Sustainability in Outer Space



S2S5

Prof. W. Peeters

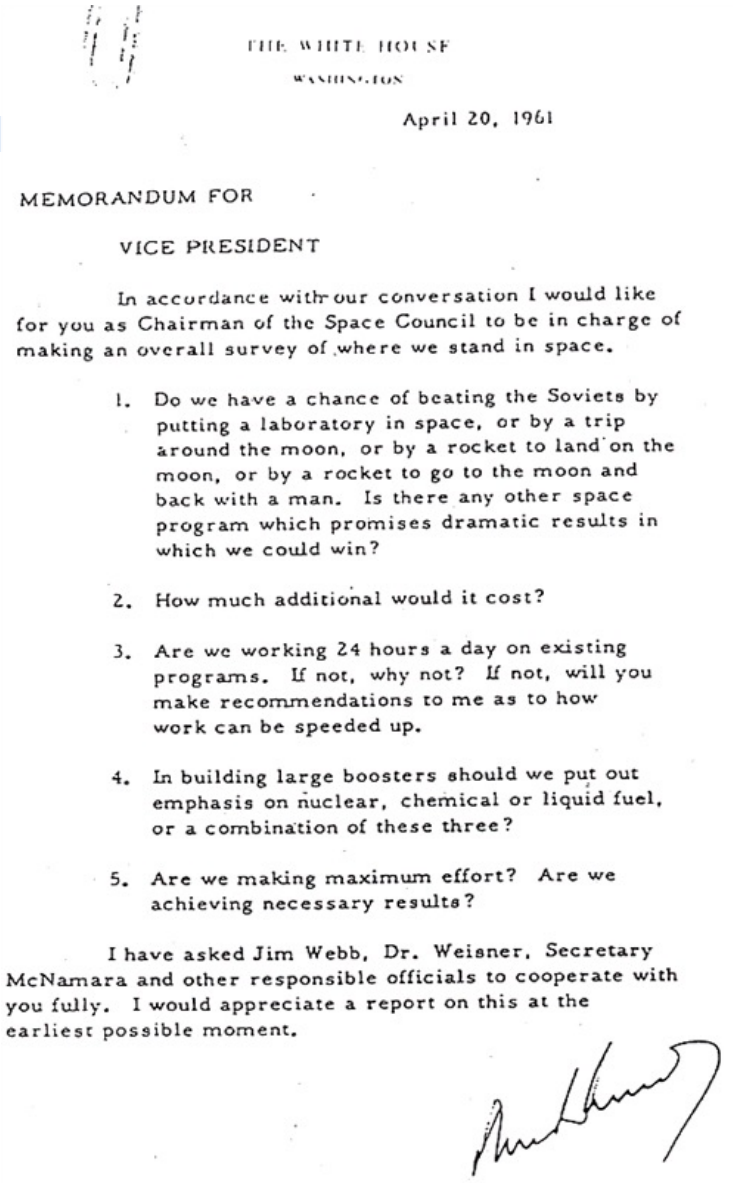
November 2026

The Political rationale

Two weeks after the memorable spaceflight of Y. Gagarin, President J. Kennedy send this memorandum to the Space Council

Few weeks after this flight, he announced the Apollo program in September 1961

So why can we not do this since then anymore?



THE WHITE HOUSE
WASHINGTON

April 20, 1961

MEMORANDUM FOR

VICE PRESIDENT

In accordance with our conversation I would like for you as Chairman of the Space Council to be in charge of making an overall survey of where we stand in space.

1. Do we have a chance of beating the Soviets by putting a laboratory in space, or by a trip around the moon, or by a rocket to land on the moon, or by a rocket to go to the moon and back with a man. Is there any other space program which promises dramatic results in which we could win?

2. How much additional would it cost?

3. Are we working 24 hours a day on existing programs. If not, why not? If not, will you make recommendations to me as to how work can be speeded up.

