Deep Dive Global Commons

Final Report

Team Lead: Jennifer Harper (AIT Team) and Suzanne Giesecke (AIT)

Expert Team:

- Dana Wasserbacher, AIT
- Cristiano Cagnin
- Kerstin Cuhls
- Luke Georghiou
- Keith Smith
- Luk van Langenhove

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Introduction & Approach

The concept of the global commons refers to resource domains that fall outside national jurisdiction, and to which all nations have legal right of access. Five are recognized by international law: the Atmosphere, Outer space; Antarctica; the Deep Seabed and the High Seas. Other natural phenomena such as the permafrost and tropical rain forests share many characteristics in terms of their ecological significance but do not have the same formal recognition of global governance. Other domains such as scientific knowledge and digital space also share characteristics with the geophysical commons listed above. For the natural systems that make up the biosphere, the five domains cited above are necessary to and accessible by all, yet are beyond the jurisdiction of local, regional or national governments.

As resource domains in which common pool resources are found, the physical commons in particular are fragile and vulnerable. There is potential for overuse to mis-use and/or over-exploitation through human activity, by both state and non-state actors, resulting in irreversible damage to the environment/ecology. From a security perspective, the strategic access and use of these resource domains for military/commercial purposes puts pressure on their status. This is primarily due to a weak and insufficiently specified legislative framework and the lack of an effective monitoring and enforcement capability, to discourage rogue behaviour. Recent geopolitical developments highlight the need for exploring appropriate forms of global governance or stewardship, to ensure responsible (sustainable) management to benefit present and future generations.

This deep dive has focused on addressing the following questions:

1. What constitutes a global commons? How do global commons differ? How is the concept of global commons likely to evolve up to 2040?

2. What are the main emerging disruptors of global commons up to 2040? What could change and upset established global commons regimes?

3. How is the economics of common property evolving (from Hardin's very influential work to the critique of Hardin by Elinor Ostrom)?

4. How can we govern the commons as a different type of ownership? The emergence of global commons-orientation in innovation? How can innovation reinforce the commons? In particular mission-oriented innovation.

5. What are the R&I policy implications?

How can we make the global commons work? - the need for cooperative behaviour if global commons and sustainability are to be achieved. Geopolitical factors include Multilateralism 2.0. and the emerging role of science diplomacy up to 2040.

While, in the past the global commons referred to the physical resources of our planet, the concept has been extended to include both extraplanetary space and aspects of the intangible domain of information. Current thinking contemplates extending the concept further to an even wider range of valued resources, including scientific knowledge. The commons are thus by no means a constant. They are shaped by evolving geopolitical (and local) interests and changing balances of power, by technological change affecting both supply and demand, and by increasing recognition of the environmental consequences of their exploitation. The concept is expected to evolve further by 2040 as other valued global resources requiring stewardship are added to the list.

A key concern is that the global commons are increasingly fragile, due to their vulnerability to over-exploitation and/or misuse through human activity, by both state and non-state actors. Policy to manage common property resources is often seen in terms of the 'tragedy of the commons' (Hardin, 1968), meaning an inexorable tendency towards destruction. Where there are common resources, such as grazing land, and there are individual maximising agents who have access to that land then all agents have an incentive to over-use the resource. Unfettered access to a common pool resource will ultimately destroy the resource, for while the benefits accrue to the individual, the costs accrue to the population as a whole. Hardin's Tragedy of the Commons has been countered by Ostrom who showed through multiple case studies worldwide, that many communities have evolved rules, institutions and organisational forms to manage communal resources sustainably.

However, climate change and the breaching of 5 out of 9 boundaries (climate, biodiversity, biogeochemical flows, deforestation and freshwater, highlight the scale and magnitude of the global commons challenge: "Scientific evidence is now overwhelming we are on a collision course with stable and resilient Earth systems on which human well-being, prosperity and safety depend... We need to transform our economic and social systems to safeguard these Global Commons or risk exceeding tipping points beyond which change may become self-reinforcing and irreversible." [1] Stewardship and policy action is needed on different levels to address different aspects of the global commons challenge. There is an urgency to bring in more effective monitoring of resource availability and use as well as ways of addressing scarcity.

Understanding the scale and scope of a resource may be challenging. Over time the perception of availability of a given resource may be altered in response to changes in supply or demand. For example a resource which is considered as abundant, may be seen as increasingly scarce if a new use becomes important or geopolitical change impedes access for some. In times of conflict, access/lack of access to strategic resources domains becomes more visible and contested. Scarcity may in turn drive up the price to a level where new sources become economic, thus changing the availability of supply.

As a system of governance, the global commons open up a new opportunity to address both the scarcity of critical resources and raw materials (sub-sea minerals, biodiversity, freshwater) and the abundance and vulnerability to exploitation of the open sea, outer space and

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[1] https://www.systemiq.earth/wp-content/uploads/2022/11/GCSF-Safeguarding-the-global-commons.pdf

cyberspace. States seek to secure, control access to and/or stockpile scarce critical resources, while other resources are more abundant and/or have become more accessible: orbit/space and deep-sea. However, new forms of governance are needed to organise access to both scarce and abundant commons to reduce the risk of conflicts and encourage public and corporate responsibility.

The global commons serve as vital zones for global connectivity (such as trade and telecommunications), as a critical source for military power (through the strategic use of the international airspace, outer space and the cyber domain, as well as maritime or high seas), and environmental resources (Earth's atmosphere and oceans are integral to the planet's habitability, functioning both as resources and waste sinks).

Countries with the resources and technological capabilities to exploit global commons' resources have long enjoyed privileged access to them and the international prosperity associated with them. This has disadvantaged developing countries where the economic opportunities associated with the high seas commons, outer space, or the Antarctic are concerned. Moreover, the principle of open access to the global commons may also depend on a longstanding (mis)perception of them as containing limitless resources.

In a period of increasing geopolitical upheaval, resurgence in national sovereignty and strategic autonomy, together with the emergence of new global players, the commons are growing in military and strategic value. This is further increasing their fragility and susceptibility to appropriation by the most powerful players.

