Can Space Economy Transform Europe's Regions?

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The Space Economy

- *"The space economy includes: all public and private actors involved in developing and providing space-enabled products and services. It comprises a long value- added chain, starting with research and development actors and manufacturers of space hardware (e.g. launch vehicles, satellites, ground stations) and ending with the providers of space-enabled products (e.g. navigation equipment, satellite phones) and services (e.g. satellite-based meteorological services or direct-to-home video services) to final users."* (OECD, 2007);
- But this a rather limited and dated definition given space programme and missions increasingly underpin socio-economic benefits that arise from technology diffusion and the creation of innovation milieux. For example, smart cities; GPS; AI and robotics and potentially smart specialisation projects.

- *"Space policy can help boost jobs, growth and investments in Europe. Investing in space pushes the boundaries of science and research. Europe has a world-class space sector, with a strong satellite manufacturing industry, which captures around 33 % of the open world markets, and a dynamic downstream services sector with a large number of SMEs. The European space economy, including manufacturing and services, employs over 230 000 professionals and its value was estimated at EUR 46-54 billion in 2014, representing around 21% of the value of the global space sector."* Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions *Space strategy for Europe* COM(2016) 705 final

European Commission Perspective

- ***Increase efficiency in agriculture and fisheries:*** satellite-enabled applications improve the mapping of cropland in need of irrigation, harvest forecasts, and fisheries control. This guarantees better food quality and security while safeguarding the environment.
- ***Help regions access knowledge and information***: satellites support communication when Earth-based solutions are limited. This reduces regional imbalances by serving communities in remote areas without internet access.
- ***Improve crisis response***: satellite services help shorten response times in emergencies. Swift damage images and assessment maps contribute to more efficient planning and relief efforts, and help guide rescue services.
- ***Protect the environment and help tackle climate change:*** environment monitoring provides crucial information on vegetation, ocean currents, water quality, natural resources, atmospheric pollutants, greenhouse gases, and the ozone layer.
- ***Increase security:*** satellite positioning, satellite communications, and Earth observation contribute to detecting illegal immigration, preventing cross-border organised crime, and combating piracy at sea.
- ***Improve citizens' health***: space-based applications can significantly improve healthcare and the health education of patients through remote medical support. They also help in preventing or mitigating the outbreak of disease.
- ***Optimise transport***: when combined with enhanced communication capabilities, highly accurate satellite positioning contributes to a modern and reliable transport sector for cars, planes, and ships. It optimises fleet management, vessel traceability, collision prevention, speed control, assistance for ship manoeuvres, etc.