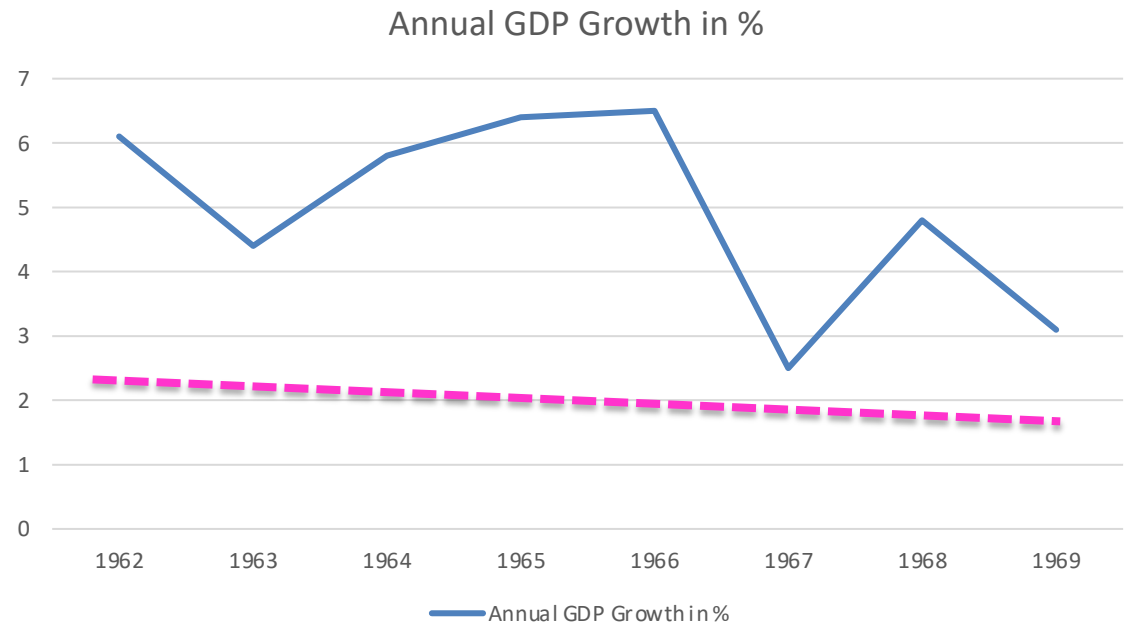
4. In building large boosters should we put out emphasis on nuclear, chemical or liquid fuel, or a combination of these three?

5. Are we making maximum effort? Are we achieving necessary results?

I have asked Jim Webb, Dr. Weisner, Secretary McNamara and other responsible officials to cooperate with you fully. I would appreciate a report on this at the earliest possible moment.