Short summary of approach and methodology

The work was undertaken through a team of experts, covering different aspects of global commons, including geopolitical, technological, economic, ecological, legal and governance. The work progressed through a series of individual mini-papers and internal expert meetings. A synthesis of the main results including the key drivers and disruptors, were produced as blogs which focused on a taxonomy and the changing nature of global commons. This work provided the basis for the development of scenarios up to 2040 and an online scenario sprint was organised using the Miro board. A dedicated workshop with EU foresight experts from the Commission services and the member states, helped to provide important insights to guide the scenario development. The experts then each worked on writing up a scenario, drawing on an agreed set of variables.

DRIVERS and DISRUPTORS

A range of disruptors may influence the global commons in different ways, for example, in terms of perceptions and behaviour in relation to the resource domains. Technological change may make resource domains more accessible, geopolitical change may affect previously agreed regimes of governance, values may change with specific generational concerns, while

ecological and economic change has meant that as land resources are depleted, deep sea minerals have gained in importance.

A key driver for the global commons is the emergence of global societal challenges, including climate change, polluted atmosphere and oceans and biodiversity loss. Widespread awareness of how these challenges are connected to unregulated, exploitative behaviour, with repercussions for social equity, quality of life and well-being, fuels the demand for climate justice. Indeed, a key driver is the view that markets can be very unfair and destructive, unless they exist within a frame of governance that ensures fairness in the community.

Increased citizen discontent is becoming more evident, particularly in the use of social media to shame exploitative market behaviour and through consumer activism, boycotting brands with unethical production processes or marketing. The drive for more equitable economic and social governance frameworks extends to the younger generation with their concern for redressing past exploitative behaviour and what they consider 'historical injustices'.

Key Factors affecting future of global commons (in no particular order)

These factors were extracted from the expert papers and the literature review and were used on the Miro board as inputs for the scenarios.

Geopolitical partition; geopolitical instability; Geopolitics of the Arctic

- Geopolitical tensions making achievement or enforceability of regimes for commons more difficult; Division of world into US-European vs China-led blocs
- Governance of the commons; existence of global governance institutions; the precautionary principle
- Refugees and migration
- Role of business - multinationals
- Civil society and citizens; social discontent increasing
- local innovation; peer production; green technologies;
- new energy technology paradigms; Energy supply crisis in Europe
- Military build-up in Europe
- Possible decline in climate collaboration
- Evolution of temperature and climate issues
- Absence of multilateral collaboration on big energy issues
- No fora or spaces for forward discussion on commons
- Need to learn from successes - Montreal/whaling etc
- Absence of net zero strategies
- Risks of geo-engineering
- Increased scarcity/value of resources accessible in global commons through exhaustion or monopolisation/cartelisation of alternatives
- Increased scarcity/value of resources accessible in global commons through new demands emerging driven by innovation – for example sites for photovoltaic or wind energy generation, rare metals needed for expanded electronics demands
- Innovation creating new 'resources' (for example manufacturing in outer space)

- Technological change making resources in commons more accessible/economic and making monitoring/policing of abuses of commons more effective
- More general breakdown of international order with increased regional disputes
- Greater opportunity for non-state criminal violations
- Climate change impacts affecting availability of resources in commons or increasing motivation to access them to compensate for losses elsewhere
- Efforts to mitigate climate change creating new demands for global commons such as preservation of equatorial rain forests
- Pollution from state territories degrading global commons.
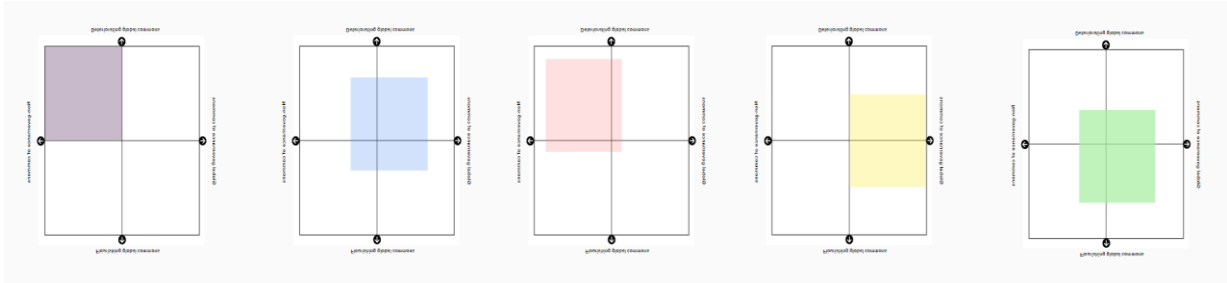
Scenarios

Introducing the scenarios

The five scenarios presented here explore possible futures for the 'global commons'. All of the scenarios acknowledge that as the world fails to constrain emissions, and fails to meet the multilateral COPS commitments, average temperatures will rise. With the exception of Scenario 5, they assume that by 2040, biospheric limits are approached and the first real 'tipping points' in the earth-system are reached or breached; the melting of the Arctic ice-cap; the collapse of the Greenland ice sheet, in imminent danger of disintegration; the weakening of the main Atlantic current, which is changing weather and rainfall patterns in Europe; and permafrost melting, e.g. in Siberia and Canada. These transitions are having global effects -- temperature increases, sea level rise, increased numbers of extreme weather events, inundation of coastal communities, changes in precipitation patterns and fresh water contamination and shortages. As this transition process proceeds, it becomes clear that in some parts of the world extreme weather events are not 'events' but permanent states - in low-lying regions storm flooding fails to subside, and large-scale migration begins.

The five scenarios we developed present alternative narratives that can be situated on two dimensions: (i) flourishing or deteriorating global commons and (ii) alternative forms of governance in response to these crises, ranging from no global governance to full global governance:

- Scenario 1 explores a chaotic free-riding situation, whereby unregulated global commons, are exploited by nations in a self-interested manner, leading to detachment and gradual alienation between humans and the physical commons;

- Scenario 2 assumes the collapse of the existing geopolitical order but sees it replaced by polycentric governance based on a foundation of caring communities;

- Scenario 3 has sovereign states remaining as the focus of governance but responding to challenges such as mass-migration and ultimately in thrall to multi-national enterprises;

- Scenario 4 is set in a world polarised into two highly competitive rival blocs; with opposing views and narratives on how to manage global commons;

- Scenario 5 assumes an earlier intervention on the tipping points through a global consensus to apply the precautionary principle to exploitation of the global commons but then explores new tensions that this regulated approach may bring.