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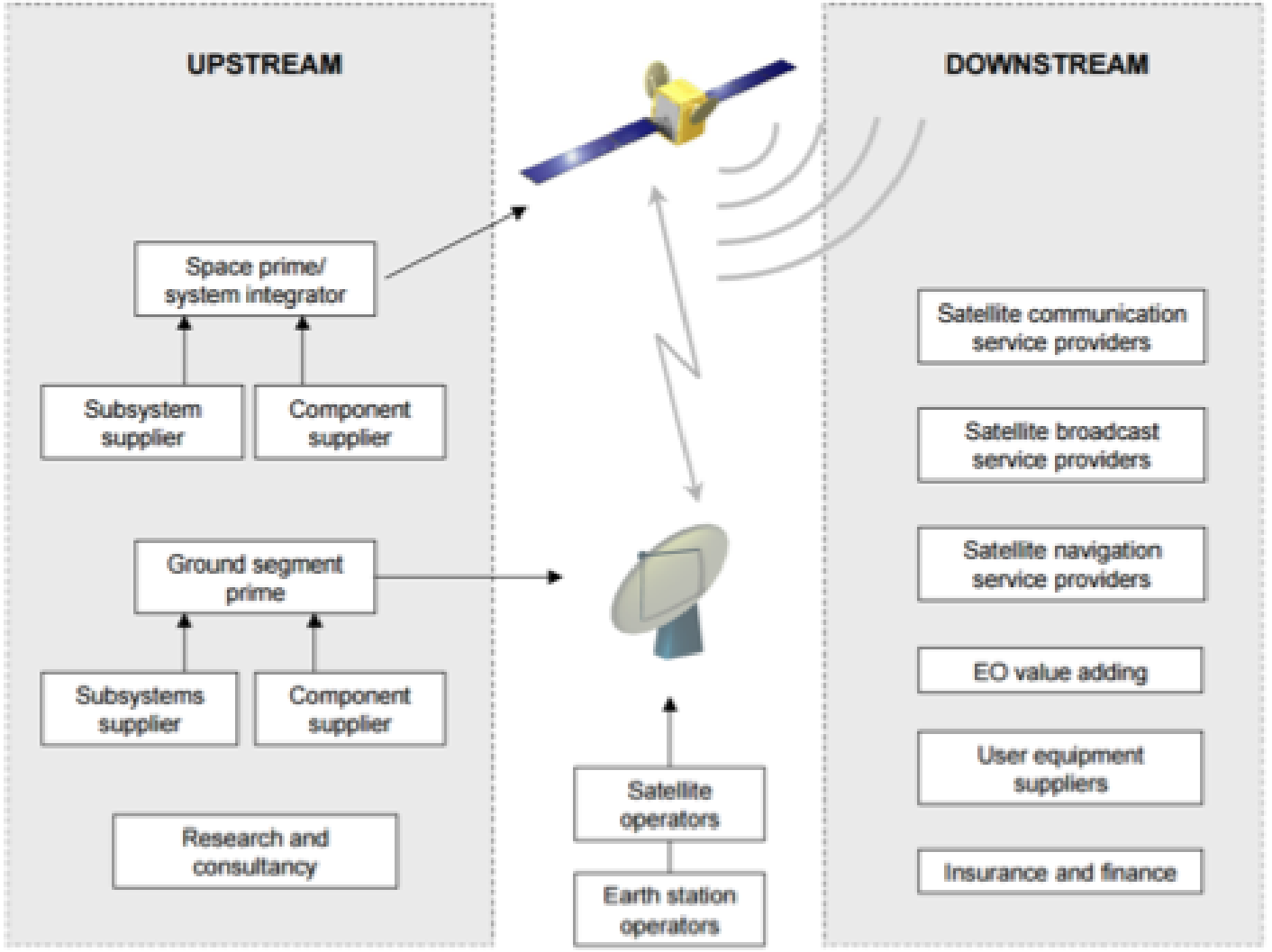
Traditional Perspective



