

Why are we sustaining what for whom?

Selfishness beats altruism within groups.

Altruistic groups beat selfish groups.

Everything else is commentary

– David S. Wilson & E.O. Wilson, 2007¹

Introduction

This paper responds to the IPSASB Consultation Paper on *Advancing Public Sector Sustainability Reporting* (the “CP”). A crucial question is the question of what reporting is required to achieve sustainability of what and from whose perspective. We use a systems theory / multi-level selection approach to examine this question. With this framework, we answer the questions raised in the CP.

In this discussion, we will use the term ‘capital’ in the accounting sense of what we own. This is counterposed by ‘income’ that requires capital for its production. In the legal field, capital is property ownership, juxtaposed against the usufruct, the right to the fruit from the property without the destruction of the property. As Friedrich List put it, “*The tree which bears the fruit is of greater value than the fruit itself.*”²

Sustainability will be considered the capacity for continuance, the capacity of the capital at hand to sustain the usufruct / revenue indefinitely. In accounting, the going concern concept evaluates whether the entity is sustainable. Stewardship, conservatism, and even the matching principle are other accounting principles that focus on the capital of the entity.

We first explore the theoretical basis for sustainability and the difficulties in achieving it. We then examine the goals of the public sector in this light. Next, we explore its implications for the measures that are required to estimate whether an entity is sustainable. Finally, we examine implications for public sector accounting.

Most of these ideas are very old. Further, although it is our central critique that the current public sector accounting framework is excessively simplistic, the exposition in this response is also highly simplified to keep the discussion manageable.

¹ Conclusion to their article, *Rethinking the Theoretical Foundation of Sociobiology*. The Quarterly Review of Biology, Vol 82, No. 4, page 345.

² Friedrich List (1841), *The National System of Political Economy*.
<https://socialsciences.mcmaster.ca/~econ/ugcm/3ll3/list/national.html>

What are we trying to sustain?

Nested systems

Humans are part of a set of nested systems³. Among many alternatives,⁴ we will use a simple hierarchy of systems to illustrate our arguments.⁵

| System level | Included | Examples of Exclusions |
|--------------|----------------------|--|
| Biosphere | Living things | Inanimate objects |
| Humanity | Human beings | Other living things (all distant cousins) |
| Civilization | Human beings except | Uncontacted tribes. |
| Nation | Citizens of nations | Stateless peoples, slaves, citizens of other nations |
| Tribe / clan | Members | Others |
| Family | Bloodline, adoptions | Others |
| Individual | Self | Not me! |

Note that humans, the human species and the biosphere are natural systems, family, tribe / clan, and nations are human-defined systems, while civilization represents a densely connected part of humanity that benefits from the systematic accumulation of knowledge. Human culture, expressed through religion / customs / norms / law, imbues families and higher-level systems with an identity, boundaries, legal personality, rules, and most importantly, goals. We can contrast this with the biological group of primates or dinosaurs, neither of which have any sort of recognizable identity, organization or goals.

In this framework, lower-level systems are subsets of higher-level systems. (Of course, in real life the situation is much more complex. For example, human-created systems like corporations can span nations, and religions may even span civilizations. Alliances among nations can create larger systems like the UAE, Malaysia, the USSR, or the EU. We will ignore this complexity, although achieving sustainability in real life will require dealing with it.)

³ Or nested groups to use terms from multi-level selection evolutionary theory

⁴ For example, scientific (Linnean) classification gives us, individual -> Species Homo Sapiens -> Genus Homo -> Tribe Hominini -> Subfamily homininae -> Family Hominidae -> Infraorder Simiformes -> Suborder Haplorhini -> Order Primates -> Class Mammalia -> Phylum Chordata -> Kingdom Animalia -> Biosphere (see [Human - Wikipedia](#))

⁵ Although each of us are also comprised of sub-systems such as genome -> cell organelles -> organs -> individual, individuals are generally the smallest system level of interest to accounting and economics.

Higher-level systems are more important

Worse than your own death is the death of you plus all your family members. Wiping out a tribe / clan / nation is genocide. Collapse of civilization is still worse, human extinction is unthinkable, and sterilizing the planetary biosphere is off the scales in terms of moral crimes.

Greater than the individual is the family

Greater than the family is the tribe / clan

Greater than the tribe / clan is the nation

Greater than the nation is civilization

Greater than civilization is humanity

Greater than humanity is the biosphere

Higher-level systems are more important as they are more difficult to create in stable form, and embody more information than the lower-level systems that constitute it. This is like the Ship of Theseus paradox – if over time all the planks of the ship are replaced, is it still Theseus's ship?⁶ From the perspective of a higher-level system, lower-level systems are simply interchangeable parts. As we know from biology, for the most part, the cells that make up each of us as an individual human are constantly being replaced. Our current civilization has seen the creation and demise of many nations.

Higher-level systems have longer time perspectives

Yes, there are many higher-level systems that are short-lived, such as limited duration companies and fixed-term mutual funds. However, in our set, higher-level systems have longer time perspectives than individuals. Families, tribes / clans & nations assume multiple generations of individuals. Civilization is comprised of multiple nations, which keep changing. From the biosphere perspective, humans are one of millions of species and have been in existence for only a fraction of the 3.5+ billion years the biosphere has existed.

Nested personhood, property rights & responsibilities

In broad strokes, the current legal regime consists of tiered levels of legal persons and related property rights. Lower-level systems have defined property rights over certain resources, but subject to the superior right of the higher-level system. This follows from the understanding that the higher-level system is more important than any specific constituent lower-level system.⁷ The higher-level system is also the residual owner of property not assigned to any lower-level system.

⁶ [Ship of Theseus - Wikipedia](#)

⁷ The family is more important than any individual of the family. However, the entire human genome (across all humans) is more important than the individual or the family, in effect is humanity.

At the level of the biosphere, we are seeing incipient development of the rights of nature, suggesting both personhood for various facets of nature (e.g., rivers) as well as a right to self-integrity. Certain traditions suggest that nature cannot be owned. In fact, even today, no one owns the climate or the sun. In ancient Roman law, which is the basis for most property law systems around the world, there is the concept of *res nullis*, things that belong to no one.⁸ Wild animals were a classic example. Note that this is a residual category, things which belongs to no one else.

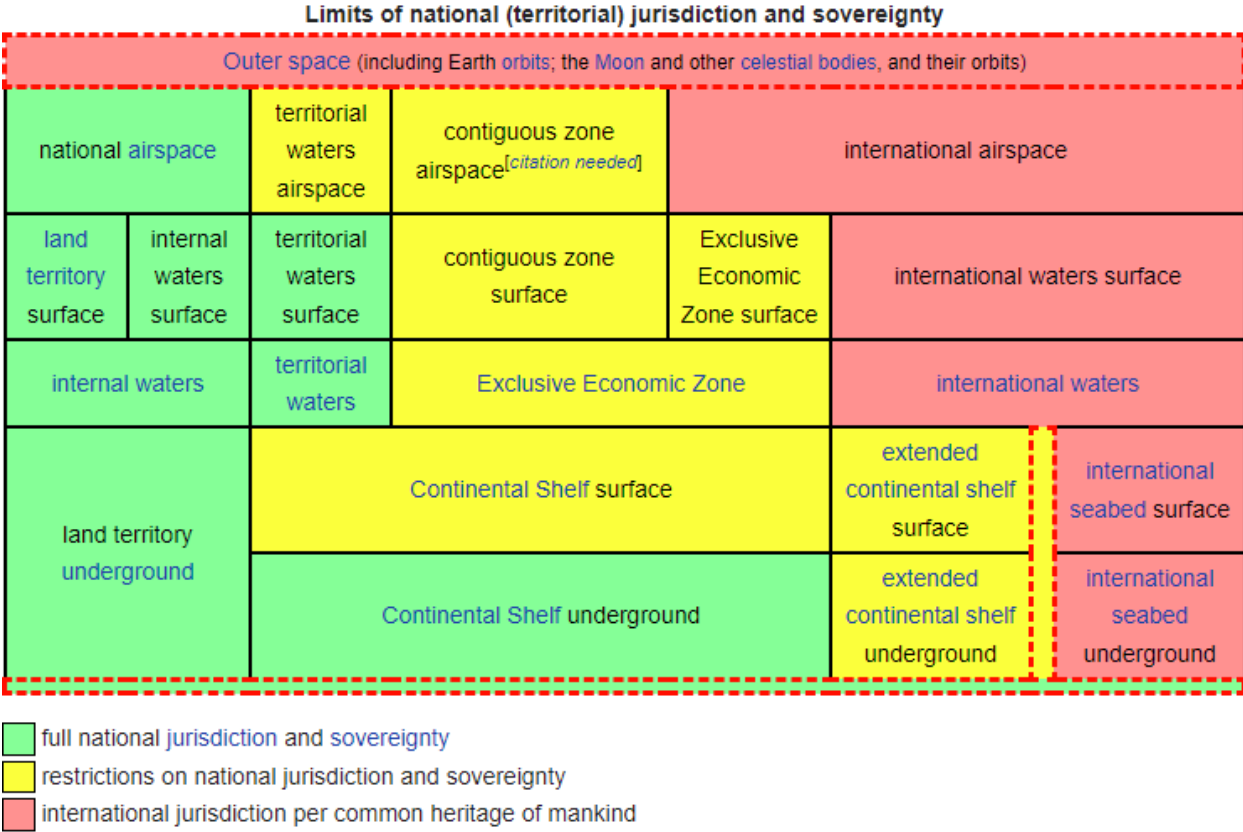
| System level | Extends to | Residual ownership | Examples of capital |
|-------------------------|--|---|--|
| Biosphere | In general, not recognized to have agency. Rights of Nature activists aim to change this. There have been some initial positive legal judgments. | | |
| Humanity / Civilization | The universe | Common Heritage of Humankind; Common Concern of Humankind | Deep sea, Antarctic, Moon, Asteroids Planetary boundaries including climate |
| Nation | Sovereign territory | Public wealth; Public Trust / Public Domain | Natural resources; Residual ownership; Escheat |

Moving on to humanity / civilization, we can see the planet as a shared inheritance, a planetary trust held by the present generation on behalf of future generations. International law suggests that a number of resources are the Common Heritage of Humanity / Humankind or alternatively the Common Concern of Humankind. This inheritance includes resources such as deep-sea minerals in international waters, outer space, and parts of our common cultural heritage such as UNESCO World Heritage Sites. Again, it is worth noting that the common heritage is largely a residual category for those aspects that no one owns. In ancient Roman law, *res communes* are things belonging to everyone and open to the use of everyone, like the sea or the air.