Scenario 1: No commons for commons - Free for All
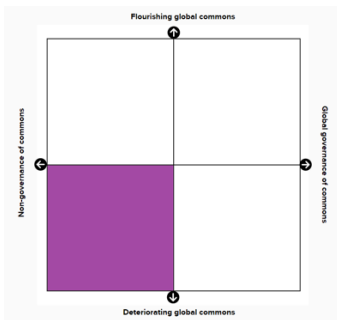
Short summary: This scenario follows a descending path to a dystopian future, in which there are no global commons, both physical and virtual. In 2040, chaotic "free for all" behaviour of states, companies, governments and institutions leads to a reality where governance of physical or digital commons has become non-existent and untenable. There are no forums or spaces for discussion and regulation of global commons or their future. The state of the remaining local commons and common pool resources is fast deteriorating on a global scale, making living conditions worse for all peoples.

Scenario description:

In 2040, Europe stands isolated in its efforts to advance /uphold the rule of law and protect the global or regional commons, both within the EU and its neighbourhood, in particular in emerging territories in and beyond Earth. With its closest ally, the United States, losing strategic direction and global power from 2030 onwards, the EU lost its main support for reforming global institutions and arming them with required capabilities and enforcement powers. The power vacuum left by the United States had been gradually filled by a mix of competing powers in the East and South of the globe. The "younger" of these nations have been keen to establish their sovereign rights to access and use the international common pool resources, physical and virtual, at any cost, even if it entails futile endless battles with rivals and in the end, causing irreversible damage to the commons. It has now become part of their global agenda to set and advance their own "rule of law" in their own interests. The older, larger powers (China, Russia and India) look on with no interest to challenge the increasing number of players, some of which are volatile and disruptive, as long as they do not tread on their territories and interests.

This chaotic world order and the deteriorating physical commons give rise to disruptive migration flows into and out of Europe, destabilising further local, national and regional economies. Small local

businesses cannot survive without a stable workforce, while multinationals constantly relocate to wherever they can take advantage of loose controls over the global commons. This forces Europe to reinforce its borders and advance its own strategic autonomy in every aspect of policy, from deep sea to space, from energy to water. Its best scientific talent and its scientific efforts are steered in this direction, namely how to make Europe less dependent on the outside world and on the remaining common pool resources, these rival powers control. This strategy minimises the risk of commons disputes extending into prolonged conflicts that Europe cannot afford. However, the lure of new opportunities offered by these rising powers is draining Europe's scientific, technological and entrepreneurial talent. Europe has been able to attract scientists worldwide (from the United States) and certain scientific advances have been made in protecting the physical commons, for example by producing viable substitutes for rare and critical resources or resources beyond its reach. But Europe lacks the profile and power to bring the required global governance mechanisms into play.

As a result, in 2040, both the digital and physical commons are left ungoverned, and the situation of the commons worsens continually. Europe is forced to play down the precautionary principle as it adapts to harsh new geopolitical and economic realities. Rather than curbing the power of its multinational corporations, and despite the ongoing visible damage to the physical commons, it creates incentives for firms to take full advantage of common pool resources within its jurisdiction, of course still within the constraints of European and international law. This places Europe on a weak footing in taking the "moral" lead in preventing over-exploitation of common pool resources both by MNCs and other more powerful nations.

In 2040, the commons have thus become a free for all space or resource, as emerging economies and multinationals see themselves as pioneers, prospecting for what resources are available. The physical commons, under attack, is retaliating against rogue human behaviour and creating havoc, with deteriorating environmental conditions for all species and biodiversity itself. Europe, itself facing desertification, disrupted food production, limited energy and water supply, remains a refuge for refugees from all territories. Supply chains are only reliable within Europe and the neighbourhood and food patterns have had to adapt. Social unrest is rife, as citizens are coping with a growing range of everyday challenges. Travel outside Europe is discouraged and risky both due to geopolitical and geophysical instabilities. There is detachment and gradual alienation between humans and the physical commons and the "commons" has become an ignored and irrelevant concept in an uncaring world.

Scenario 2: Down to Earth[2] Commons
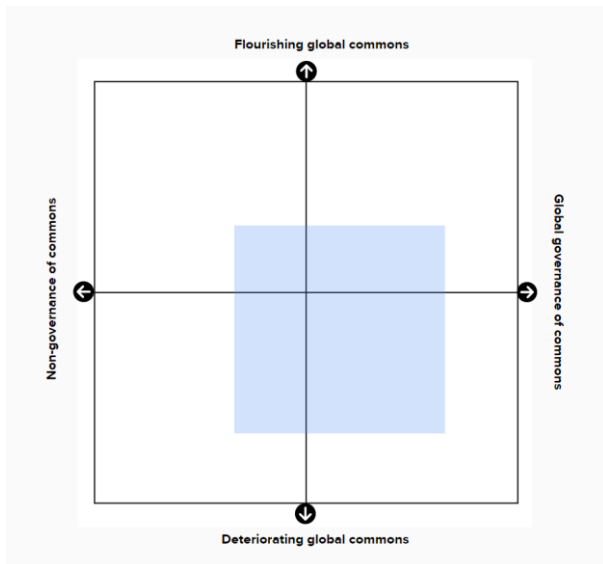
Short Summary:

This scenario has emerged out of the climate catastrophe which had accelerated beyond even the more pessimistic assumptions of climate scientists ever since the early 2020s. Attempts at global governance of the earth's ecosphere broke down several decades ago, when it had finally become clear that any serious approach would have meant adoption of precautionary principles in all dealings with the earth's biosphere and therefore limitations to economic growth as well as major transfers to the global South. On the contrary, throughout the 2020s multinational companies intensified the already fierce competition for the last remaining resources from oceans and forests, often supported by the governments of rich countries. Very few nations seriously followed zero emission strategies and collaboration on climate issues eroded quickly.

In the long term, this scenario could lead to a re-emergence of the notion of global commons if many of the small countries, regions and localities connect with each other, and push to extend their local solutions and practices to a larger scale. However, although smaller entities can establish boundaries for governing their regional commons, they cannot translate this to a global level. Thus, it seems unlikely that overarching system-wide rules will come to prevail over the local ones in the logic of this scenario.