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Space Economy Value-Chain

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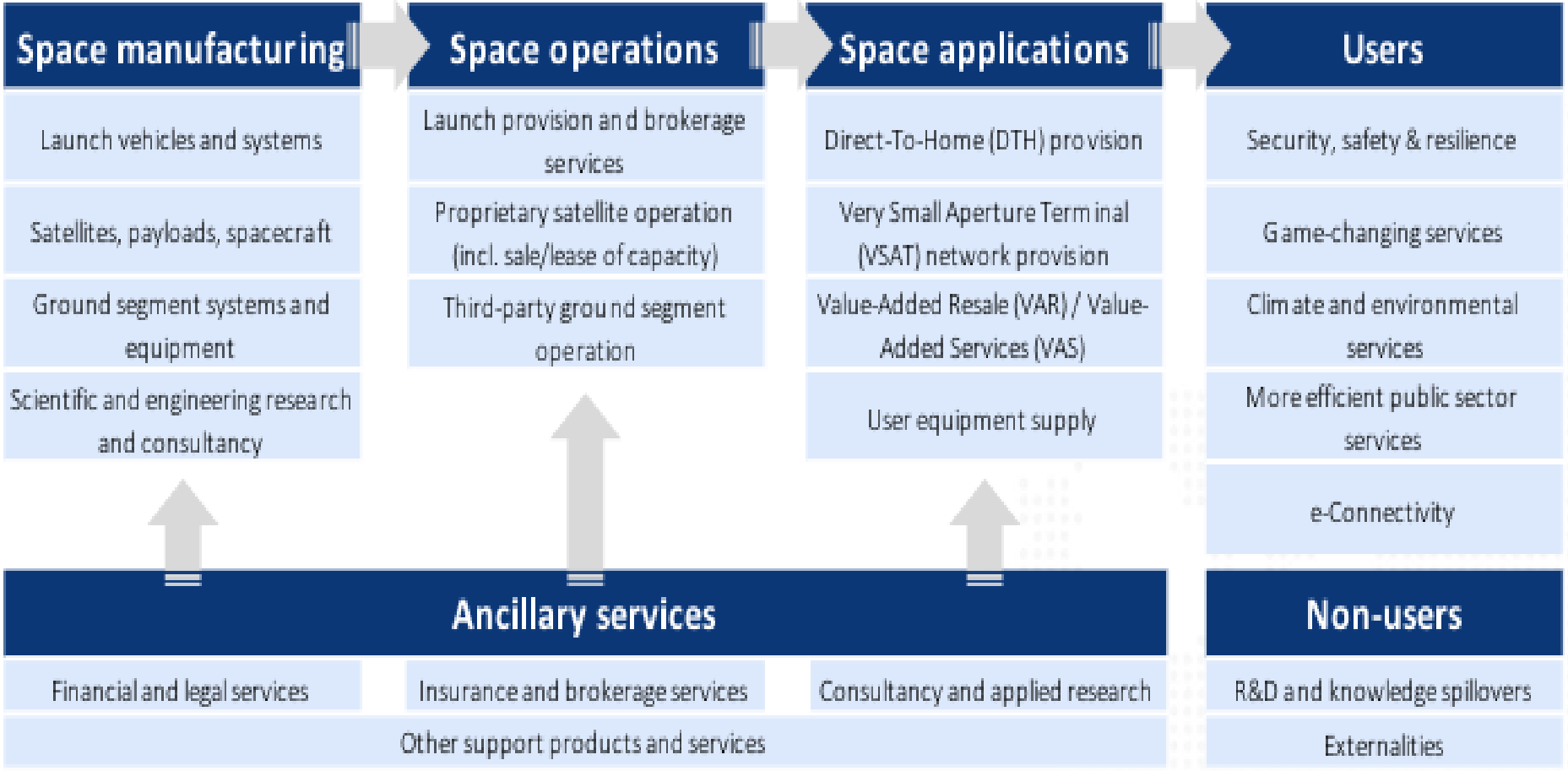

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Benefits of Space Programmes

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Direct Benefits	Indirect benefits	Other	Downstream Benefits
Societal inspiration from spaceflight and exploration; Creation of scientific knowledge and its general applicability. The technical competence of nations and regions is improved and enhanced The capacity to work more productively and efficiently in space; New markets for space products and services are created; Greater collaboration through strengthened international space explorations;	Improved socio-economic prosperity; Health discoveries; Sustainable environment; Greater security and safety; Wider and deeper human experience; Enhanced understanding of humankind's role in larger universe;	Health and Medicine; Transportation; Public Safety; Consumer, Home & Recreation; Environmental and Agricultural Resources; Computer Technology; Industrial Productivity.	Clean Drinking Water; Improved Agriculture and Food Distribution; Telemedicine and Wireless Networks; Environmental Monitoring and Management; Disaster Warning and Relief; Educational Resources; Energy Storage; Hazard Reduction.

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UK Space Economy 2012/13

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Space manufacturing

£0.9bn Turnover
(**8%** of total)
UK global share*: **1.8%**
5,800 direct employees
£0.3bn direct GVA

Space operations

£1.5bn Turnover
(**12%** of total)
UK global share*: **11.2%**
4,800 direct employees
£0.8bn direct GVA

Space applications

£9.3bn Turnover
(**78%** of total)
UK global share*: **10.3%**
26,000 direct employees
£3.9bn direct GVA

Users

Market creation/access
Productivity boost
Cost avoidance/efficiency
Enhanced risk/decision-making
Better policymaking
Improved emergency services
Informed disaster response
Time savings

Ancillary services

£0.2bn Turnover (**2%** of total); UK global share: **n/a**
700 direct employees; **£0.2bn** direct GVA