A nation is usually sovereign within its territories. Legally, a nation is the owner of the wealth within its territory. The superior right can be legally realized by the nation retaining allodial title to land (all lower-level titles are subject to the superior title of the nation), eminent domain rights (the right to expropriate property for public use without the owner's consent), treatment of certain resources as part of the public trust (not proprietary assets of the government), and being the residual owner of un-owned property (e.g., unpopulated land, escheat). The wealth of the nation is the sum of the wealth of individuals, wealth held in common (often owned in trust by

⁸ Domingo, R. (2017). [The Law of Property in Ancient Roman Law](#). The Law of Property in Ancient Roman Law (June 12, 2017).

the government), proprietary wealth of the government, residual wealth and net relationship with other nations / civilization. This last component includes ownership rights in assets in foreign nations and even extractive licences in the deep sea in international waters against which exist liabilities including cross-border debt and other liabilities like pollution. In Roman law, *res communes* cannot be owned privately and are open to the use by everyone (e.g., river banks, the sea), while public assets of the government are *res publicae* (e.g., harbors).



Source: [Common heritage of humanity - Wikipedia](#)

Of interest to the public sector, within nations there are sub-national entities that go all the way down to towns/villages and even wards. A similar system is visible here as well. A large number of commons and common pool resources exist with nations. In many property systems, if agricultural land is left fallow, it can be taken back by the community and reassigned to someone who will actually farm the land.

Sustain what?

From the preceding discussion, we have seen that the world is comprised of a nested (& overlapping) set of systems. Sustaining is the capacity to continuance. From a public sector standpoint, we are interested in the sustenance of the public sector unit, its higher-level aggregates, as well as the sustenance of the relevant sub-national entity or nation, and more importantly, sustenance of civilization, humanity and the biosphere as functioning systems.

For example, a sub-national state-owned enterprise in the extractive industry is concerned with its own sustainability, the sustainability of the sub-national public sector and the sub-national entity, the national public sector & the nation, civilization, humanity and the biosphere (eight different entities). An entity like the International Seabed Authority is concerned with its own sustainability, as well as the sustainability of the Common Heritage of Humankind that it manages on behalf of humankind, civilization (e.g., through impacts on ocean biodiversity), and the biosphere.

System survival, future generations and sustainability

Beyond nuclear families, it is difficult to conceive of a situation where the present generation (i.e., the people alive) agrees not to procreate, but instead simply consume their resource base equitably though unsustainably? Other than the logistical impossibility of a global consensus, we believe that most individuals would instinctively find it morally unacceptable. Why? We believe the answer is that it endangers the survival of many systems. No future generations! The end of the family, tribe, nation, civilization, and the human species.

Natural, Cultural, and Group Selection

The current theory of evolution comprises three key elements: variation, selection and replication. In the natural world, genes vary across individuals, the natural world “selects” survivors when the rest die, and replication takes place through transmission of genes to “children”. Natural selection results in a range of behavior, including the drive to survive, and the drive to have children. Since success is measured in differential terms, having more children than others is important.

This idea has been extended to cultural selection, where innovation generates variation, competition in the real world decides which ones survive, and they replicate in cultural space as fashions, norms, institutions, etc. One obvious consequence is the drive to pass on social & cultural advantages to children so that they in turn may have more grand-children.

Finally multi-level group selection suggests natural selection can take place not just at the level of individuals but also at the level of groups. In simple terms, an individual in a group is best served to try to replicate his genes, i.e., to be selfish. However, if groups are competing against each other (warfare among bands), then groups comprised of cooperative individuals may be more likely to survive warfare and reproduce. As a consequence, over time, the population may have more cooperative genes.

Multi-level selection has been suggested to be the evolutionary reason for the high level of cooperation among humans compared to our closest primate species.⁹ To be specific, humans are

⁹ Boehm, C., 1999. *Hierarchy in the forest: The Evolution of Egalitarian Behaviour*. Harvard University Press

very cooperative within defined groups they are members of, and highly competitive with other groups and their members.

Survival Imperative

The most basic criterion for the success of a system is survival (sometimes through reproduction). As Warren Buffett puts it, “*In order to win, you must first survive*”. Elinor Ostrom’s criteria for successful commons were those that were long-lived. They survived. If the commons, society or system does not survive, then it has failed.

This ‘Survival Imperative’ is usually an implicit but overriding goal. To our knowledge, no national constitution declares that national survival is the overriding goal. However, when national survival is threatened, emergencies are declared overriding normal rules.¹⁰ (And in some cases, failed national systems are dissolved, like the USSR.)

Terminal risks

Reducing terminal risk improves the likelihood of long-term survival. Accidents, disease, famine, and natural disasters all threaten survival. Individuals are exposed to terminal risk from conflict at various levels - knife fights, blood feuds, civil, national or world wars. Consequently, in most arenas of conflict, great effort is taken to avoid physical violence. And even where violence is involved, it may be strictly constrained so that the participants survive the conflict.

Unconstrained conflict at lower levels can threaten higher-level systems. For example, nuclear weapons threaten not just the nations using them but civilization as a whole and, in an extreme case, even humanity.¹¹ Thankfully, we do not yet have the capability to sterilize the biosphere.¹²

Survival, Capital Maintenance & Growth

Maintenance of capital is a minimum condition for survival. Any system with declining capital has a rising risk of termination or extinction.

¹⁰ For example, Article 33 (1) of the Bhutan’s Constitution 2008 says “*The Druk Gyalpo may, on the written advice of the Prime Minister, proclaim an emergency if the sovereignty, security, and territorial integrity of Bhutan or any part thereof is threatened by an act of external aggression or armed rebellion.*”

¹¹ So far, only the USA has used nuclear weapons in war. However, the number of nations with nuclear weapons continues to rise, along with the development of “tactical” nuclear weapons, which increase the risk of their use. During the cold war, numerous accidents involving nuclear weapons put the world at risk of accidental nuclear war. [List of military nuclear accidents - Wikipedia](#). The Doomsday clock estimates the likelihood of a man-made global catastrophe that ends civilization. This is closer to midnight than ever before. [Doomsday Clock - Wikipedia](#). Finally, a cobalt nuclear weapon could make humanity go extinct. [Cobalt bomb - Wikipedia](#)

¹² As a commentor points out, aliens may well be able to sterilize the biosphere, or even evaporate the planet like the Vogons do to our planet in *The Hitchhikers’ Guide to the Galaxy* by Douglas Adams.

The Survival Imperative drives growth. Capital growth is a common strategy for improving chances of survival. The fat better survive famines. The rich better survive economic downturns.¹³ The well-armed better survive a fight or war.

It is easy to see that if there is growth in capital in one period, the target for the next period is set at this higher level, resulting in growth of capital over time. After a downturn (e.g., losses which reduce capital), growth in capital is required simply to get back to the starting point. In an intergenerational context, growth can be considered maintenance of inherited capital plus a bequest or legacy for future generations.

Note that there is no requirement that capital be used to produce articles for consumption (e.g., gold in the bank vault, fat on the belly), nor is there a requirement to maximize either production or consumption.¹⁴ It is also not ruled out. The potential to produce is what is important, not the actual production. Of course, certain consumption must be maintained for system maintenance, and production may be required.

Capital maintenance as a principle is akin to Sen's Capability Approach, where the capabilities of individuals are their capital and what the individual makes of those capabilities results in income / consumption / utility / welfare.¹⁵ There is no requirement to utilize capabilities to the maximum.

Capital Maintenance Heuristic

We posit that a 'Capital Maintenance Heuristic' is used in many systems to aid survival instead of more complex optimizations of growth. In essence, the Capital Maintenance Heuristic is: *Try to ensure that the end of period capital is at least as much as the starting capital.* In peasant societies, ensure adequate seed corn for the next year. In accounting terms, avoid loss. In private sector accounting, the going concern concept examines whether capital is maintained in order for survival.

In 1898, Veblen asked: "*Why is Economics not an Evolutionary Science?*"¹⁶ In partial response, Alchian (1950) remarked: '*The economic counterparts of genetic heredity, mutations and natural selection are imitation, innovation, and positive profits*' and "*those who realize positive profits are survivors; those who suffer losses disappear.*"¹⁷

¹³ As a commentor correctly points out, these may not be strategic choices by the individual. The rich may just have inherited wealth; the fat may have different genes.

¹⁴ For example, Apple Inc has a cash hoard of over \$200 billion that it is neither investing nor paying out as dividends. [13 Firms Hoard \\$1 Trillion In Cash | Investor's Business Daily \(investors.com\)](https://www.investors.com/news/technology/apple-cash-hoard/)

¹⁵ [Sen's Capability Approach | Internet Encyclopedia of Philosophy](https://www.iep.umd.edu/entry/sen-capability-approach/)

¹⁶ Veblen, T., 1898. *Why is Economics not an Evolutionary Science?* The Quarterly Journal of Economics Vol. 12, No. 4 (Jul., 1898), pp. 373-397. <https://www.jstor.org/stable/1882952>.

¹⁷ Alchian, A.A., 1950. *Uncertainty, Evolution, and Economic Theory.* Journal of Political Economy, Vol. 58, No. 3 (Jun., 1950), pp. 211-221. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2406175

The Future Will Be Richer conjecture

A frequent argument is that since humans are intrinsically inventive, technological progress @ [0.5%] per annum is likely. Further, the capital maintenance heuristic predicts increasing capital over time. Hence the Future Will Be Richer (FWBR). Consequently, we should not care about capital maintenance or about future generations in any significant sense. Indeed, if we look at the past 200-500 years of human history, viewed in totality, things have arguably improved significantly.

However, if we assume that our species will last for millions of years, FWBR is at best a conjecture, as it ignores volatility in the path. We only have to look at nations such as Nauru, Iraq, Afghanistan, and Ukraine to see that the future is not always richer. Empirically, the World Bank found resource-dependent countries were becoming poorer.¹⁸ It is of no comfort to citizens of these nations that the civilization as an aggregate has become richer.

The future will be richer conjecture also assumes that there are no large-scale setbacks to technological progress. The dark ages are a recent example of large parts of the world being poorer than their ancestors were. Colonisation made many parts of the world poorer, even technologically.

The Turkey Problem of Induction

In The Black Swan, Nissim Nicholas Taleb (2010) remarks on the Problem of Induction:¹⁹

How can we *logically* go from specific instances to reach general conclusions? How do we know what we know? How do we know that what we have observed from given objects and events suffices to enable us to figure out their other properties? There are traps built into any kind of knowledge gained from observation.

Consider a turkey that is fed every day. Every single feeding will firm up the bird's belief that it is the general rule of life to be fed every day by friendly members of the human race "looking out for its best interests," as a politician would say. On the afternoon of the Wednesday before Thanksgiving, something *unexpected* will happen to the turkey. It will incur a revision of belief.

We should also note that there are wildly diverging forecasts for future growth. Here are 4 examples (a) singularity, when growth becomes exponential, (b) 0.5% technological progress, (c) those alarmed by climate change, expecting widespread disruption (negative growth), and (d) the doomsday clock, that is currently the closest ever to midnight. It is not clear why 0.5% is a superior long-term forecast. Is it simple anchoring?