Scenario Description:

By 2040, "Gaia is fighting back"[3] in ever more unexpected ways. After several tipping points had been reached by 2025, a multitude of unexpected repercussions caused socio-ecological disasters at various points of the globe. By 2040, these feedback loops from climate change fundamentally had already changed the global context, and affected every regime.

The global landscape is highly hetero-polar and fragmented. In several areas around the globe, including in the formerly "rich countries", national governments have ceased to exercise control. In

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[2] In honour of Bruno Latour 1947-2022
[3] Latour 2017.

some areas local territorial defence and independence movements reign. In others, wealthy elites have retreated into secure compounds and gated communities. Large movements of refugees are prevalent driven by floods, drought, scarcities, pollution, military conflicts and violent social unrest. Many people are dying in these struggles, and life expectancy has dropped sharply in most countries. Infrastructures such as electricity, water, transport and internet have broken down in many places and are at best patchy in others.

Against the backdrop of this dire situation humans had no choice but to "land on earth"[4]. In scattered small "caring communities" people are developing novel practices of jointly governing shared resources as a means of survival. In the negotiations within these collectives the human perspective is not necessarily privileged. Not only human beings but also entities such as rivers and mountains are seen as legitimate right holders in the territories they inhabit way longer than humans. Nature based solutions become the starting point for negotiations rather than an afterthought for offsetting the destruction caused by human activities.

Such communities are innovating at a rapid pace in order to find ways of communicating with these entities and establish new multi-species civic contracts that maximise the capability to thrive for all "inhabitants". These polycentric governance arrangements largely follow design principles that humanity had used for millennia to govern common resources as it was shown by Elinor Ostrom[5]. However, those Ostrom principles that require nested government arrangements are no longer applicable as many communities are operating largely autonomously and cannot rely on a stable legal framework from a national, let alone global level.

Several of the well-established extractive practices of fulfilling human needs are no longer feasible, not only because the governance principles do not accommodate them due to objections of other right holders but also because the infrastructure behind these practices (e.g. pesticides, fertilisers, antibiotics, water, energy, and transport) are no longer available on a large scale.

Consequently, in these multi-species communities, creativity and innovation flourish in order to make the most of the scarce resources available. To this end, the very meaning of science and innovation has shifted. In line with the notion of "commons-based peer production"[6] diverse motivations are harnessed for these innovation endeavours that serve the common interest. Rather than limitless exploitation of the biosphere, innovation means continuous careful and cautious negotiation of boundaries with all inhabitants of the "common" territory for finding shared solutions. These negotiations are often highly conflictual and involve countless painful choices.

Beyond these commonalities, the "caring communities" are highly diverse as their practices and solutions are adapted to local contexts. Often they use the remains of the respective industrial societies as raw materials. Several have developed sophisticated technologies operating within the community boundaries among them communication networks resembling the former internet. Some communities are building on long established indigenous practices, others have developed novel rules and rites from scratch when they had to reinvent themselves in order to survive. Yet another type has emerged out of the collectives who had practiced collective care of commons in the internet, e.g. through open source coding and online sharing projects.

Finally, some groups have formed out of early initiatives of environmental activists to live in line with planetary boundaries (e.g. eco-villages). When the climate situation had worsened and environmental

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[4] Latour 2018.
[5] Ostrom 2005.
[6] Benkler und Nissenbaum 2006.

activists were threatened in ever more regions some countries had made efforts to actively support such communities, providing legal rights to ecosystems and spearheading more local communication systems. These countries are now seeing more patches with higher social cohesion and less violence than many others.

Scenario 3: Sovereign States Governance - Regulated (Thriving) Commons
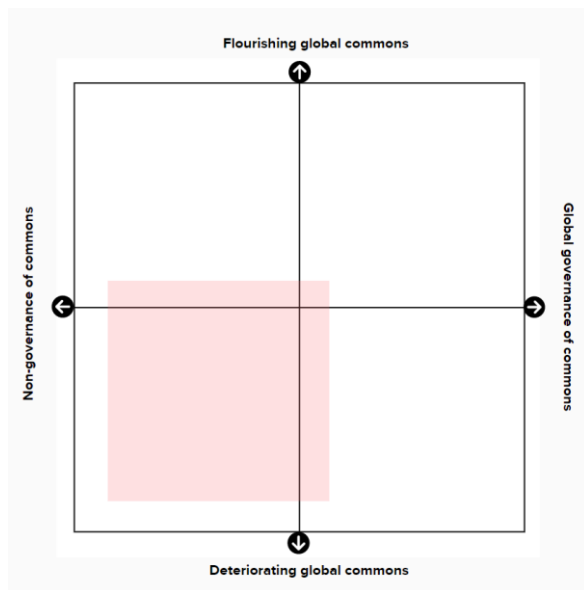
Short Summary:

This scenario depicts a world in which national governments are still at the forefront, but stuck in traditional reactions, old measures and fears, always driven by the aim to preserve power in one way or another. Strategic autonomy and self-interest dictate decisions related to international and global commons, as well as to common pool resources, particularly in relation to critical resources. Governance activities around these common pool resources are organised in multiple nested layers and provide new solutions and opportunities. Science diplomacy plays a central role in international negotiations and governance efforts related to global commons[7].

Scenario Description:

In 2040, national states are still in the forefront of political organisation, and they are driven by national interests in a geopolitical VUCA (Volatile, Uncertain, Complex and Ambiguous) world.

The most important issue at this moment is to deal with the massive migrations that are taking place world-wide because of climate change. In some cases, this influx of people from different regions of the world puts the local social security systems under strong pressure: Since too many externals who came to Europe 20 years ago - in the last wave of 2022 - claimed the same benefits as the locals, the states decided already in 2037 to stop any direct payments to newcomers. Even the formerly rich welfare states are close to being unable to pay their usual debts, so the minimum of help and shelter for heat refugees or other new "persons on the way" (as they are called nowadays) must be enough.