Non-users

R&D and knowledge spillovers, externalities, environment

Total UK space turnover (2012/13):	**£11.8bn**
UK share of global space economy**:	**6.3%-7.7%**
Direct Gross Value-Added (GVA):	**£5.1bn**
Direct Employment:	**37,000**

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Valuation of *sectors* supported by space-enabled services*				Typology of *spillover* effects	
Sector	Turnover (£ million)	Value-Added (£ million)	Employment ('000)	*End-user* spillovers (division per markets)	
Agriculture, forestry and fishing	4,443	1,804	41	market	user categories
Mining and quarrying	51,623	25,064	66	Security, safety and resilience	Maritime geospatial services, Secure satellite communications, Galileo PRS, Polar infrastructure for shipping & exploration, Polar infrastructure for shipping & exploration, Disaster & emergency response, Space robustness services.
Manufacturing	522,106	156,975	2,483		
Electricity, gas, steam and air conditioning supply	111,254	24,731	129		
Water supply, sewerage, waste management, and remediation activities	33,713	16,808	165		
Construction	204,282	79,900	1,301	Game changing services	Low-cost access to space, Persistent surveillance, Power from space, Driverless vehicles.
Wholesale and retail trade; repair of motor vehicles and motorcycles	1,487,353	153,384	4,803		
Transport and storage	156,850	70,728	1,205	Climate and environmental services	Insurance and finance, Agriculture and food security, Environmental services, Weather forecasting.
Accommodation and food service activities	76,412	38,096	1,973		
Information and communication	198,895	99,656	1,118	More efficient public sector services	Transport management, Smart cities/urban services for local government, Energy (and other critical) infrastructure services.
Finance	-	124,500	-		
Real estate activities	54,250	36,789	540		
Professional, scientific and technical activities	228,944	129,404	2,055	E-connectivity	Direct-To-Home TV, Fixed broadband, Broadband to ships and aircraft, Ubiquitous m2m, Location based services, Managing unmanned vehicles and hosted payloads, Seamless personal communications.
Administrative and support service activities	188,084	95,356	2,272		
Public Administration and Defence; compulsory social security	-	87,094	-		
Education	34,899	15,777	1,106		
Human health and social work activities	47,629	30,152	1,686	*R&D and Knowledge* spillovers	
Arts, entertainment and recreation	120,222	22,518	661		
Other service activities	31,192	15,437	547	On the one hand, space activities import basic technologies that have previously been developed in other sectors such as defence or aeronautics. On the other hand, space applications and space-born technologies spillover to other sectors.	
Activities of households	-	-	-		
Total	**3,552,151**	**1,224,173**	**22,151**		

The BEERS Project

- Benefits of the ESA Exploration Roadmap in Socioeconomics (BEERS) €350k one year project to analyse and evaluate E3P Programme based upon six initiatives;

ESA Initiatives	Potential socio-economic benefits
ISS Continuation and Future LEO Platforms	Improved health outcomes in patients under severe physical and psychological stress. New drug treatments to improve well-being and life expectancy
Beyond Low Earth Orbit (BLEO)	Development of electric, autonomous vehicles. Efficient energy and propulsion generation. New medical technologies
Early Robotic Lunar Missions	Renewable resources New forms of mining Heat management and generation systems Remote communications systems
Human Lunar Surface Exploration	New opportunities for mined and synthetic material production Sustainable power systems Remote communications
Exomes	Clean atmosphere management. Remote vehicle power systems New mining technologies and processes Origin of human species development
Mars Sample Return (MSR)	New robotic and AI applications and processes Origin of human species Autonomous vehicles development

ESA Benefit Categories

- ***Economic growth***: is defined simply a long-term expansion of the productive potential of the economy by increasing the capacity of an economy to produce goods and services, compared from one period of time to another. It can be measured in nominal or real terms, the latter of which is adjusted for inflation. Traditionally, aggregate economic growth is measured in terms of gross national product (GNP) or gross domestic product (GDP), although alternative metrics are sometimes used.