¹⁸ World Bank (2010): *The changing wealth of nations : measuring sustainable development in the new millennium*. World Bank, Washington DC. <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/630181468339656734/the-changing-wealth-of-nations-measuring-sustainable-development-in-the-new-millennium> Accessed on 24-Aug-2022

¹⁹ Taleb, N. (2005). *The black swan: Why don't we learn that we don't learn*. NY: Random House.

Intergenerational Equity & Future Generations

Intergenerational equity can be achieved if we ensure that our children inherit at least as much we did – capital maintenance in perpetuity. If we successfully apply the Capital Maintenance Heuristic and if all future generations follow the same heuristic, then we and all our future generations have at least equal opportunities to use the inherited resources in ways that are meaningful at the time. A crucial aspect of the intergenerational equity principle is that it treats the present and future generations (as a cohort) equally. We sustain for our future generations. They will replace us in the higher-level systems, the new planks of Theseus’s ship.

As Edith Brown Weiss, the legal scholar who identified the principle of intergenerational equity in international law in the 1980s, said

“Sustainability requires that we look at the earth and its resources not only as an investment opportunity, but as a trust passed to us by our ancestors for our benefit, but also to be passed on to our descendants for their use. ... Fortunately, the notion that each generation holds the earth as a trustee or steward for its descendants strikes a deep chord with all cultures, religions and nationalities. Nearly all human traditions recognize that we, the living are, sojourners on earth and temporary stewards of our resources. The theory of intergenerational equity states that we, the human species, hold the natural environment of our planet in common with other species, other people, and with past, present and future generations. As members of the present generation, we are both trustees, responsible for the robustness and integrity of our planet, and beneficiaries, with the right to use and benefit from it for ourselves. ... The theory of intergenerational equity states that all generations have an equal place in relation to the natural system, and that there is no basis for preferring past, present or future generations in relation to the system.”²⁰

Using the capital maintenance heuristic to implement intergenerational equity also achieves sustainability. Bond & Basu (2021) say on intergenerational equity:²¹

“the concept has deep roots in human civilization, which unfortunately have been obscured over time. Consider inheritance law: inheritors of property are simply custodians for future generations, especially if the inheritance involves entailment, which constrains the present heir from consuming the inheritance by recognizing the rights of subsequent heirs. (To illustrate, in most cultures, there is the rich good-for-nothing heir who lives by selling off the family silver, unfairly impoverishing his future generations.)

Or, consider endowment funds, where the capital is conserved and only the income used. The deepest rationale in this case is the idea of stewardship, the idea that capital must first be

²⁰ Weiss E.B., 1992. In fairness to future generations and sustainable development. American University International Law Review 8, no. 1 (1992): 19-26

²¹ Bond, P., Basu, R., 2021. Intergenerational equity and the geographical ebb and flow of resources: The time and space of natural capital accounting. In *The Routledge Handbook of Critical Resource Geography*, 2021, 260-273

conserved. Indeed, the accounting and economics professions generally define income not as revenue but as the residual after we ensure that the capital is held constant.

Further, environmental economics provides us with the “sustainable yield” principle: we can only consume that amount that does not endanger the capital. And, in most countries, natural resources—including forests, streams, beaches, oceans, atmosphere, and minerals—are owned by the state as a trustee on behalf of the people and especially future generations. This is the public trust doctrine and represents the implementation of the IE principle in the public domain. It is often derived from natural law and considered more fundamental than the Constitution. For the trustees, the foremost obligation is to ensure the corpus of the trust is kept whole. Moreover, there is a duty to treat all the beneficiaries equally. To illustrate, in 2017, the Pennsylvania Environmental Defense Foundation won a judgment in the Supreme Court of Pennsylvania that the state must consider natural resources in the role as trustee, not proprietor, and therefore must use the proceeds from extracting oil and gas for restoring the environment, not general government expenditure.”

Intergenerational equity in international environmental law

Weiss, while discussing the Earth as a whole, suggested three kinds of normative values need to be conserved for future generations – conservation of options, conservation of quality and conservation of access.

1. Conservation of options “*means conserving the diversity of the natural and cultural resource base, so that each generation does not unduly restrict the options available to future generations in solving their problems and satisfying their own values.*”
2. Conservation of quality requires us “*to maintain the quality of the planet so that it is passed on in a condition no worse than that in which it was received.*”
3. Conservation of access requires “*each generation should provide its members with equitable rights of access to the legacy of past generations and conserve this access for future generations*”.

The intergenerational equity principle has been accepted as a principle in international environmental law and is present in numerous treaties & legal instruments. Furthermore, many national constitutions and laws recognize the principle of intergenerational equity, sometimes as rights of future generation or of Mother Earth. A variety of international and national legal judgments have accepted the principle of intergenerational equity. Finally, there are a variety of national mechanisms, such as the Welsh Commissioner for Future Generations, designed to achieve intergenerational equity.²²

²² Weiss, E.B., 2020. *Intergenerational Equity*. Max Planck Encyclopedias of International Law. [Oxford Public International Law: Intergenerational Equity](#)

Intergenerational Equity in economics & public finance

Four significant areas where intergenerational equity issues arise have been identified. In 1974, in the context of endowment funds, James Tobin observed: *‘The trustees of an endowed institution are the guardians of the future against the claims of the present. Their task is to preserve equity among generations. The trustees of an endowed university like my own assume the institution to be immortal. They want to know, therefore, the rate of consumption from endowment which can be sustained indefinitely. Sustainable consumption is their conception of permanent endowment income. In formal terms, the trustees are supposed to have a zero subjective rate of time preference. Consuming endowment income so defined means in principle that the existing endowment can continue to support the same set of activities that it is now supporting. This rule says that current consumption should not benefit from the prospects of future gifts to endowment. Sustainable consumption rises to encompass an enlarged scope of activities when, but not before, capital gifts enlarge the endowment. ... the university can consume the noninflationary fraction of the earnings of the businesses whose securities it holds. The remainder ... must be plowed back to enlarge the endowment enough to keep up with inflation.’*²³

When non-renewable natural resources such as subsoil minerals are depleted, Hartwick (1977) suggested: *“Invest all profits or rents from exhaustible resources in reproducible capital such as machines. This injunction seems to solve the ethical problem of the current generation shortchanging future generations by "overconsuming" the current product, partly ascribable to current use of exhaustible resources.’ Under such a program, the current generation converts exhaustible resources into machines and "lives off" current flows from machines and labor.”*²⁴ As we know, all over the world, nations are selling off their oil, gas & mineral wealth, treating the sale proceeds as current flows and not capital, consuming most of these sale proceeds. In effect, consuming inherited wealth, becoming poorer, and violating intergenerational equity.

In the arena of public pensions, the incentives are for the incumbent ruler to promise large pensions whose bill will be paid by future generations. All over the world, there has been a shift away from defined benefit pensions towards defined contribution pensions, as well as setting aside funds today for future payments under defined benefit pensions.

Finally, when public consumption is financed by raising public debt, the present generation is consuming while future generations will pay the bill. In the case of minerals, we are consuming wealth. Here, we are taking on debt to finance consumption, again becoming poorer and violating intergenerational equity.

²³ Tobin, J., 1974. *What is Permanent Endowment Income?* The American Economic Review, Vol 64 No 2, 427-32

²⁴ Hartwick, J., 1977. *Intergenerational Equity and the Investing of Rents from Exhaustible Resources*, The American Economic Review, Vol 67 No 5, 972-974

The importance of future generations

In the Intergenerational Equity perspective of organizing society, the present generation are custodians over inherited capital on behalf of all future generations. Morally, the present generation only has a right to the income from the capital, the usufruct, provided capital has been maintained. This framework achieves sustainability through capital maintenance and gives rise to moral rights of future generations.

However, since the future generations do not exist, they have zero legal rights and no political power. Instead of raising taxes on the rich to fund public services for the poor, it is easier for the rich to raid the inheritance of future generations. For example, by and large governments funded COVID relief by taking on debt (repayable by future generations) instead of using wealth & income taxes.²⁵ If we have to achieve sustainability, we have to prevent present generations from reducing the capital, whether by theft, loss, waste, or consumption. This makes it imperative that the rights of future generations to inherited capital are placed ahead of those of the present generation to the usufruct.

Varieties of Capital

There are many ways to classify capital, especially natural capital. Accounting has long maintained a distinction between wasting assets and non-wasting assets. Non-wasting assets were those that did not depreciate over time, and classically were land, precious metals and precious stones. We propose the term “intergenerational asset” for “non-wasting asset”.

In classical economics, there were three factors of production: land (meaning natural resources), labour, and capital (meaning human produced capital). Around 1900, neo-classical economics started treating land and capital as a single factor of production as though natural resources and human made capital were substitutable.²⁶ Later, entrepreneurship/technological improvement/innovation was added as a factor driving growth. Importantly, national accounts (e.g., UN SNA, IMF GFSM, UN SEEA) maintain separate accounts for produced capital and natural capital, and public sector accounting standards (e.g., IPSAS) currently do not differentiate between them.

The contemporary literature on inclusive wealth suggests there are three kinds of capital – natural, produced, and human capital. A fourth kind of capital, the social institutions of the collective, is also important, but difficult to measure, and treated as an enabling factor.²⁷

²⁵ As a commentator points out, inflation is an indirect tax on the present, and to the extent it is caused by COVID relief, the burden is paid by the present.

²⁶ Gaffney, M., 1994. *Neo-classical economics as a stratagem against Henry George*. In *The Corruption of Economics* (London: Shephard-Walwyn Ltd., 1994) pg 29-163.

²⁷ Managi, S., Kumar, P., Eds. 2018. *Inclusive Wealth Report 2018: Measuring Progress Towards Sustainability*. United Nations Environment Program. <https://www.unep.org/resources/inclusive-wealth-report-2018> accessed on 22-Aug-2022

For example, after WW2, both Germany and Japan suffered massive reductions in natural, produced and human capital. However, it is notable that both countries swiftly bounced back, while many other countries in the global south which were relatively less impacted by the war were unable to capitalize. This can be partly attributed to the continuity of social capital.²⁸

Useful classifications of natural resources

Within the literature on natural resources, we find different classifications. Here are a couple of classifications that we find useful.