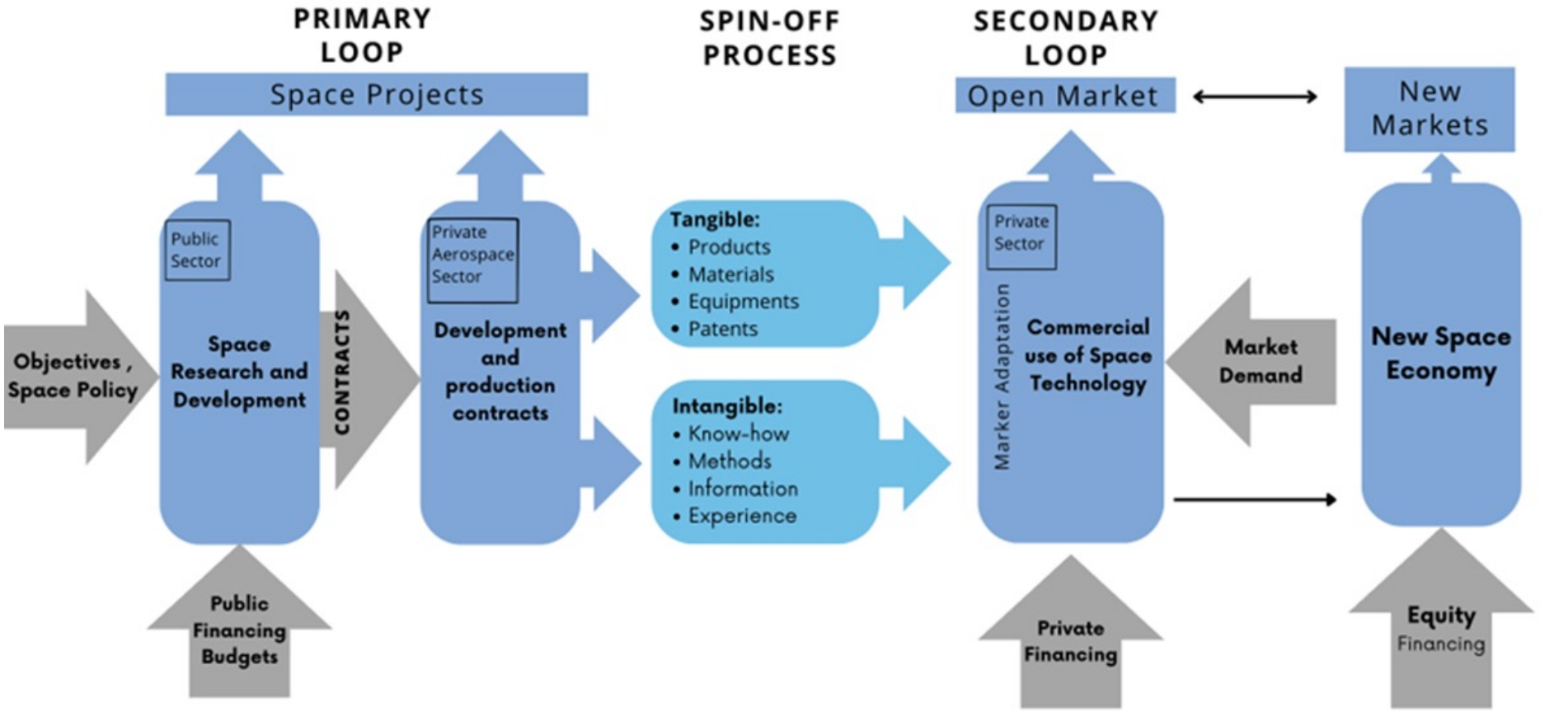
Financial aspects

- **The Space Race was over, and there were no compelling arguments to convince the (US) politicians**
- **Financial conditions are not there anymore…**



US Forecast 2026-2031 (Deloitte)