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[7] Van Langenhove (2011)

In many cases, migration also fuels the idea of tribal identities, where state and nation are seen as synonyms. The 2040 politics of ethno-nationalism foster all kinds of secession or independence movements. The ideas have political consequences in a lot of countries where neo-fascist or autocratic nationalist movements are gaining popularity. As a result, national states are complicating geopolitics and making it ever more difficult for the UN to fill the governance gap above the state level. But even democratic or liberal governments are stuck in old measures and fears as they and their citizens struggle for survival. Decisions related to international and global commons, particularly in relation to critical resources, are dictated by perceptions of strategic autonomy and self-interest ("my country first").

A second major concern for most states is the will to be as independent as possible from other countries both regarding their food and energy supplies and the technologies they use. This had already consequences for global trade, which is more and more restricted by import taxes and quotas. Some countries still take international collaboration seriously and try to have bilateral partnerships with others on selective policy topics. But regional organizations (such as ASEAN, African Union or EU) are disintegrating, and the UN has become a talking-shop. There is no longer any forum that can take care of commons or even think about the commons as something important for all on Earth.

The 'nested' character of governance of the commons begins to break down. When a common-pool resource is closely connected to a larger social-ecological system, governance activities were in former times organized in multiple nested layers. But in 2040, they are no longer effective. Protected by their governments, business begins to take over. Multinationals go where they can set the rules and standards, leaving national governments deprived of revenue, which in turn makes it more difficult for states to support their populations.

Meanwhile, the internet and digitalization make it possible not only for enterprises but also for citizens to create their own (virtual) communities and distance themselves from the states in which they physically live. They build their own universe, something like a "new commons". The world is tribal for the most, except for a nomadic elite who call for less national governance and adheres to a mix of localism combined with ideas of the necessity of a single world-government. Within that context, the 2040 global physical commons have some degree of international regulation. Science diplomacy and the use of science for common good have already brought many new solutions and opportunities to work together and join forces - but in an isolated way and not under the heading of "commons".

Scenario 4: Commons Lost in a Bipolar World
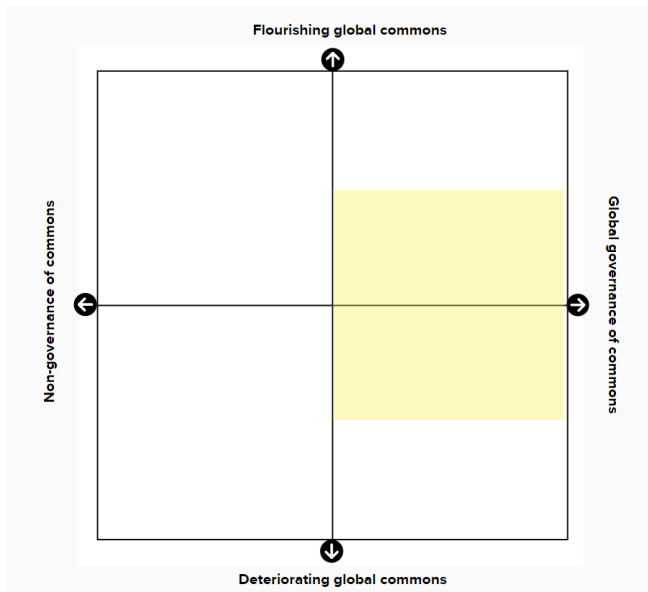
Short Summary:

In 2040, our bipolar world is characterised by two well defined blocs of countries and regions, with others gravitating around these according to the situation. On the one hand, Western world powers including the EU stand for democracy, social rights and individual property. The West's narrative is that the commons are collective and should be governed for all and for future generations. On the other hand, a new Chinese-Russian geopolitical bloc leads a dissident front that appeals to other countries in the south and across the globe (and including countries formally inside the EU). For emerging economies, the narrative is that global and local commons are needed for prosperity and it is considered a right to exploit and use them.

Scenario description

In 2040, the world is fractured within a bipolar order. A few countries inside the EU became isolated and others expelled, and its internal rules have changed to enable an easier decision-making process. Former Russian regions that became independent in the aftermath of the war in Ukraine in the middle of the 2020's have become Candidate Countries to join a Union of 30+ Member States.

The world is far from stable, but the fear of a 3rd World War that dominated much of the last two decades has dissolved with new global agreements in place. Behind this stability was the agreement signed by the global powers (including the EU) to clarify the Antarctica Treaty a decade before its due date. The Antarctica has been divided among the global powers and a security buffer has been implemented. The high seas remain important for global trade and security. Although an all-encompassing global agreement for oceanic governance has not been achieved, a new agreement is in place to protect its seabed and trade routes, as well as to recover fisheries and ecosystem services disrupted by climate change and overexploitation. Countries have agreed on both individual and collective actions led by the EU, the US, China and Russia.

In 2040, the world is on a path to more than 2.5 degrees Celsius global warming. Many environmental tipping points have been breached, beyond the partial melting of Antarctica, and this has lead countries to collaborate. A collective global effort is in place to recover the Amazon forest and its

indigenous communities, led by local governments, to avoid its desertification after decades of overexploitation. Similar efforts are seen in Africa and Australasia. The Chinese Green Wall has grown substantially. In the EU Southern regions, their efforts implemented in the early 2030s to fight desertification are finally showing results and the Sahara Green Belt is broadening. The renaturing of cities, implementation of green buffers with local produce, as well as the recovery of rivers and watersheds are now seen as a global blueprint for fighting climate change locally. Experiences tested in the early 2020s in Singapore and cities across the globe have been adapted to context and are providing know-how and helping local solutions to flourish. However, clean drinkable water has become a scarce resource and potential source of conflict. The water purification industry profited from this.

Global aid and development programmes work in alignment and targeted to support local solutions aligned with education, basic needs of food, shelter and psychological support, as well as more inclusive governance systems to improve quality of life locally and fight migration due to conflict or environmental disruptions.

While physical global commons on Earth are either stabilised or on a certain path of recovery with local actions aligned with collective efforts, those in outer space are not. Nor are the virtual and the immaterial global commons regulated in a clear way. The bipolar world is characterised by hybrid warfare. Misinformation and disinformation have been scaled up as tools for manipulation and propaganda. Cyberattacks in critical infrastructure led to the creation of parallel grids and local networks disconnected from the internet, which has become the means to transform scientific knowledge and discovery into a global common.