Table 1 : Examples of natural resources

| Availability | Physical Properties | | | |
|-------------------|---|---|--|---|
| | Biological | Non-energy, Mineral | Energy | Environmental |
| Expendable | Most agricultural products, e.g., corn, grains | Salt | Solar radiation; Hydropower; Ethanol | Noise Pollution; Non-persistent, e.g., air pollution (NO _x , SO _x , particulates), water pollution |
| Renewable | Forest products; Fish; Livestock; Harvested wild animals; Wood; Whales; Flowers; Insects | | Wood for burning; Hydropower; Geothermal | Ground Water; Air; Persistent, e.g., air pollution, water pollution (CO ₂ , toxics); Animal populations; Forests |
| Depletable | Endangered species | Most minerals, e.g., gold, iron ore, bauxite, salt; Top soil | Petroleum; Natural gas; Coal; Uranium; Oil shale | Virgin wilderness; Ozone layer; Water in some aquifers |

Source: Sweeney, James L, 1993, Economic Theory of Depletable Resources: An Introduction, Chapter 17 of the Handbook of Natural Resource and Energy Economics, vol. III, edited by A. K Kneese and J.L. Sweeney, Elsevier Science Publishers

²⁸ The US also provided significant capital under the Marshall Plan.

Table 2 : Stationarity & Storage as two axes

| | Can be stored | Cannot be stored |
|-------------------|---------------------------------------|--------------------------|
| Stationary | Groundwater | Shellfish & grazing land |
| Mobile | Migratory livestock, irrigation water | Migratory wildlife |

Source: Agarwal Arun, 2001. *Common Property Institutions and Sustainable Governance of Resources*. World Development, Vol 29, No 10, 1649-72.

What capital should be maintained?

For individuals and higher-level systems, the most important resources are those necessary for survival and reproduction. For individuals, these are basic goods such as food to eat, energy to cook food, water to drink, salt to maintain blood pressure, air to breathe, low UV solar radiation, etc.

For nations, food-producing land, water & energy sources are particularly important, along with social institutions. Countries like Germany and Japan bounced back after WW2 despite major reductions in their produced and human capital.

For the biosphere, human capital or produced capital is meaningless. Only natural capital is of any consequence. Humans can of course detract from natural capital, by opening up the ozone layer, irradiating the surface with nuclear radiation, polluting land, the oceans and the atmosphere, or simply reducing the extent of biodiversity. As we know from the Montreal protocol, this may be reversible: CFCs eventually degrade and the ozone layer regenerates. Unfortunately, for many processes, this period is very long, sometimes millions of years. In theory, if adequate usable energy is available, any adverse impact is reversible. In practice, the process of harnessing energy takes energy and can cause further problems.

Are all kinds of capital infinitely substitutable?

Of course not. No amount of other capital can substitute for the ozone layer, unless we move to living largely underground, out of the reach of UV rays. Many other kinds of natural capital are similar – largely complementary.

System survival and intergenerational equity require sustainability

From the preceding discussion, we have seen that the world is comprised of a nested (& overlapping) set of systems. The ultimate criterion for the success of each system is survival (sometimes through reproduction). Sustaining is the capacity to continuance. Survival requires maintenance of capital which enables the generation of income for consumption. The intergenerational equity principle sees capital as the inheritance of powerless future generations, which inheritance is a significant temptation to present generations. The responsibility for survival, capital maintenance, and achieving intergenerational equity depends on who controls

capital. Capital maintenance to ensure survival and sustainability must be measured on at least three dimensions – diversity, quality, and quantity. Capital comes in many types, and they are not all substitutable.

Why is sustainability so difficult?

On a global basis, we are consuming inherited natural resource wealth, leaving less for our children to inherit.²⁹ Society is not sustainable. We are violating intergenerational equity. We have also significantly increased the risk of a terminal event of civilization, many nations, and without a doubt families and individuals through nuclear war, genetically modified organisms, artificial intelligence, etc. Why does this happen?

Competition & multi-level selection

At each system level, there is often intense competition for resources. Individuals compete against each other. Groups of humans from bands all the way to groups of nations compete against each other. Usually, the competition takes the form of demonstrating greater strength / power over the rival. Occasionally, it leads to war.

Competition can take many other forms. For example, grasses like rice tend to grow tall as they can then harvest more sunlight, leading to more seeds and eventually offspring. Short rice strains would simply be outcompeted, unless shortness helps them survive different ecological niches.³⁰

Cancerous growth can threaten survival

The unconstrained growth of a lower-level system can threaten the survival of higher-level systems. As ecological philosopher Edward Abbey put it, “*growth for the sake of growth is the ideology of the cancer cell*”. A cancer cell can threaten the functioning of the organ. Cancer metastasis can threaten the survival of the individual. Canine transmissible venereal tumour (CTVT) threatens the entire dog species with extinction, as it spreads among individuals by the transfer of living cancer cells, usually during mating.

In a similar fashion, growth of individuals & nations is threatening the survival of civilization through global warming, multiple problems in the ocean, and crossing multiple planetary boundaries and tipping points.

Group cohesion & cooperation

"*Selfishness beats altruism within groups. Altruistic groups beat selfish groups. Everything else is commentary*"³¹ This is the fundamental insight of multilevel selection theory. If individuals

²⁹ International Resource Panel (IRP) of the United Nations Environment Program (UNEP), 2019. *Global Resources Outlook 2019: Natural Resources for the Future We Want*. <https://www.resourcepanel.org/reports/global-resources-outlook> viewed on 22-Aug-2022

³⁰ The genes for short variants were found by intensive search and selective breeding of short strains. They exist but at lower frequencies.

³¹ Wilson, D.S., Wilson, E.O., 2007. Rethinking the Theoretical Foundation of Sociobiology. *The Quarterly Review of Biology*, Vol 82, No. 4, 327-348. See page 345.

only look out for themselves, then forming effective and cohesive groups is hard. Being selfish is a successful strategy to garner disproportionate resources. However, cohesive cooperative groups will outcompete groups formed of selfish individuals. Under certain conditions, over time, cooperators will become a greater part of the population.³²

One of the key differences between humans and our closest cousins, chimpanzees and bonobos, is the extent to which we cooperate.³³ We cooperate at large scales, and not just in wars between bands. While both chimpanzees and bonobos also live in bands, they are hierarchical. On the other hand, evidence indicates that for much of prehistory, humans lived in highly egalitarian bands (although there were times such as in conflict with other such bands when they could form hierarchies and follow an individual).

Cooperation versus selfishness

As Snower and Wilson (2022) put it, “*Cooperation at any given scale is vulnerable to disruption from within (the social equivalent of a cancer) and itself can be disruptive at larger scales. Self-preservation is a good thing – until it becomes self-dealing. Helping family and friends is a good thing – until it becomes nepotism and cronyism. Growing a nation’s economy is a good thing – until it overheats the earth.*”³⁴ Selfishness takes various forms.

Rulers and Managers

One particular form of selfishness faced by human-created systems like corporations or nations is when the agent/manager representing the collective puts his interests ahead of that of the collective. This is the principal-agent problem arising from a conflict of interest.

Coordination Failure

As we have seen, in a field of grass, strains that grow taller than others capture more sunlight for photosynthesis. There’s an inexorable trend towards the tallest specimens surviving and reproducing, until no seeds are produced at all (e.g., the stalks may fall over). If all the plants could coordinate to grow shorter, then they could all produce more seed, and hopefully many more offspring. However, if there is genetic variation in the seeds, inevitably there will be variation in height, and the competition will restart. This is a simple version of a coordination failure.

For another example, consumer goods companies must advertise to keep selling their products. But much of the advertising goes towards switching brands, not new consumers for the category. If the companies could coordinate to reduce brand advertising, their profits would increase. Indeed, when broadcast TV & radio advertising for cigarettes was banned in the US, profits rose.

³² The selection pressure at the group level must be high enough to override the selection level for selfish behaviour at the individual level. When taken to extremes, we have *The Major Transitions in Evolution* as set out by John Maynard Smith and Eors Szathmary in their 1997 book for Oxford University Press.

³³ Boehm, C., 1999. *Hierarchy in the forest: The Evolution of Egalitarian Behaviour*. Harvard University Press

³⁴ Snower, D.J., Wilson, D.S., 2022. *Rethinking the theoretical foundations of economics I – The multilevel paradigm*. Economics (e-journal). Draft manuscript for open review.

<https://drive.google.com/file/d/17mSkmb0nP1UNyrKE0LIN8-AfgD3DQGF4/view> accessed on 23-Aug-2023

In some instances, part of the advertising budget is devoted to the product category (through an industry association) in order to make the overall pie bigger. Eventually, all market products compete for a share of the wallet (a limited resource) through advertising which competes for a share of our attention (another limited resource).

Theft, rent-seeking, corruption

In all these cases, selfish entities are taking resources from others. From a public sector perspective, these losses often reduce public resources that impact a large group, while the resources of a few increases.

Waste

Accounting treats wasting assets as those that reduce in value over time. A related meaning of waste is something unwanted or unusable. Waste is in the eye of the beholder. From the perspective of an individual rice or wheat plant, using resources to grow tall to capture more sunlight is important for survival and reproduction. From the perspective of the modern farmer, this is a waste of resources: a field of dwarf plants that grow quicker and produce more seeds is preferable. However, a traditional farmer may prefer the taller plants for the hay they produce, useful to keep livestock alive in winter.

Warren Buffett said: *'[Gold] gets dug out of the ground in Africa, or someplace. Then we melt it down, dig another hole, bury it again and pay people to stand around guarding it. It has no utility.'* The women of China and India would disagree: gold is a dense store of wealth that is easy to hide and transport.

In general, waste is when resources are not utilized towards the essential goals of the system, primary of which are survival (& reproduction).

Resources are needed to suppress these problems

Each system must find ways to limit waste from competition among lower-level systems, principal-agent problems, theft, rent-seeking, corruption, coordination failures, etc. Laws, norms, standards, police, metrics & reports, independent audits, benchmarking are all used partly for this reason.

Although the biosphere and humanity follow natural law, we can see these measures at the level of civilization and below. For example, international law makes the wartime theft of natural resources (pillage) an international war crime. Similarly, environmental damage (deliberate poisoning of wells or salting fields) is also an international war crime.

Resources must be diverted to minimize waste or losses caused by these problems. From the perspective of the higher-level system, this is yet another form of wasted resources. In business terms, this is the overhead. The Japanese system of quality management, Kaizen, revolves

around minimizing waste.³⁵ For society, an example is resources devoted by entities of all kinds to developing the rules of the game (laws, standards, etc.) and ensuring they are followed.

As we shall see in the next section, the survival imperative, competition and multi-level selection lead to systems having multiple goals. These goals could conflict with each other, as well as conflict with the goals of other system levels. The addition of well-being / progress / development as goals further complicates the situation.

System goals and the public sector

As discussed earlier, from a public sector standpoint, we are interested in the sustenance of the public sector unit, its higher-level aggregates, as well as the sustenance of the relevant sub-national entity or nation, and more importantly, sustenance of civilization, humanity and the biosphere as functioning systems. How does this translate into real-life goals? What about other goals such as progress and development?

What is the goal of the nation?