Space Business Flow



Recent : Astropreneurs in space exploration

- Only few can afford the initial investments

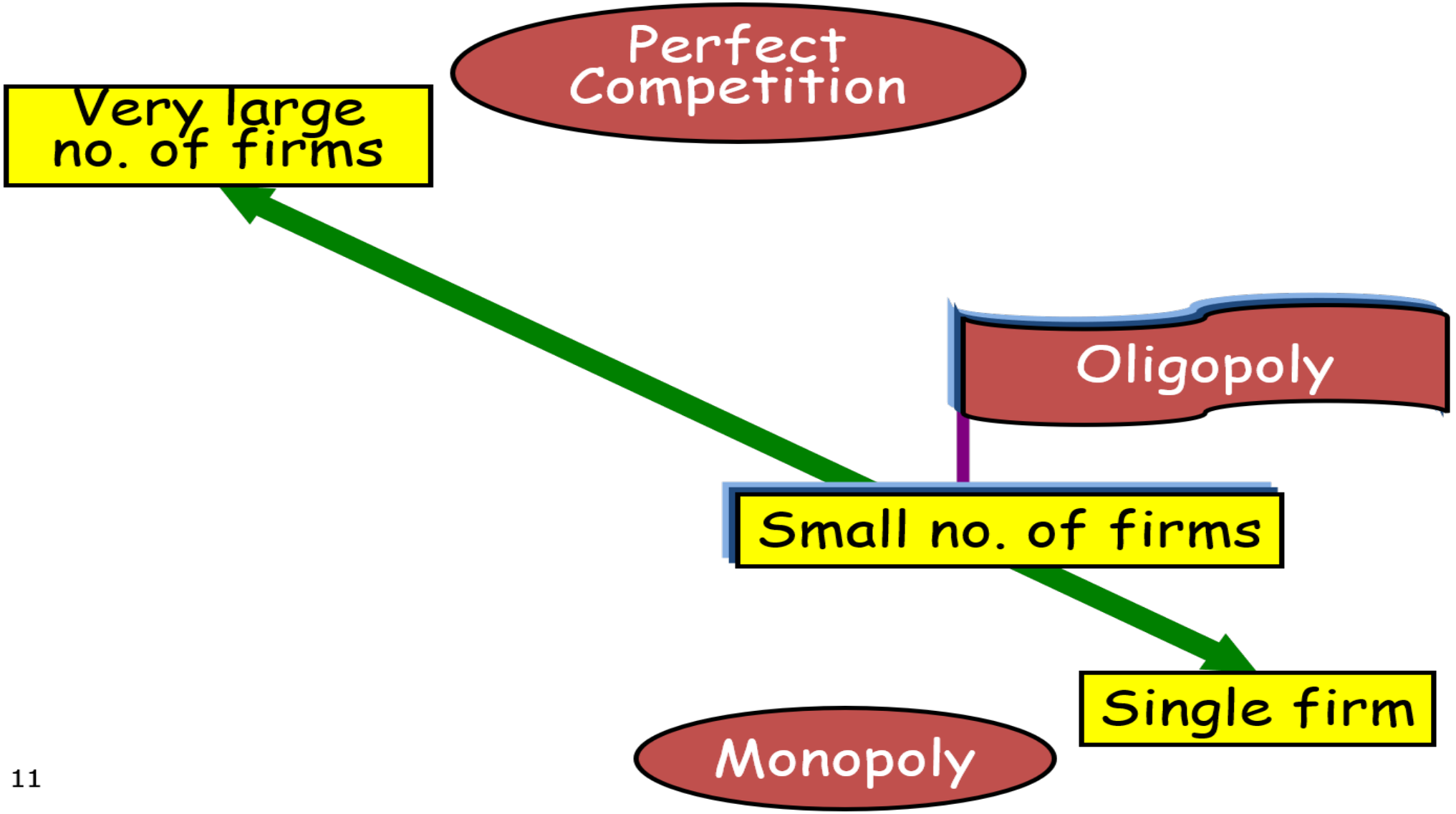
- Risk for oligopoly, or even monopoly!

Name	Wealth source	Project supported
Paul Allen	Microsoft	Virgin Galactic
Jeff Bezos	Amazon	Blue Origin
Larry Page	Google	Planetary Resources
Elon Musk	PayPal	SpaceX
Sergey Brin	Google	SpaceX, Breakthrough

- Tension between profit-making and sustainability
  - Putting polluting industry on other planets
  - Placing datacenters in space (1 million satellites application…)

- As space resources are a global 'Common', this leads to a risk of 'Tragedy of the space commons'