- *Competitiveness;* This concept is a controversial one in that there are various forms at different territorial scales. The European Commission defines it;

  "... the ability of a business, a sector or a country to effectively sell and supply goods and services in a given market, harness the opportunities offered by globally integrated markets, and benefit from international trade. It is determined by the level of an economy's productivity and diversification and the quality of the goods and services it delivers".

ESA Benefit Categories

- ***Global Challenges/Sustainable Development Goals***; The former is not exhaustive but includes, inter alia, global poverty, poor health and drug resistance; climate change and other severe environmental damage; geo-political risk and conflict; population growth and immigration; food security and production; water management.

The latter are defined by the United Nations using 17 goals:

No Poverty; Zero Hunger; Good Health and Well-Being; Quality Education; Gender Equality; Clean Water and Sanitisation; Affordable Energy; Decent Work and Economic Growth; Industry, Innovation and Infrastructure; Reduced Inequality; Sustainable Cities and Communities; Responsible Production and Consumption; Climate Action; Life Below Water; Life on Land; Peace, Justice and Strong Institutions; Partnerships for Goals.

ESA Benefit Categories

- ***Inspiration;*** The typical description of inspiration in space missions is that it increases the number of school children who wants to study Science, Technology, Engineering and Mathematics (STEM) subjects.
- This tends to limit the definition in that space exploration contributes to generating cultural/symbolic capital;
- From early space exploration going back to the Soviet Union's Sputnik and US Apollo missions have inspired succeeding generations, often manifested in literature, films art and architecture;
- It has also inspired a new generation of entrepreneurs, whether private or social, who seek new opportunities to address challenges on Earth to which the diffusion of new technologies, material and innovations could address.
- Human space missions also create inspiration in asking questions about fundamental question about the origin, history and place of humans in the planetary system and beyond.

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BEERS Methodological Framework

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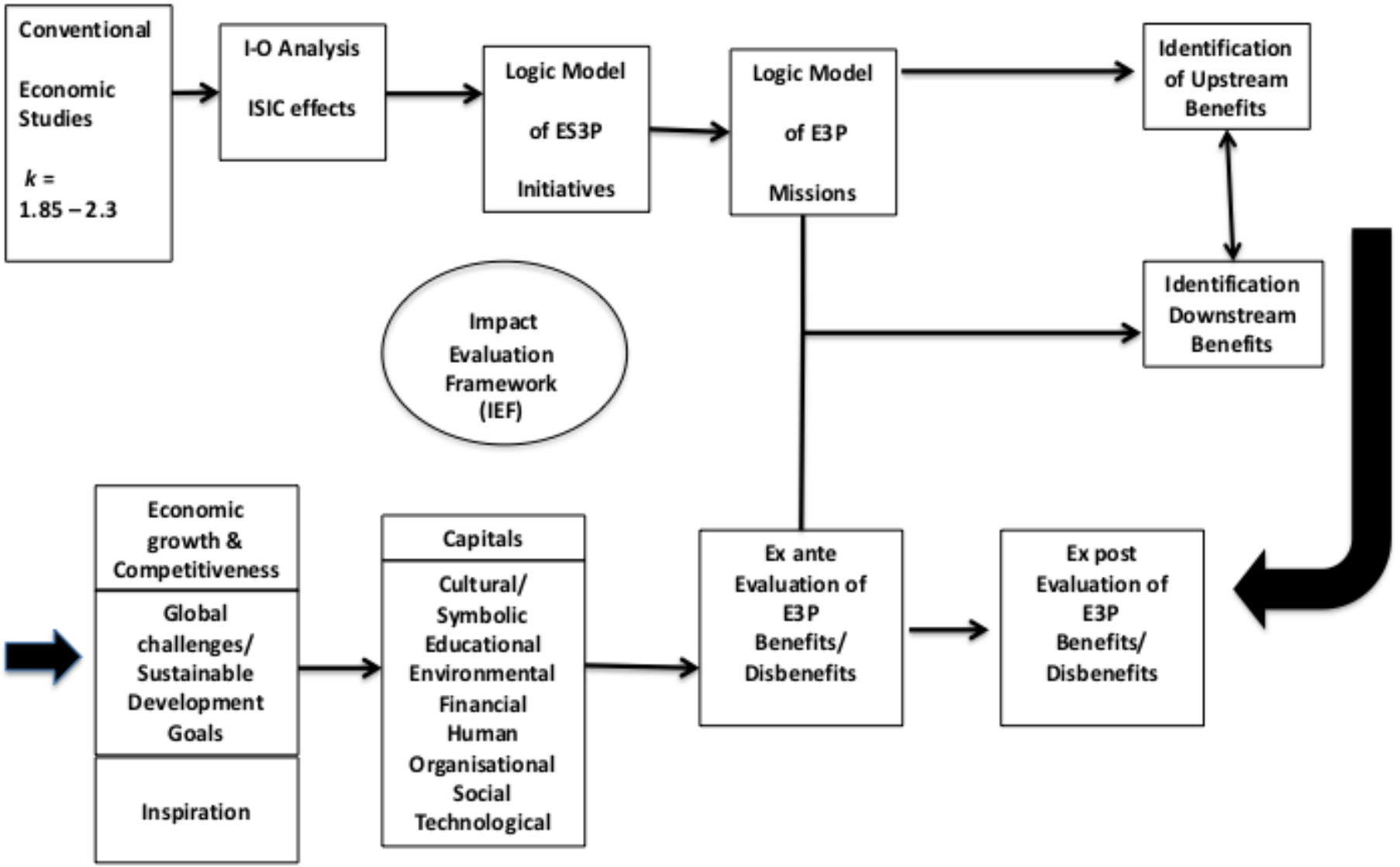