The purpose of sustainability disclosures by the public sector is related to the question of the long-term survival of the nation & civilization, threatened by the climate breakdown and other sustainability crises. Let us examine three different national goals, survival, output during war and well-being.

Survival

As discussed earlier, the Survival Imperative encourages the growth of capital. Savings invested in productive assets (as opposed to gold reserves) increases the total national output.

There is little discussion of what is the minimum required for national survival. As we have seen, for nations, territory, natural resources and social institutions are very important, as is the survival of a certain number of the individuals making up the nation. The equivalent question for individual humans is how far can we starve ourselves and still recover. For the species, this is the minimum viable population, currently estimated at around 2,500-5,000 individuals.³⁶ It is important to understand that if humanity were reduced to 5,000 individuals, the cultural inheritance would be largely destroyed. Humanity would probably restart at the hunter-gatherer phase and slowly innovate and learn to revive civilization.

Capital Maintenance & Sustainability

National Wealth and Net National Income (NNI) are key metrics to observe from a conventional sustainability standpoint – capital maintenance. However, measuring national wealth is very

³⁵ See Six Sigma US, 2017. Kaizen: Eliminate Waste and Improve Your Project. [Kaizen: Eliminate Waste and Improve Your Project - SixSigma.us \(Gsigma.us\)](https://www.sixsigma.us/kaizen-eliminate-waste-and-improve-your-project) accessed on 24-Aug-2022

³⁶ Bradshaw, C., 2018. Why populations can't be saved by a single breeding pair. Phys.Org. <https://phys.org/news/2018-03-populations-pair.html> accessed on 24-Aug-2022

hard. Even measuring the consumption of capital (losses, depreciation, etc.) is difficult. Changes in national wealth may be easier to measure.

NNI only accounts for consumption of produced capital in the production process (loss, depreciation, etc.). It was observed that in the production process, many natural resources were also being depleted – oil, gas, minerals & groundwater; forests clear-cut; species like the passenger pigeon hunted to extinction;³⁷ topsoil; pollution of fresh water sources; the ocean; SO_x in the atmosphere; the ozone layer; and now greenhouse gases in the atmosphere. The field of green / natural capital accounting and the UN System of Environmental-Ecological Accounting (UN-SEEA) was developed. The World Bank has been publishing estimates of “adjusted net savings” through its Changing Wealth of Nations series, which attempts to adjust national savings for the impact of these aspects – capital maintenance requires national savings to be at least zero, not negative.

Maximum potential war output

Having a reasonable assessment of the ability of a nation to wage war was always important. At the time of World War 2, Simon Kuznet started a systematic exercise to measure the potential output of the nation in a war effort. In war, all resources are mobilized, and the goal is to maximize national output.³⁸ The Gross Domestic Product (GDP) was the key output variable. It is worth pointing out that national wealth was not the focus, because not all of the national wealth can be rapidly mobilized towards war. Minerals in the ground may take a long time to extract. And in war, accumulated reserves would be consumed. Rebuilding capital would need to wait for peace time.

Aggregate well-being

The formation of modern republics without a sovereign changed the emphasis of governance towards the individuals making up the polity. Utilitarianism is the idea that the goal of the system should be to maximize the lifetime well-being of individuals across present and future generations, or cumulative well-being. The well-being of individuals is made comparable and commensurate by adopting money as a measure. However, a secondary goal is equal well-being across the individuals that make up the polity (equality).

Individual well-being is aggregated at different moments in time over the individuals alive at that point. This aggregated well-being at different points in time is aggregated to the present using [social] discount rates. Consumption leads to higher well-being. Capital and savings are simply deferred consumption.

The utilitarian framework then permits examination of alternative strategies to see which produces greater well-being aggregated over individuals and time. All of this assumes rational

³⁷ Hung, C.-H., et al, 2014. *Drastic population fluctuations explain the rapid extinction of the passenger pigeon*. Proc Natl Acad Sci USA Vol 111 No 29, 10636–10641

³⁸ This is in keeping with the perspective of Friedrich List, where the goal of a nation is what it produces, not what it consumes. <https://www.theatlantic.com/magazine/archive/1993/12/how-the-world-works/305854/>

humans, marginal prices in perfect competition, trade, perfect foresight, and continuous equations to achieve allocative efficiency at equilibrium and over time. Finally, redistribution by the government through the political process could enable equality of well-being – a key assumption of the Kaldor-Hicks Criterion used for Social Cost-Benefit Analysis.

If consumption creates well-being, Net National Income (NNI) is the relevant metric: the amount that can be consumed or saved for deferred consumption, after maintaining capital. (In a war, foreign-owned domestic assets can be nationalized or expropriated and so can domestically owned foreign assets by those countries, so GDP is a more appropriate measure.)

Competition for survival vs Well-being

Utilitarianism seems to neatly connect maximizing war output with maximizing well-being through the equation:

$$\text{Gross Output} = \text{Consumption} + \text{Savings} = \text{Consumption} + \text{Deferred Consumption}$$

The conclusion drawn is that higher output will eventually result in higher potential war output and higher well-being. This is of course true in many cases. But not all, and the difference is important.

We can decompose GDP (or NNI) as population x per person output (net income). Increasing either population or the output per person increases war-making capability. Even an increase in population with a smaller reduction in output per person may increase war-making capacity. Indeed, populations of agricultural societies were more numerous but physically weaker compared to hunter-gatherers, whom they have gradually replaced across the planet. The industrial revolution in Britain was marked by a similar dynamic - a larger population of workers with poorer health compared to farmers. From a well-being standpoint, it would seem perverse to reduce standards of living so that there are more miserable individuals alive, increasing aggregate well-being.

Maximizing output also requires using resource efficiently. During the colonization of America and Australia, the doctrines of *vacuum domicilium* (devoid of inhabitants) and *terra nullius* (territory without a master) were used to dispossess the original inhabitants of their lands on efficiency grounds. Eminent domain is usually justified on grounds of the greater good, often development, which eventually translates into enabling greater output.

As Henry George argued, taxes on land have the effect of pushing them to optimal use – leaving land fallow or unused was expensive.³⁹ In agricultural societies, this meant a larger crop, which eventually supported a larger population, while the ruler had access to food to feed an army or build pyramids in the non-growing seasons. Note, however, that raising a land value tax

³⁹ The farmer would have to work harder, presumably reducing their well-being. However, aggregate output would increase. George, H., 1879. *Progress and Poverty: An Inquiry into the Cause of Industrial Depressions and of Increase of Want with Increase of Wealth: The Remedy*. New York: D. Appleton & Company.

increases the output but simultaneously reduces the exchange value of the land (it does not change the intrinsic value of the land). In contemporary societies, the need for money to pay for essentials also functions as a tax – something needs to be exchanged to acquire money to pay for say cellphone service, unlike a self-sufficient hunter-gatherer, herdsman or farmer who could barter⁴⁰.

People need [to] work

As Bertrand Russell eloquently pointed out in his 1935 essay, *In Praise of Idleness*, we can greatly increase well-being by reducing working hours.⁴¹ In the distant past, in many parts of the world, humans worked for short hours in the day, not around the year. Often this was determined by the environment they lived in. The Arctic has a short growing / hunting season when effort may be intense, but the winter did not permit much activity. Before lighting became cheap, dark hours were largely free of effort. If short hours of work were sufficient in prehistoric times, surely we are much more productive and even less time needs to be expended on work? That would increase free time enabling self-actualization, undoubtedly an improvement to aggregate well-being.

In most societies, there is a social norm to work, which attaches guilt to those who do not.⁴² The idle mind is the devil's workshop. And there are many pejorative terms for those who do not – lazy, idle, slacker, lotus eaters, welfare queens. Distractions such as the TV, video games and social media are frowned upon. There are strong social and even legal restrictions on certain kinds of individual pleasure that may reduce motivation and aggregate social output, e.g., alcohol, opium & marijuana.

A simple explanation for such well-being-reducing social norms is that the higher-level systems – family to nation – are concerned about growing both potential output as well as capital to better survive. And historically, lazy groups would have been wiped out in conflict with groups that had a social norm to work hard.

The imperative to have children; contraception, abortion, suicide

The final route to increasing output and improving chances of survival is to increase the population. Consequently, we find norms to have children, and norms against contraception, abortion, suicide and murder. Higher-level systems could adopt these norms to better compete.

Capital – consume, maintain or grow?

If we measure capital using a social discount rate, it is implicit that the national and public sector net worth should grow by at least the social discount rate, not simply stay constant (unless the

⁴⁰ Except for extreme situations, it is unlikely that mobile telephony companies would barter with farmers in exchange for their services

⁴¹ Russell, B. (1935). *In praise of idleness*. Unwin.

⁴² Roex, K.L.A., Rözer, J.J. *The Social Norm to Work and the Well-Being of the Short- and Long-Term Unemployed*. Soc Indic Res 139, 1037–1064 (2018). <https://doi.org/10.1007/s11205-017-1723-0>

social discount rate is zero). Unfortunately, except for a handful of nations, this is not a government or national objective.

If capital is considered deferred consumption, maximization of consumption implies the eventual consumption of inherited capital, with all planetary resources fully consumed at the instant when humans go extinct. The fundamental dynamic doesn't change even if knowledge tends to accumulate - future generations will be able to produce the same output from an ever-diminishing set of resources until it is all over – both resources and humanity. This is a circular argument: If all resources are depleted, humans will go extinct.

How much capital can we consume today? Milton Friedman's famous Permanent Income Hypothesis (PIH) was that individuals increase consumption only when they perceive an increase in wealth / income is permanent.⁴³ However, at the end of life, the capital would be fully consumed. When starting off with inherited capital, the risk of self-serving estimates of maximum sustainable consumption by the present generation is obviously very high. Higher estimates of sustainable capital consumption bring forward the day when the inherited capital is consumed.

The ongoing consumption of capital suggested by the PIH (& utilitarianism) is directly opposed to the survival imperative to grow capital. Indeed, we can see that individuals save for the future and die with large estates, and most nations are getting richer over time, not poorer.

The sustainable standard of capital maintenance (known in fiscal policy as the Bird-in-Hand rule) lies between the PIH on capital consumption and growth in capital for improving survival.

Capital maintenance benefits from simplicity and parsimony as a rule of thumb. It requires monitoring of the starting amount and the changes. If capital is to be maintained, it must be protected against theft, waste, loss, or consumption. If our children have higher income and are richer than we are, we are happy, not morally outraged. The family name will continue for longer, and may bring greater renown in the future. And our genes are more likely to survive and reproduce.