Patent rights were initially breached in the pharmaceutical industry so that poorer countries could produce life-saving generic medicines and vaccines. This was key as COVID-19 was only the first global pandemic of the century. Global warming and environmental exploitation led to many more pandemics in the late 2020s and during much of the 2030s, and is currently the reason why patent rules are changing and scientific knowledge is generally accepted as a global common. Led by a reorganised and strong facilitator UN, a new framework to transform cultural diversity and education gains traction in its general assemblies. However, culture is also used as a root cause for separation and as a narrative for division of the globe into a bipolar world.

Outer space in 2040 is the new source of competitive advantage between nations and regions. Space mining, telecommunications, cyber security and its potential for espionage and warfare, and initial human settlements are all at the heart of the current technological race. The discovery of new materials is already powering the green and digital revolutions of developed nations and constitute their source of strategic autonomy, who are in the path to reach carbon neutral economies by 2060. Research for synthetic substitution of these materials is much more in the focus in the global south as these countries lack the required technologies to access them. Private companies now govern much of the outer space global commons while those on Earth are more regulated. India emerged as a key global player in the space race and uses this as leverage to keep both blocks of this bipolar world in check.

Scenario 5 Commons: Protected and Preserved
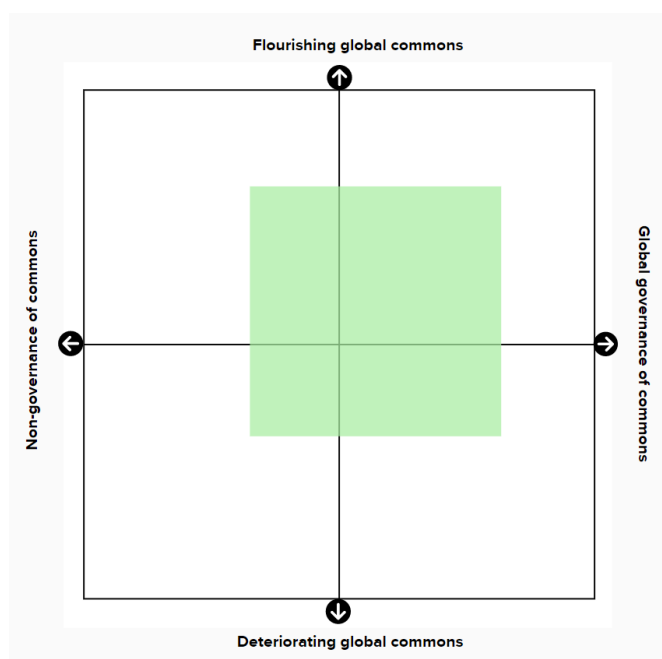
Short Summary:

It is 2040 and the main domains of the global commons are in a better state of protection than could have been imagined in the first two decades of the century. Building on an existing base of international treaties and applying the precautionary principle on a global basis as a foundational legal principle, the direction of travel has been towards maximising intergenerational benefit. Controversy has switched from the potential degradation of the Commons to a fierce debate about whether excessive risk aversion is harming vulnerable sections of the population by depriving them of access to essential resources and the benefits of innovation. How did this situation come about?

Scenario description

In 2040, the current planetary governance framework, administered by what is commonly called UN2.0, emerged in response to a series of man-made disasters attributable to global warming, an outbreak of increasingly bitter regional wars over diminishing water resources and access to valuable minerals, and fears that congested access to outer space would prompt a wave of militarisation. Governments had turned to the overwhelming scientific consensus that existing trajectories were not sustainable but more importantly, were able to base their policies upon a fundamental shift in public opinion towards a precautionary approach. Mainstream and social media had raised fears in a manner similar to the 'Frankenstein Food' stories about genetically modified agriculture and the anti-vax campaigns during early-century pandemics. When the dust had settled on these outliers, there had remained a broad consensus that a clearer rule of law was needed for the physical domains covered by the Global Commons and that such a legal framework had to reflect equity across the global population.

Today's regime is distinguished from earlier efforts at international treaties and regulation by being enforceable, initially by legal redress but ultimately through a series of guarantees underwritten by all three global power blocs and the Association of Independent Nations. Its operational arm functions as a global enforcement agency dealing with infractions on a similar basis to historical actions against piracy on the high seas.

The original foundations of the United Nations Conferences on the Law of the Sea still apply but a series of enhancements completed at UNCLOS 6 in 2033 finally justifies its epithet as a 'constitution for the oceans' firmly founded upon a 'sustainability first' principle. Current challenges are driven by territorial and liability disputes emerging from rising sea levels, displacement of traditional fisheries by changing ocean currents and temperatures and the opening up of new maritime routes through melting of ice in the polar regions. Marine Protected Areas are now a default in most parts of the ocean. With licences for what is now called 'wild-fishing' being limited to coastal regions and traditional communities, environmentally driven declines have been offset by a considerable recovery in the populations of marine species. A global levy on marine transport helps to support the ongoing clean-up of a still-persisting legacy of plastic and other non-degradable waste in the oceans.

Antarctica has remained essentially closed to economic development though the forthcoming expiry in 2048 of the 50-year old *Protocol on Environmental Protection to the Antarctic Treaty* has caused some to question whether the relatively easier access to the territory should lead to any relaxation of its over-riding principle of designating Antarctica as a "natural reserve, devoted to peace and science". International Space Law had originally shared many elements and principles with the earlier-recognised domains of Global Commons but had evolved with rapidly developing technologies and an ever-widening range of State and private actors with the capability to undertake economic activities in space. An initial period is now dubbed the Wild West of space exploration as it had been characterised by ever increasing amounts of debris but it ended after the tragic Antares 5 incident led to a strict regime being agreed.

The preservation and protection of the Global Commons has been an unprecedented international achievement. It is not, however, universally acclaimed. With land-based resources under pressure, an increasing number of scientific organisations, supported naturally by the business sector and some societal actors, have been lending their support to a movement for an opening up of the commons for a greater degree of controlled exploitation. This they claim will alleviate food shortages and disruption to the progress of green and purple technologies resulting from soaring prices of critical minerals in short supply. Their argument is that the regulatory regime was put in place on the basis of what is now decades-old science and we are now close to a position to optimise the benefits of the Commons at a level where the environment remains sustainable. A modest increase in risk-appetite will, they say, create the conditions for innovators to bridge the remaining gap and create a platform for human progress. As one commentator put it, "if we had not been allowed to graze our cattle we would never have had a common in the first place!"