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The Update of the Galileo Case

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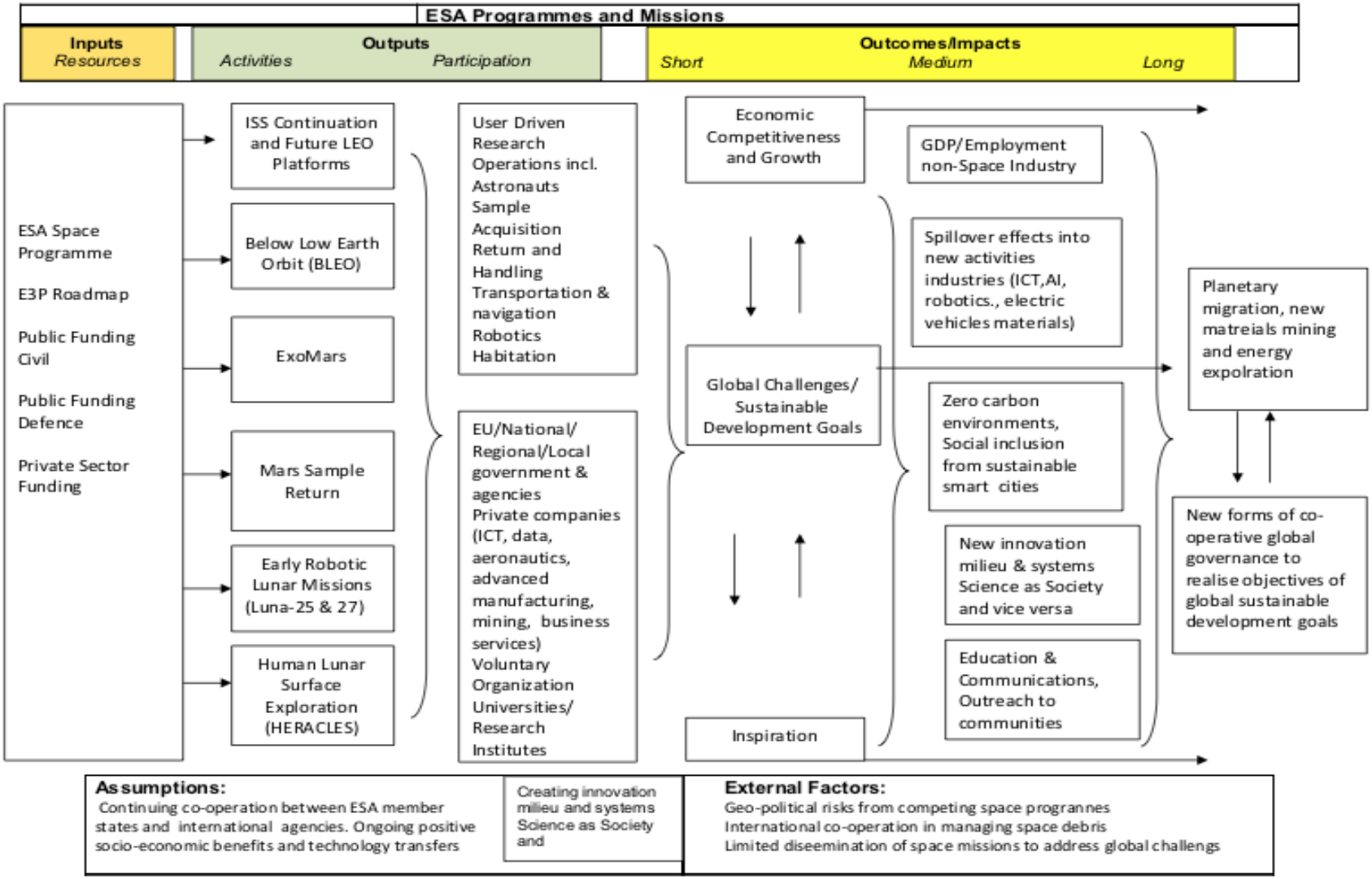
BEERS Logic Model