Production Boundary

A question that has been hotly contested is what counts as productive output. As discussed earlier, the answer depends both on the perspective taken (which system) as well as whether we are measuring well-being or survival capability. In *The Value of Everything* (2018), Marianna Mazzucato sets out how various people have answered this question:⁴⁴

⁴³ Friedman, M., 1957. *The Permanent Income Hypothesis*. In *A Theory of the Consumption Function* (Princeton: Princeton University Press, 1957), Chapter III, pp 20-37

⁴⁴ Mazzucato, M. (2018). *The value of everything: Making and taking in the global economy*. Hachette UK.

| Who | Included in output | Excluded |
|---------------------|---|--|
| Sir William Petty | Agriculture, merchants, artisans | Lords, clergy, civil servants |
| Gregory King | Agriculture, merchants, artisans, lords, clergy, civil servants | Seamen or soldiers |
| François Quesnay | Primary sector only | Secondary, tertiary, household or government sectors |
| Adam Smith | Primary sector + manufacturing / secondary | Tertiary sector |
| Karl Marx | Primary sector, production sphere, circulation sphere | Household, government |
| Arthur Cecil Pigou | Paid things which increase welfare | |
| Simon Kuznets | Paid things and even unpaid labour of house wives | Government, inflated cost of modern living |
| John Maynard Keynes | How to pay for the war, government is part of the output | |

These variations are fundamentally due to different perspectives and different questions being answered from those perspectives. In an approximate sense, for survival in a semi-autarkic situation, the primary sector (agriculture, forestry, fisheries, mining) is essential – e.g., Cuba over the last 60 years. In order to wage war, parts of the secondary sector (construction, manufacturing, electricity, gas, water & other utilities) as well as of the tertiary sector (education, healthcare, travel, trade, transport, and communication) are required in addition to the primary sector. For well-being, other aspects are valuable such as the tourism or entertainment industries.

Within nations, corporations spend money on advertising, like peacocks attracting mates. While this is essential for the corporation survival, from the standpoint of the nation, much of it is waste. Similarly, expenditure on the military helps nations survive, but from the standpoint of civilization, much of it is a waste of scarce resources.

If we measure the capital required to generate this productive output sustainably, we would find similar variations in what capital would be included depending on which system-level perspective is being taken and what question is being asked (survival, peak war output, well-being, sustainable development, etc.)

Goals of the national public sector

The previous discussion was focused on the national goals. While the public sector of a nation owns only a subset of property, as the sovereign has the right to tax and even acquire / expropriate private property, the nation and its public sector are strongly connected.

The optimum size of the government is hotly disputed across the economic and political spectrums. Whether capital maintenance is even an objective isn't obvious. For the longest time, the IMF was only concerned about public sector debt to avoid global systemic financial crises. And governments around the world are deeply in debt.

Traditionally, nations were run by sovereign rulers, often claiming to be descendants or representatives of the Gods. As Margaret Levi has argued in *Of Rule and Revenue*, the central goal of a ruler is to retain power.⁴⁵ And a key tool in that quest was 'revenue', essentially all cash inflows into the treasury other than debt. Rulers need revenue to survive. The larger the "revenue", the more the ruler could spend.

"The international resource privilege (IRP) is the power to transfer ownership or freely dispose of the natural resources of a country by the authority that countries give to the current leadership or government of that country".⁴⁶ The IRP enables rulers to sell off natural resources and treat the sale proceeds as 'revenue' of the government, in essence selling off wealth and consuming the sale proceeds to retain power. We are familiar with oil autocrats. Similarly, the international borrowing privilege (IBP) enables rulers to take on debt that future citizens/residents would have to repay.

The historical record indicates that the need for tax revenue led to the development of fundamental technologies such as geometry to conduct land surveys, recordkeeping (Waymire & Basu, 2007) and auditing. Improving the measurement of the revenue base was helpful – the Domesday Book from 1086 AD is a famous example. In his book, *The Reckoning*, Jacob Soll shows the importance of accurate and transparent public sector accounts in European nations over the 15-19th centuries for gaining and retaining power.⁴⁷

Public sector accounts were usually cash-based single-entry systems with no measurement of public sector net worth. Put differently, capital maintenance for the survival of the nation / public sector was not an important consideration – survival of the ruler was the overriding goal. A classic principal-agent problem. Even today, few nations report a public sector balance sheet, and even fewer focus on the public sector net worth.

⁴⁵ [Of Rule and Revenue by Margaret Levi - Paperback - University of California Press \(ucpress.edu\)](#)

⁴⁶ [The International Resource Privilege - Wikipedia](#)

⁴⁷ Soll, J., 2014. *The Reckoning: Financial Accountability and the Rise and Fall of Nations*. Penguin.

For the public sector, IPSASB is promoting accrual accounting. Further, IMF has a new focus on measuring the [intertemporal] public sector net worth. And IPSASB has a Consultation Paper for a new set of standards on Natural Resources for the public sector.

Goals & measures of higher-level systems

In earlier sections, we discussed the national goals and the measures that have been developed. We also examined how the public sector's goal has so far been somewhat indeterminate in theory, but the rulers have clear goals – “revenue”. With this perspective, let us examine higher-level systems.

We are all familiar with large corporations, which have multiple business divisions, operating in multiple jurisdictions through multiple legal entities, which in turn may have factories and a variety of staff functions. From an accounting perspective, we consolidate accounts from each of these lower-level units. In that process, there are transactions among units that need to be cancelled out to arrive at the correct measure of the aggregate. In a similar manner, higher-level systems are comprised of lower-level systems, and issues of consolidation arise.

Biosphere

In our hierarchy of systems, the highest level is the biosphere. From the perspective of the biosphere, we seem to be triggering a sixth mass extinction event. However, the biosphere tends to eventually bounce back, even if it takes 20 million years. Sterilizing the planet (hothouse earth) would be extremely difficult, as life exists in great quantity at the bottom of the ocean and at great depths underground.⁴⁸ It would seem we do not need measures of survival for the biosphere.

If we consider the incipient theory of the rights of nature, one aspect of which is integrity, then it is clear that we are diminishing the biosphere greatly. Great rivers have become open drains. It is worth pointing out that capital other than natural resources, i.e., produced, human, knowledge, and social capital is essentially of zero value to the biosphere. Arguably, they are of negative value – for example, roads are fragmenting the amazon forest, diminishing biodiversity. We are a cancer that is not yet life-threatening.

From a biosphere well-being standpoint, output could be measured in how much solar energy is captured and used.⁴⁹ There are a growing number of other species that are recognized to have language and culture, including orangutans, crows, elephants, whales, bottlenose dolphins, killer whales, great white sharks, and octopi. There is a trend towards recognizing their personhood, and recognition of their rights (including well-being) has begun, notably with some dolphins.

⁴⁸ [Life in Deep Earth Totals 15 to 23 Billion Tonnes of Carbon—Hundreds of Times More than Humans | Deep Carbon Observatory](#)

⁴⁹ A commentor correctly points out that there are numerous living organisms that rely on geothermal energy at hydrothermal vents, and recently life has been found at deep sea methane vents. The general point is the capture of energy.

Humanity

From a survival perspective, threats to humanity include supervolcanos, synthetic biology and artificial intelligence.

Genetics show that humans successfully went through a genetic bottleneck around 70,000 years ago when the population dropped to around 3-10,000 individuals.⁵⁰ The resources required to support this population base represent the minimum survival threshold for humanity. In the absence of a competitor species on the Earth, extraterrestrial aliens or sentient artificial intelligence, there is no requirement to measure potential peak war output. (This may have been relevant when the Neanderthals were a competitor species.)

From the perspective of humanity, money as a yardstick is meaningless. Capital is then best measured in physical terms and not treated as infinitely substitutable.⁵¹ Well-being would be measured in terms of fulfilling basic needs, as well as the capabilities / opportunities provided to individuals.

Civilization

International law sees humans as stewards over the entire planet, holding it in trust for future generations. Recognition of property rights or stewardship responsibilities of other species and trade with them are yet to be recognized.⁵² At the civilization level, we have already crossed four planetary boundaries (extinction rate, nitrogen and phosphorus fluxes, and climate change) and are at risk with one more (ocean acidification). We have also successfully dealt with the threat to the ozone layer through the Montreal Protocol. There are man-made risks like AI, synthetic biology, and nuclear war that can threaten civilization.

Civilization represents a level of complexity greater than that of nations. The continuation of civilization requires both the presence of a significant number of individuals as well as much of the knowledge. When civilizations collapse, populations drop, overall complexity of life reduces, and technologies are lost. We have only just rediscovered how the Romans made concrete resistant to the sea.⁵³

Civilizational subgroups can compete with each other – arguably, this is underway at this moment among different alliances of nations. No doubt, each alliance is estimating its potential peak conventional war output and that of their opponents. Hopefully nuclear war is off the table. Current events have shown the importance during war of the primary sectors of the economy (agriculture, oil, gas & minerals) as well as the industrial sector (for weapons).

⁵⁰ [Toba catastrophe theory - Wikipedia](#)

⁵¹ Historically, there have been societies with a sacred money, which was used only in certain circumstances. An example are [Rai stones - Wikipedia](#). If something is sacred, it is not comparable to the normal.

⁵² [Trade among species of animals](#) has been documented. Humans are responsible for the incredible success of species such as grass, corn, wheat, potatoes, dogs, cats, cattle, etc. A few of these relationships can be seen as trades – we spread corn around the world, in exchange for eating most of their seeds.

⁵³ [Roman concrete - Wikipedia](#)

For the goals of sustainability & maximizing well-being, we would need to measure capital first, then recurring output. If we draw up the accounts for civilization, we would encompass everything – natural resources, produced capital, human, social, knowledge capitals. In this frame,

Civilization Wealth = Common Heritage of Humankind + Wealth of Nations

Deep sea minerals in international waters, Antarctica, the Moon and asteroids are all the Common Heritage of Humankind. Not all national wealth is relevant to civilizational wealth. For example, nuclear weapons are a liability for civilization, not an asset. Since debt is owed to someone else within civilization, it cancels out during consolidation of accounts.

Consider the value of the global commons. The single most valuable asteroid, Davida, contains minerals whose value at current prices is US\$ 26,990 trillion⁵⁴. By comparison, the most optimistic estimates of the wealth of all nations put together does not exceed US\$1,000 trillion. Of course, if Davida were brought down to Earth, presumably prices of these minerals will collapse approaching zero (unless all minerals in the universe, including asteroids, are managed as a global monopoly).

It brings to the fore the issue that the wealth of civilization / humanity is much much greater than the wealth of all nations put together. Public wealth includes the ocean, the atmosphere, outer space, electromagnetic spectrum, ozone layer and much else of intrinsic value far in excess of private wealth. For most of these, if they did not exist, there would not be humans and private wealth will be zero. Similarly, for most nations, the resources controlled by the government such as land, fresh water, and much else would have far greater value than private wealth. Vast amounts of the capital are not “productive”. Asteroid Davida is not productive. All the gold in Fort Knox is just sitting there.

