total volume of 830k products archive

User Ground segment
- >4000 registered multi-user accounts for catalogue access
- 2000+ for data access

The most important **Italian EO system** is the **COSMO-SkyMed** dual use satellite system:

a constellation composed of four satellites equipped with a Synthetic Aperture Radar, jointly developed by the Italian Space Agency (ASI) and the Italian Ministry of Defense.

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COSMO Sky Med data policy

- **no specific legislation in force in Italy to regulate the dissemination of Earth Observation data**.

- **COSMO-SkyMed system data policy-** general principles of the national policy for the distribution of COSMO-SkyMed data, in order to ensure the respect of foreign policy and national security needs as well as commercial and other national public purposes (e.g. civil protection, research and development, etc.)

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THE NEW BIG DATA EXPLOITATION PARADIGM: from DATA HOME to USER HOME

SPACE DATA are too BIG to be moved into the user computer

>>> the direction will be fully reversed

>>> **is the user and his know-how which will be brought where the data reside**

ASI is currently developing a pilot project which operates with a cloud processing enviroment embedded in the data archive

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Big Data legal background

Lack of **explicit and specific legal regime** for Space Big Data:

- Space Law Legal Regime -> **Remote Sensing Principle** (1986)

- UN Space Treaties -> mostly refer to **results of space missions,** that should be **freely accessible and potentially available** to everyone (Outer Space Treaty - art. I and IX). There is also a general obligation for States to share the benefits coming from the space scientific investigation, rapidly and effectively (art. XI).

Open Universe initiative promoted by Italy to UN COPUOS: with the objective to expand the availability of and the accessibility to space science data

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European Regional law enforcement

At the **Regional level**, the principle of free availability of scientific data is reflected in **high-level legal documents**.

- **ESA Convention**: article III 'Information and Data', even if with some limitations (ESA and Member States' IPR and the right for participating States to missions to firstly exploit results), encourages States to publish scientific results from space activities (contained in the art. V of the Convention)

At the EU level, the **Data Policy** of the current **Copernicus Regulation**, affirms the open and free access to data, but pose a **limitation** in case of **security reasons**, trying to achieve a balance between data openness and data protection.

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The current frame

- Several regulations providing general principles and some detailed rules exist but the **risk of fragmentation** among not connected different sources is very real>>> **asimmetries** in legislations, markets conditions and opportunities in Europe

- The Space Economy introduced new stakeholders which play an active role in management of big data>>> **new governance and partnerships not yet regulated for big data management**

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Criticalities

This ever larger availability and accessibility of data causes some criticalities to be discussed at national and European level in the near future:

- Potential **Privacy** issues, also connected to use of EO high resolution data>>>the new GDPR is imposing stricter limits to data sharing and processing.
- **Cyber security** threats, linked to the vulnerability of datasets to external attacks or to interferences with satellite systems.
- **IPR**, relevant to the EO images, database and data processing software. Due to the rapid distribution of space big data and its various uses, tracing and protecting the rights of the author of this data, or the intermediate users is difficult.

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The way forward

- The growing scientific and commercial interest in the use of big data from space is confirming its beneficial character, but also poses **challenges for a regulatory regime.**
- As technology progresses, **regulation should follow in a way to complement and facilitate further development and not to block it.**
- **A joint effort at institutional level is needed to guarantee both a balanced growth of the European market and the necessary control on BD exploitation**
- **The involvement of all the stakeholders is essential to share a proper level of responsibility in BG management**

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Thank You!

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