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What is Galileo?

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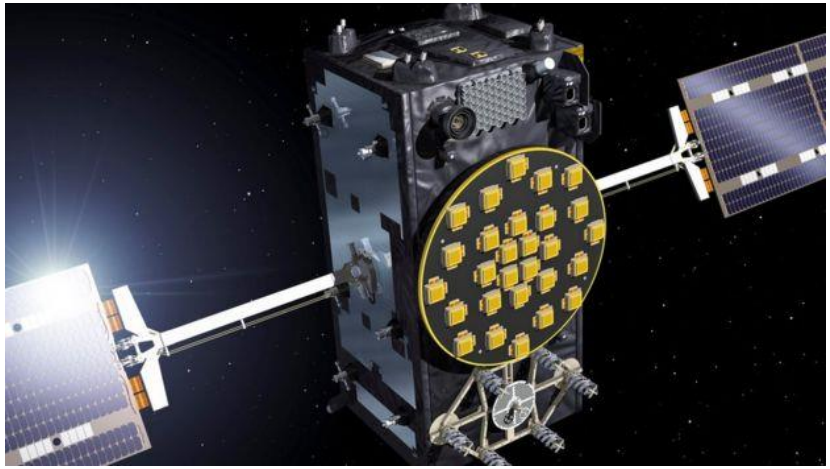
- The €10 billion ($12.4 billion) EU-funded project – named for the famous Italian astronomer Galileo Galilei – aims to create Europe's own global navigation satellite system to rival the United State's global positioning system (GPS). Completion date: 2020.

- There are currently FOUR geolocalisation systems: GPS (US) and Glonass (Russia), Beidu (China)

>> Galileo is interoperable with all of them

- 26 (latest batch sent up in July 2018) satellites constitute a full system but it will have six spares in orbit also
- Original budget was 3bn euros but will now cost more than three times that.
- Promises eventual real-time positioning down to a metre or less



A UK enhanced involvement since day one

>> Galileo: the majority of its existing satellites have been provided by UK company SSTL, which is a subsidiary of Airbus, and the German company OHB.

>> Surrey Satellite Technology subsidiary makes the payload — or brains — for the current generation of Galileo satellites. Galileo's ground services are managed by Airbus in Portsmouth.

>> UK has historically been one of key countries in ESA and in the conception of Galileo itself.

The matter of contention

- Galileo's **public regulated service (PRS)** is a secure navigation system for governments that is designed to be able to function when all other navigation services are being jammed.

- It is seen as a **vital back-up system for both civil and military purposes when it becomes fully functional after 2020. In particular its enhanced encryption** — making it highly resistant to efforts either to jam its signal or to spoof the navigation system into believing it is somewhere else.