From the perspective of political economy, as Jean Baptiste Say pointed out, natural wealth, while very valuable, unless exchangeable, could not impact politics. We can think of a large calm lake of water like Lake Superior (total wealth) where minor ripples of water (private wealth) are all that is of consequence - the vastness of the lake is of no consequence (the public wealth).⁵⁵

A number of these great planetary commons are treated as open access free gifts from God and are being plundered. This is the familiar tragedy of the commons. Economics theory tells us that greater value is achieved if they were managed as a public monopoly, especially from the perspective of future generations. From an accounting standpoint, it is an intriguing issue. If the planetary commons are treated as open access resources, their price is zero and so their value is zero. If somewhat regulated like minerals which are open access in exchange for royalties, then

⁵⁴ [The Colossal Untapped Value Of Asteroids | Statista](#)

⁵⁵ Nitzan & Bichler make a similar point in *Capital as Power*. <https://www.routledge.com/Capital-as-Power-A-Study-of-Order-and-Creorder/Nitzan-Bichler/p/book/9780415496803>

that becomes the price and value is derived accordingly. However, if the global commons were managed as an intergenerational monopoly, then the price & value is indeterminate in current economic theory, but certainly higher than zero or the royalty case.

It is worth pointing out that when someone or a nation encloses part of a global commons for less than its true value, it is an unfair transfer of wealth to the encloser, with every human losing equally. Examples include the expansion of the exclusive economic zones under UNCLOS (where states without a coast lost completely) and whaling bringing some species to the brink of extinction despite the CITES treaty and the International Whaling Commission. While public wealth of civilization diminishes, this is often coded by the encloser as capital gains, implying private / national income increases. However, since it is coded by the encloser as income, it has a higher propensity to be consumed (as opposed to it remaining public wealth), leading to an overall reduction in capital.

As far as output and well-being is concerned, we can estimate a Net Civilizational Income. This would be a consolidation of net national incomes and any income flows from the global commons. Again, we would find certain kinds of national positive output to be excluded from net civilizational income.

At the civilization level, the UN and multilateral agencies constitute the public sector. For example, the International Seabed Authority (ISA) manages deep sea minerals in international waters on behalf of humankind (not as a sovereign). Ideally, they would establish appropriate structures to manage intergenerational inheritance. However, the incentives for the ISA are similar to those of rulers - to liquidate the deep-sea minerals quickly and use the sale proceeds to stay in charge.

Perspectives change with system level

It is important to understand that different system levels value capital differently. In general, natural resources are more important for the highest-level systems (e.g., humanity & the biosphere), while human-created capital, especially social knowledge & institutions, is more important at lower levels (individuals, families, tribes, nations).

Competition at lower levels can result in a waste of resources from the perspective of higher levels. For example, nations find it useful to have weapons, they improve the chance of national survival. But from the perspective of civilization, weapons are a waste of resources, threatening survival.⁵⁶

A number of debates can be understood as a confusion between different system perspectives.

⁵⁶ Weapons development has had many kinds of spin-off benefits in terms of new technologies, but increasing knowledge capital isn't the primary goal of weapons development & manufacturing.

Strong versus Weak Sustainability

In the literature on sustainability of natural resources, proponents of “strong sustainability” argue that natural resources cannot be substituted by other forms of capital (human, produced, social, etc). On the other hand, proponents of “weak sustainability” argue that except for the category of critical natural capital (e.g., the ozone layer), natural resources can be substituted by other forms of capital. As a practical matter, we can sell off land and use the sale proceeds to buy an education or a car.

This debate is perhaps a difference in perspective. The biosphere is largely unconcerned about anything other than natural resources. Only strong sustainability makes sense. From the perspective of human civilization, much of natural capital, social and knowledge capital are crucial. However, most produced and human capital is important. While some empires and nations have collapsed due to destruction of their natural resource base, in general, human and produced capital takes on greater importance, and substitution between forms of capital more conceivable.

Social discount rate

The long debate between a zero social discount rate and a positive social discount rate is perhaps again fundamentally a difference in the perspective of systems. From the standpoint of individuals, or artificial systems like companies and nations, a positive discount rate is logical. In the short run, growth is a means for survival.

Seen from the standpoint of humanity or civilization, a zero discount rate is logical – the well-being of future generations is not different in value from ours, just as our well-being today is not different in value from our well-being in the past, or the well-being of our ancestors. If we value well-being the same regardless of when, then we in the present are surely better off than most of our ancestors.

A positive discount rate will accelerate the depletion of natural resources – extracting today is always better than extracting tomorrow. This goes against survival. From a systems standpoint, the higher-level system must prevail, as otherwise it will not survive. Hence, the higher the system, the lower the discount rate, with a zero social discount rate at civilization and higher levels.

Interest rates are the opposite side of discount rates. In many ancient societies, demanding more than the principal amount in repayment of loans (usury) was banned. This was supported by most significant thinkers like Plato, Aristotle, Cato, and Cicero. A key reason is that allowing the charging of interest could increase inequality, leading to lower group solidarity, endangering the group.⁵⁷ From a society / civilization standpoint, banning usury improves cooperation and group survival.

⁵⁷ Interest could increase inequality, leading to lower group solidarity, endangering the group. See Wikipedia on Usury. <https://en.wikipedia.org/wiki/Usury> accessed on 24-Aug-2022

The neo-classical utilitarianism framework (discussed below) is particularly appealing to economists because mathematically it becomes possible to directly add utilities to arrive at the aggregate.⁵⁸ Note that when we aggregate utilities over all future generations, unless the social discount rate is positive, we encounter infinite sums. This is an additional reason economists insist on positive social discount rates. Similarly, accountants estimate values of many assets based on discounting future flows; when these are perpetual flows, a positive discount rate is required to avoid infinite asset values.

Sustainable Development as a civilizational goal

Sustainable development is different from Sustainability as capital maintenance. A static system can be sustainable without development – much of human pre-history seems to be of this nature. Development presumably implies higher output leading to higher consumption leading to higher well-being. Development creates new demands on the system in which it is embedded. Consequently, if survival is the overriding goal, being sustainable comes before contemplating development. In this understanding of sustainable development, first be sustainable (maintain capital), and then, if possible, develop. If humans have actually crossed four planetary boundaries, it would seem that we are already unsustainable, and further development by growth may not be feasible, although redistributive development may still be feasible.⁵⁹

In 1987, the United Nations Brundtland Commission (a.k.a. World Commission on Environment and Development) defined Sustainable Development as “*meeting the needs of the present without compromising the ability of future generations to meet their own needs.*” This definition is framed in terms of desired consumption (development), not in terms of conserving capital (sustainable). It assumes that the “needs of the present” can be met in a sustainable manner. Needs are fuzzy – does everyone on the planet need the same standard of living as the average American? The Global Footprint Network estimates that it would require 5.1 planet Earths to achieve that level of consumption sustainably.⁶⁰ As Mahatma Gandhi said, “*The world has enough for everyone's needs, but not everyone's greed.*”

In substance, the Brundtland Commission definition requires consumption (needs of the present) to be maximized to the point where consumption by future generations is under threat. If the resource base is not impacted, it results in equating maximum consumption across generations, thereby maximizing aggregate well-being. This is utilitarianism in another garb.

It is unfortunate that the term Sustainable Development has in effect been hijacked by this definition. Regardless of which approach we adopt, an implicit critique is the treatment of natural resources within neo-classical economics as a free gift of nature, not as a shared inheritance which has value and to which future generations have an equitable claim. As remarked earlier, national accounting differentiates between natural capital and produced capital. Conventional accounting,

⁵⁸ Also ignoring pesky issues like Arrow's Impossibility Theorem.

https://en.wikipedia.org/wiki/Arrow%27s_impossibility_theorem accessed on 24-Aug-2022

⁵⁹ This is the central argument of the Degrowth community

⁶⁰ [How many Earths? How many countries? - Earth Overshoot Day](#) accessed on 28-Jun-2022

whose origins are for private enterprises with short time horizons, treats all types of capital the same, except for “non-wasting” assets not subject to depreciation.

Can the needs of the Present Generation be met sustainably?

In what direction should we direct our resources? Do we prioritize? At the level of civilization, it would seem that the first priority should go towards reduction of the threat of survival of civilization, humanity or the biosphere. This threat has been increasing in recent years. Presumably the first call on our resources should be towards the energy transition as well as where we are already near or exceeding other planetary boundaries.⁶¹

The second priority should go towards meeting the basic needs of the present while still being sustainable. What are these needs? According to Coote & Percy (2020), there are basic needs or capabilities such as affiliation, bodily integrity and practical reason, or health and critical autonomy.⁶² In order to satisfy these needs, the means are “*listed by need theorists as water, nutrition, shelter, secure and non-threatening work, education, health care, security in childhood, significant primary relationships, physical and economic security, and a safe environment.*” Needs can change. “*access to motorized transport and to information and communication can be added to the list.*” The Living Well Within Limits (LiLi) project is examining “*If remaining within planetary boundaries requires rapid decreases in resource & energy use, how could these scarce resources best be employed to enhance and preserve well-being?*”⁶³

Argued from a well-being perspective, any change to economic / social arrangement is justified only if it improves [aggregate] well-being. Increasing well-being is met by increasing consumption, which requires economic growth. Marshall Sahlins wrote about the original affluent society.⁶⁴ People who worked for perhaps 4-5 hours a day, enjoyed great health as evidenced by their height and lack of apparent disease, enjoyed fresh water, organic food, and much else, while being able to spend the rest of the time as they felt – play, even with political structures as suggested by Graeber & Wengrow⁶⁵, contemplation, arts & crafts, and of course mock war games. Yes, many were injured or killed due to conflict between groups, but surely we have since learned a lot about cooperating in bigger groups (as well as how to create conflicts between peaceful groups). Can achieving a comparable level of affluence be a reasonable goal for society (in second priority after sustainability)?

⁶¹ According to the Stockholm Resilience Centre, we have exceeded planetary boundaries for biodiversity integrity (extinction rate), land-system change, nitrogen and phosphorus flows and climate change, while we are at risk with ocean acidification. [The Nine Planetary Boundaries](#) accessed on 28-Jun-2022.

⁶² Coote, A., Percy, A., 2020. *The case for Universal Basic Services*. Polity Books

⁶³ [Living Well Within Limits project](#), accessed on 28-Jun-2022

⁶⁴ Sahlins, M., 1972. *The Original Affluent Society*. In *Stone Age Economics*. Aldine de Gruyter, 1972, pg 5-41

⁶⁵ Graeber, D., & Wengrow, D. (2021). *The dawn of everything: A new history of humanity*. Farrar, Straus, & Giroux.