Implications for R&I Policy

Global commons are affected and shaped by the conditions which form the context of science and innovation efforts. In the past those conditions have incentivized innovations that did not respect planetary boundaries with the consequence that many of the global commons such as the earth's biosphere were severely depleted. How can we build appropriate governance regimes that prevent degradation of the Global Commons? Can successful local approaches be upscaled to global level or should there be other approaches that need to be explored in parallel?

Appropriate governance of global commons is very important for sustainability on the planet earth. Governance of global commons need to give due consideration in parallel of multiple policy factors, one amongst which is how to best coordinate R&I efforts to support it. Research on commons governance models is one such way, but there is a much more important relationship between global commons, science and scientific knowledge and capability. Science has a triple function in relation to global commons and global problems: (i) as a public good that helps dealing with global problems; (ii) as a spokesperson for global commons and related goods that have no voice; and (iii) as a part of the global commons itself. Taking this into consideration, Europe could have a more strategic orientation and directionality in how the different lines of EU R&I come together to address the big challenge of global commons effectively.

From this perspective the key question is how to bring Europe and the world closer to Scenario 5, where the commons are protected and preserved, and away from scenarios in which the global commons are mismanaged and depleted. This entails at least four key reorientations in current R&I policy:

- there is a need to capitalise on important advances underway across the whole spectrum of impact areas of Horizon Europe with a view to harnessing them more directly to advance the global commons and their effective governance. This would position the EU to play a more leading role on the SDGs at global level and to ensure that these impact areas have more global impact.
- the whole approach to SSH and responsible research and innovation needs to be revisited and amped up to take on board the concern with global commons and their protection and governance in a more targeted, systemic and holistic way. This can be done by taking into account and building on signs /signals of emerging societal changes in this direction, e,g, growing concern with historical inequities, animal rights recognition, eco-communities, innovation peer to peer networks. Global commons need to be given a more central position on the R&I policy agenda in line with and in support of the SDGs.
- global commons need to be more effectively factored into Europe's security strategies, geopolitical and Open Strategic Autonomy policy approaches and how these link to R&I policy. There needs to be an enhanced awareness among policy makers in these areas of the tight connection between security, OSA and R&I policy in relation to global commons governance, extending to protecting global commons and common pool resources, by identifying and addressing key threats and risks (conflict, climate change) as well as equity and access issues and the appropriate balance between preservation and responsible use of scarce resources.
- The role of science and science diplomacy in advancing global commons needs to be revisited as an integral part of a global commons-responsible R&I policy.

- As such, effective governance and stewardship of the global commons is closely linked to education and cultural literacy. For a thoughtful stewardship of the global commons, integrating initiatives, resources, languages and cultures within SSH and responsible research and innovation in connection with security and strategic autonomy initiatives, it is necessary to draw upon multiple disciplines and viewpoints to address the world's current and future problems, challenges or situations, and work collaboratively with others in understanding and tackling these.

Suggestions for new emerging impact areas for EU R&I policy are identified in the table below.

New emerging impact areas for EU R&I policy identified are:

societal /SSH/ RRI	- public/social awareness of global and local commons challenges; governance of local and global commons - social well-being linked to inter-generational fairness; multi-species communication - education: futures literacy; future generations - post normal society experience - underpinning social consensus for protecting global commons
Security/ geopolitics	- geopolitical dimension of global commons: e.g. engagements to restrain land reclamation in the sea; energy security; space security - global influence in securing a commons framework - defense aspects of global commons - securing access to quality air, water and food
Governance / Economic /political paradigm	- Potential for Universal Basic Income - earth system governance - Improved understanding of behavioural incentives and better informing the public of the balance of risk.
Innovation/ Technology	- exploring Commons-oriented innovation frameworks - engagement of independent start-ups to help regulate to bridge wealth gap and help manage global /local commons - More effective monitoring technologies to identify and if necessary prevent those breaching global commons agreements and regulations; - Increased focus on developing substitutes and alternative sources for critical materials and resources which are creating pressure to over-exploit global commons.

References

Armstrong Mackay, David et al 'Exceeding 1.5°C global warming could trigger multiple climate tipping points', Science, 9 Sep 2022, Vol 377, Issue 6611

Benkler, Yochai; Nissenbaum, Helen (2006): Commons-based Peer Production and Virtue. In: J Political Philosophy 14 (4), S. 394–419. DOI: 10.1111/j.1467-9760.2006.00235.x.

Buck, S.J. (1998). The Global Commons: An Introduction (1st ed.). Routledge. https://doi.org/10.4324/9781315086415

EC Radical Innovation Breakthrough Inquirer RIBRI Workshop of key future Global Value Networks (GVNs) Report Tender Contract No. 30-CE-0864067/00-27 "Horizon Scanning for Radical Innovation Breakthrough" (EC, 2018)

GEF: The Opportunity of the Commons https://www.thegef.org/sites/default/files/publications/GEF_GlobalCommonArticles_July2018_CRA~.pdf

Latour, Bruno (2017): Facing Gaia. Eight lectures on the new climatic regime. First published. Cambridge, UK, Medford, MA: Polity.

Latour, Bruno (2018): Down to Earth, Politics in the New Climatic Regime. Newark: Polity Press.

Miller, Jack. Environmental stewardship of the global commons. Published Thursday, 29 April, 2021 https://post.parliament.uk/environmental-stewardship-of-the-global-commons/ accessed 9 Novermber 2022.

Ostrom, Elinor (2005): Governing the commons. The evolution of institutions for collective action. 17. print. Cambridge: Cambridge Univ. Press (Political economy of institutions and decisions).

Rikap, Cecilia and Lundvall, Bengt-Ake. *The Digital Innovation Race. Conceptualising the Emerging World Order*, Macmillan Palgrave, London 2022.

Van Langenhove, Luk (2011). Global Science Diplomacy as a new tool for Global Governance. Barcelona: FOCIR pensament n° 3.