Oligopoly and Space



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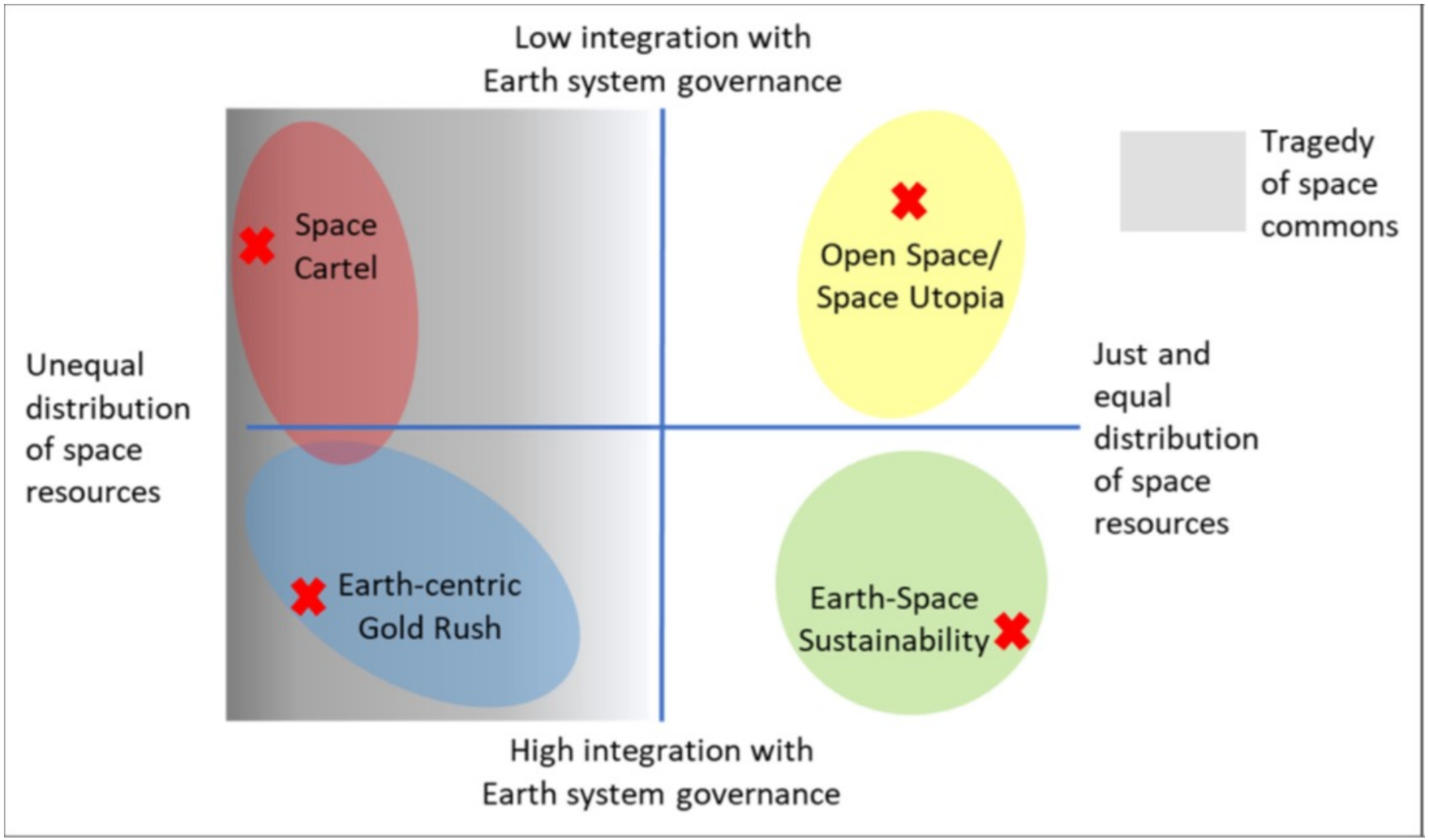
Global Commons

- Commons can be very broadly referred to as a set of resources, natural and cultural, that are shared by many people.

- Classical Commons includes natural resources such as forests, fisheries, groundwater but also extends to e.g. atmosphere, Polar regions, high Seas and …space.

- 'Tragedy of the Commons' (*Hardin*) Shared resources can be over-exploited by individuals at the detriment of the global society

Concerns on Space Sustainability



Source : Yap et al. (2023)

Governance Solutions

Mechanism	Observations	Probability
Moon Treaty extension / revival	National Space Acts (USA, Japan, UK, Luxembourg, UAE, New Zealand, India, Philippines) interference	Extreme unlikely in the present geopolitical climate (14 signatories, but not the main space nations)
Moratorium	Same as above blocking consensus	Unlikely in present geopolitical climate and astropreneurs impact
Specific Regulatory Agency	Precedent : ISA (international Seabed Agency), but based on Law of the Seas	**Presently geopolitical unlikely, but best alternative long-term?**
Corporate Responsibility	Works in competitive environment, not in present space oligopoly	Unlikely for oligopolistic environments as market prestige plays secondary role
SDG18 (new Sustainability Goal)	Not compatible between rectifying (17 SDG) and avoiding (SDG18)	Low, reluctance of responsible UN office
CDG (Cosmic Development Goals)	**New concept, will take time to implement. Needs a host-organization**	**Plausible**

ENFORCEABLE SOFT LAW

The 18th Sustainable Development Goal



Cosmic Development Goals (CDG)



Source : Peeters and Trur (2026)

Note: Each Goal broken down in tangible sub-goals, see publication

References

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