- **Under EU rules PRS can be accessed only by member states >> albeit access can be negotiated on a ad-hoc case. But the issue remains the proprietary technology.** According to the EU, Galileo's security would be "irretrievably compromised" if the UK continues to participate.

Since January 2018, at the moment of the new contract issues, there has been never-ending disputes over the terms of the UK participation in Galileo.

(I) A **letter to the UK from the European Commission in January 2018** explained that it would be inappropriate to divulge highly sensitive information on post-2019 plans for Galileo's highly encrypted public regulated service (PRS) to a departing member state. (Jan, 018)

(I) Tom Enders, **Airbus** chief executive, called on both sides to find a long-term solution to the row between Brussels and the UK over Britain's participation in all space programmes (March 2018)

(I) UK Reactions: (a) **remaining outside Galileo and build a system on its own** (*UK Space Agency, 2 May 2018* (b) **stopping British companies to work in Galileo** (*BBC, 16 May 2018*))(c) **claiming back £1.2 bn spent so far** (*The Independent, 19 May 2018*).

- >> The Government commissioned a design of a new navigation satellite programme that will rival the EU's Galileo post-Brexit at a cost of around £92m (BBC News, Aug 2018).
- The UK Space Agency will lead the technical assessment. The first contracts for this study work could be issued as early as this winter and it will take about a year and a half.
- [If this is (a) feasible (b) cost-effective (c) viable is a completely other matter…]

>> Theresa May advocates full cooperation on Galileo, but not as a end-user (Oct 2018)

- ESA Director Jan Woerner didn't elaborate on Brexit but he did on the UK in space. "*The UK is part of ESA. ESA is not part of the EU. There is no change in UK participation in ESA as a result of Brexit*." (July 2018)

WHO OWNS GALILEO?

- The definition, development and in-orbit validation phases were carried out by ESA, **and co-funded by ESA and the European Commission**. This phase created a mini constellation of four satellites and a reduced ground segment set up to validate the overall concept, ahead of further deployment.

- Success led to the current **Full Operational Capability phase, fully funded by the EU** and managed by the Commission.

- The **EU Commission and ESA have a delegation agreement** by which ESA acts as **design and procurement agent** on behalf of the Commission.

BUT:

ESA IS NOT AN EU BODY

Since in space everything, and not just Galileo, has a “Brexit angle”, the EU has started talking of a possible, future EU Agency for the Space Programme, alternative and in addition of ESA, even though stating clearly that ESA will still be in the lead.

"*There is definitely no transfer of competence from the European Space Agency to the future Agency for the Space Programme.” […] All the institutions need [each other]. We are just strengthening the EU agency for the programmes to adapt itself to the new space activities and the security accreditation*.” (BBC News, EU Commissioner Elżbieta Bieńkowska, 6 June 2018)

- UK Prime Minister Theresa May has repeatedly said she wants a full defense and security treaty with the EU.

- The European Commission (EC) has told the European Space Agency (ESA) -- which isn't part of the European Union body -- that it should prepare for scenario where there's no Brexit deal in place.

  [November 2018: What's in the draft deal for space, if anything? No idea]

- Precedent for a non-EU participation in Galileo do exist (*agreements* have been signed with **two ESA but non-EU** member states: Norway, 2010; Switzerland, 2013)
- If the deal is finalized at the last hour, however, it might be too late for Britain to keep access to Galileo.

Issues

- Space missions increasingly cross public and private organisational boundaries, with many privately- funded space missions displaying public good characteristics. In regard to the ESA goals of space missions in increasing public value-added is a crucial over-arching objective;
- *"The regional dimension is fundamental for bringing the added value of space to the citizen and thus putting the user at the centre of a European space strategy"* (Network of Regions using Space Technologies, 2016*);*
- City-Regions crucial agency in realising downstream and indirect benefits of ESA Missions and fulfilling the three categories of:
  - Economic competitiveness and growth;
  - New means to address Global Challenges/Sustainable Development Goals;
  - Inspiration;
- BUT political dimensions of BREXIT overshadow European space strategy in realising benefits of Space Economy as shown in Galileo case.

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Thank You!

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