J. Warren Evans, The Future is Now: Scenarios to 2025 and Beyond. Too Global To Fail: The World Bank at the Intersection of National and Global Public Policy in 2025. December 2014, 67-91

Annex

Annex 1: Global Commons: Definitions, concepts and perspectives – Towards a Taxonomy

Global commons have been traditionally defined as those parts of the planet that fall outside national jurisdictions and to which all nations have access. International law identifies four global commons, namely the High Seas, the Atmosphere, the Antarctica and the Outer Space.[8] These resource domains are guided by the principle of the common heritage of mankind. Resources of interest or value to the welfare of the community of nations – such as tropical rain forests and biodiversity - have lately been included among the traditional set of global commons as well, while some define the global commons even more broadly, including science, education, information and peace. To incorporate the potential for overuse by some at the expense of others they can also include the atmosphere, land, ocean, ice sheets, a stable climate and biodiversity.[9]

According to the Global Commons Alliance, there are currently two definitions of the global commons: One is based in geopolitics. In this definition the global commons are areas – and their potential economic resources – that lie beyond national jurisdiction: the atmosphere, the high seas, Antarctica and outer space. The second definition has its roots more in economics than geopolitics and relates to how shared resources can be overused by some at the expense of others, regardless of national jurisdiction.

One of the main characteristics of global commons is that they have a value for humankind and the planet. In some cases they even play a crucial role in the survival of our species. There is increasing discussion at present on the status of the digital environment in relation to the commons. Major components of the digital world - the cables and servers that comprise the physical basis of the internet, the tech companies that provide major open access services - are privately owned and operated, or subject to control by specific national governments. But these increasingly look like international public goods, and thus intersect with the global commons. Because there is no world government to provide international public goods, such goods can only be provided by multilateral collaboration, and this may ultimately to the digital commons (see Rikap and Lundvall 2022 for an important discussion of this). More recently, cyberspace has also been regarded as meeting the definition of a global common.

The global commons, comprising the areas and resources beyond the sovereigny of any state, build up on the heritage of Grotius's idea of mare liberum – an idea that aimed to preserve the freedom of acc ess for the benefit of all.[10]However, the old mare liberum idea digressed into 'first come, first served' a dvantages for industrialised countries. Especially at the initiative of developing countries, it has now been replaced by a new law of international cooperation and protection of natural wealth and resources beyond the limits of national jurisdiction.

According to Vogler, global commons can be considered as "social constructs that overlay, interpret and allocate 'brute' physical facts such as the gravitational forces in space, marine organisms, or deep seabed features that exist independently of our observation (Searle, 1995). The designation of areas and resources as global commons is evidently related both to technological change and scarcity, and both have combined to shape current definitions of the commons problem. ….the list of candidates for global commons status continues to grow. Cyberspace or the 'digital ecosystem', intellectual property and crop genetic resources are all so described with attendant implications for governance and

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[8]https://www.un.org/en/development/desa/policy/untaskteam_undf/thinkpieces/24_thinkpiece_global_governance.pdf
[9] https://post.parliament.uk/environmental-stewardship-of-the-global-commons/
[10] https://www.tandfonline.com/doi/full/10.1080/01436597.2016.1154441

security. The defining characteristic of commons relates to the question of access. One shared characteristic of the global commons is their close association with scientific discovery and developing technological capability (mare liberum 1609, Antarctica 1958, outer space from 1957).

There has been substantial recent interest in the global commons amongst the military and strategic studies communities (Jasper, 2010). Their paramount concern is, as ever, the maintenance of access to strategically significant parts of the global commons. Access is also at the heart of environmental framing of the commons, but here it is the consequences of an open access regime and associated tragedies of resource degradation, depletion or destruction that are usually highlighted.

Towards a Taxonomy of Commons

Drawing on the work of Susan Buck[11], this paper outlines a draft taxonomy of commons, distinguishing between local, international and global commons as well as common pool resources.

Table 1: Draft Taxonomy of Global Commons (Georghiou & Smith drawing on S.Buck)

	Physical	Virtual/Digital	Notes
Local Commons Not exclusionary	Traditional commons concept covering pasture, forests, rivers, rights of way, fishing, lakes, etc		
International Commons Exclusionary	Resource domains shared by more than one nation, such as agreed regimes for spaces bordering states e.g. estuaries, the Mediterranean Sea and Baltic Sea	Cyberspace – the network of information systems across which information is transmitted, shared and stored.	**Cyberspace** depends on a range of physical assets that make up the internet, or satellite-based communications, or satellite networks for global positioning. These are all under the direct physical control of states and large corporations, and can readily be controlled (or terminated) by them. Berners Lee and others campaign for it to be recognized as a public good.
Global Commons Not exclusionary	Resource domains to which all nations have legal right of access. 4 are UN recognized: Atmosphere, Outer space; Antarctica; High Seas They refer to human-made but widely accessible resources,	S&T Knowledge (published) – the open science and open data movements aim to remove economic barriers to access but in principle published knowledge is a common resource.	The geophysical commons can also to some extent be regulated - the oceans are subject to the Law of the Sea Treaty of 1982 (which established substantial Exclusive Economic Zones for countries), the stratosphere has been regulated, for example, by the Montreal Protocol.

[11] Distinguishing between global commons, common pool resources and public goods
https://www.taylorfrancis.com/books/mono/10.4324/9781315086415/global-commons-susan-buck

		Large amounts of scientific knowledge are privately appropriated for their economic or strategic value.	
Common pool resources

Not exclusionary | Subtractable economically relevant resources managed under a property regime in which a legally defined user pool cannot be efficiently excluded from the resource domain and resources are shared among them. | | |

According to Susan Buck, the commons are resource domains in which common pool resources are found.

"Common pool resources are subtractable resources managed under a property regime in which a legally defined user pool cannot be efficiently excluded from the resource domain.

International commons or global commons are very large resource domains that do not fall within the jurisdiction of any one country.

International commons are resource domains shared by several nations, such as the Mediterranean Sea and Antarctica (although recent United Nations environmental treaties have affected the Antarctic regime so that it has some of the characteristics of a global commons).

Global commons are resource domains to which all nations have legal access, such as outer space. The distinction between the two is important, especially because international commons are exclusionary while global commons are not". (Buck)