Sustainable Development Goals (SDGs)

It seems that the Sustainable Development Goals are intended to encompass the first two priorities. The third priority for any residual sustainable output would be towards increasing knowledge and meeting other needs such as private jets and space tourism. Unfortunately, research suggests that the SDGs in total would not achieve sustainable development or even be sustainable.⁶⁶

Goals of systems

In conclusion, public sector units have to keep in mind multiple conflicting goals of multiple levels in mind, even when considering only sustainability is considered. When we add in well-being / progress / development, we get a further set of conflicting goals. Measures also change. In the following section, we look at various issues when developing measures of sustainability for various systems and the public sector.

Measures of sustainability

The origins of record-keeping and accounting lie in the public sector. However, double-entry bookkeeping and accrual accounting were developed in the private sector. When we examine its extension to the public sector, which has much longer perspectives, a number of issues arise.

Value of Capital

There is a long-standing recognition of the difference between intrinsic or use value and exchange value. Clean air may well be free (zero exchange value), but its use value for any individual is infinite – we can perhaps live for 30 minutes without taking a breath.

In accounting, there are other value measures used such as the cost of acquisition of the asset or the replacement cost of the asset. However, there has been a recent trend towards using the exchange value of the asset over other measures. In addition, there has been a longer trend towards measuring the value of an asset as a discounted stream of income, again valued at the margin. Utilitarianism is the bedrock when we value assets & liabilities for accounting purposes.

Utilitarianism, marginal prices & neoclassical economics

The mainstream methodology for valuation of capital derives from the marginal revolution developed into neo-classical economics (along with utilitarianism). The marginal revolution is based on the idea of tiny changes in the supply or demand of a good in a marketplace at equilibrium with an enormous number of small competing buyers and sellers. The current price at the margin of a good is then used to arrive at the value of the totality of that good. For example, if one apple is bought at the margin at \$1, then all (similar) apples are valued the same. This is the exchange value.

⁶⁶ Hicckel, J., 2019. *The contradiction of the sustainable development goals: Growth versus ecology on a finite planet*. Sustainable Development. 2019;1–12.

As discussed, the utilitarianism framework is particularly appealing to economists because mathematically it becomes possible to directly add utilities to arrive at the aggregate. It connects the micro (individual) to the aggregate (family) and macro (nation, civilization). Fundamentally, each entity optimizes its expected utility from the choices before it. Then the whole neoclassical economic framework suggests that we arrive at marginal prices, equilibrium, Pareto optimality, etc.

The critiques of the absurd assumptions of utilitarianism are many – though Milton Friedman famously argued that “*theory is to be judged by its predictive power for the class of phenomena which it is intended to "explain,"*” not on whether its assumptions are realistic.⁶⁷ In many arenas, utilitarianism does seem to work, especially when reality is closer to the assumptions. However, as the scale enlarges – marginal to aggregate, infinitesimal time to long time, perfect competition to monopoly, this framework diverges more and more from reality.

Paradoxes of value

The Lauderdale Paradox is pertinent to natural resources. Exchange value, which is used to measure private wealth, is present only when there’s scarcity, while natural resources can have enormous use value, even when abundant.⁶⁸ As Foster and Clark put it,

This paradox led Lauderdale to argue that increases in scarcity in such formerly abundant but necessary elements of life as air, water, and food would, if exchange values were then attached to them, enhance individual private riches, and indeed the riches of the country — conceived of as “the sum-total of individual riches” — but only at the expense of the common wealth. For example, if one could monopolize water that had previously been freely available by placing a fee on wells, the measured riches of the nation would be increased at the expense of the growing thirst of the population. ... The Lauderdale Paradox was nothing but an expression of this twofold aspect of wealth/value, which generated the contradiction between total public wealth (the sum of use values) and the aggregation of private riches (the sum of exchange values). ... In line with Lauderdale, [David] Ricardo stressed that if water, or some other natural resource formerly freely available, acquired an exchange value due to the growth of absolute scarcity, there would be “an actual loss of wealth” reflecting the loss of natural use values — even with an increase of private riches.⁶⁹

Consider Polluter Pays liabilities, which may be prosecuted long after the event. Let’s consider carbon emissions. While there is a range of carbon prices bandied about, it is quite possible that if carbon emission permits are treated as a finite global common, then the price for the last few units will be astronomical. Does this mean that at this point in time, the loss & damages for historical emissions under the Polluter Pays principle should be valued at this astronomical

⁶⁷ Friedman, M., 1966. *The Methodology of Positive Economics*. In *Essays In Positive Economics* (Chicago: Univ. of Chicago Press, 1966), pp. 3-16, 30-43.

⁶⁸ Maitland, James, 6th Earl of Lauderdale, 1804, *An Inquiry into the Nature and Origin of Public Wealth and into the Means and Causes of its Increase*

⁶⁹ <https://monthlyreview.org/2009/11/01/the-paradox-of-wealth-capitalism-and-ecological-destruction/>

price? The overwhelming majority of carbon emissions have occurred after 1950, not at some distant time in the past. If we adopt long-term perspective, how do we understand the relationship between the current price and its evolution over time for depletable natural resources?

There is another paradox of value when we use marginal exchange values to value the total. The diamond-water paradox is that if water is vital to life while diamonds are not, why are diamonds more valuable than water?⁷⁰ The common answer is that the marginal value of diamonds is greater than the marginal value of water. However, the value of all water in aggregate is clearly far higher than the value of all diamonds in aggregate – one is essential to life, the other is not. Yet using marginal prices to measure the value of the total could arrive at completely different results. As Warren Buffett once commented,

*You could take all the gold that's ever been mined, and it would fill a cube 67 feet in each direction. For what it's worth at current gold prices, you could buy — not some — all of the farmland in the United States. Plus, you could buy 10 Exxon Mobils (XOM), plus have \$1 trillion of walking-around money. Or you could have a big cube of metal. Which would you take? Which is going to produce more value?*⁷¹

Governments impact both value and output

In his seminal book, *Progress and Poverty*, Henry George wrote “*Many things are commonly spoken of as wealth which in taking account of collective or general wealth cannot be considered as wealth at all. Such things have an exchange value...insomuch as they represent as between individuals, or between sets of individuals, the power of obtaining wealth; but they are not truly wealth [from a social standpoint], inasmuch as their increase or decrease does not affect the sum of wealth. Such are bonds, mortgages, promissory notes, bank bills, or other stipulations for the transfer of wealth. Such are slaves, whose value represents merely the power of one class to appropriate the earnings of another class. Such are lands, or other natural opportunities, the value of which is but the result of the acknowledgement in favor of certain persons of an exclusive right to their use, and which represents merely the power thus given to the owners to demand a share of the wealth produced by those who use them....By enactment of the sovereign political power debts might be canceled, slaves emancipated, and land resumed as the common property of the whole people, without the aggregate wealth being diminished by the value of a pinch of snuff, for what some would lose others would gain.*”⁷²

Discounting

Discount rates no longer work when we take a long-time perspective. The well-being of our children and future generations are no less than our well-being. If we take a very long-time perspective, then the optimal time to extract a depleting resource (like minerals) is far less

⁷⁰ https://en.wikipedia.org/wiki/Paradox_of_value

⁷¹ <https://www.forbes.com/sites/robertberger/2020/08/28/warren-buffetts-gold/?sh=4613b266a63a>

⁷² <https://monthlyreview.org/2009/11/01/the-paradox-of-wealth-capitalism-and-ecological-destruction/>

obvious. Clearly exploration and extraction technologies will be far superior. All minerals would be discovered and extracted at close to zero cost. At the same time, the value of a finite resource may be many times higher or lower – we have no idea what new uses may be found in future, nor do we have any idea of substitutes that may be developed. Interest rates, the converse of discounting, along with the treatment of mineral sale proceeds as “revenue”, accelerates extraction.

Markets, Information & Future Generations

Markets are useful for providing information on the “needs of the present” in terms of marginal prices reflecting willingness to pay. We have *laissez faire*, where individuals create incentives through exchange of goods with market prices to be more effective on the production side and improve well-being. However, when natural resources are concerned, we cannot incorporate the “needs of future generations” into price information – they cannot participate in the market.

While markets in perfect competition provide useful information, for goods with limited supply, economics suggests a monopoly / central allocation mechanism may result in a higher total value received for all the goods. This is the thinking behind cartels, the famous De Beers diamond monopoly or the Railroad Commission of Texas, which effectively controlled oil & gas supply and set the world price prior to OPEC.⁷³ In such cases, it is not clear what the market price represents in either capital maintenance terms or consumption utility terms.

Survival & utilitarian math

There is a mathematical flaw at the foundations of utilitarianism going back 300 years or more. Utilitarianism is flawed because it doesn't place individual survival first. Consider a game where you bet your life to play Russian Roulette⁷⁴ multiple times in succession. The reward for each round is large, say \$1 million, i.e., expected earnings \$833,333 (six chambers one bullet).⁷⁵ Losing even once is death. Playing multiple times makes death almost certain. This is an extreme example where expected utility fails.

Let's look at another example.⁷⁶ Suppose you face a 50:50 bet where your wealth increases 50% if you win, and if you lose, your wealth reduces 40%. With a starting wealth of 100, each of us can end up either at 150 or 60 with equal likelihood. Therefore, the expected value is $(150+60)/2 = 210/2 = 105$. So our expected utility is 105 and utilitarianism suggests you should accept this bet.

⁷³ [Railroad Commission of Texas - Wikipedia](#)

⁷⁴ https://en.wikipedia.org/wiki/Russian_roulette

⁷⁵ Even if we assume there is a disutility to death, we can make the reward for each round to take into account this disutility. For example, let's say the disutility to death is \$6 million, or an expected disutility of \$1 million each round. Then if each round pays off \$2 million, the expected utility is the same as the example. And multiple rounds will result in death.

⁷⁶ Peters, Ole., 2012. Time for a Change: Introducing irreversible time in economics. Gresham College website. <https://www.gresham.ac.uk/watch-now/time-change-introducing-irreversible-time-economics> accessed on 29-Jun-2022

What happens when this bet is repeated with multiple individuals many, many times? Does everyone become super rich? Surprisingly, no. It is true that when aggregated over everyone, the total wealth increases by 5% each round, headed to infinity. However, if we calculate the median outcome, the outcome for the individual in the middle of the distribution, it is actually bankruptcy. Most individuals become bankrupt, but a few become super-rich, so that the average across everyone is increasing while inequality is increasing as well.

To understand this, let us play a second round. Those who start at 150 reach 225 or 90. Those who start at 60 reach 90 or 36. The expected value is $(225+90+90+36)/4 = 441/4 = 110.25$. But if we look at the 4 individuals, who are individually at 36, 90, 90 & 225, now only 1 in 4 exceeds 100, their collective starting point. The most common outcome is 90, or a 10% reduction for each 2 rounds of this bet. When extended to infinity, this divergence is startling – the average across everyone rises, but the average individual is bankrupt (Figure 1). Individuals should not accept this sort of bet.

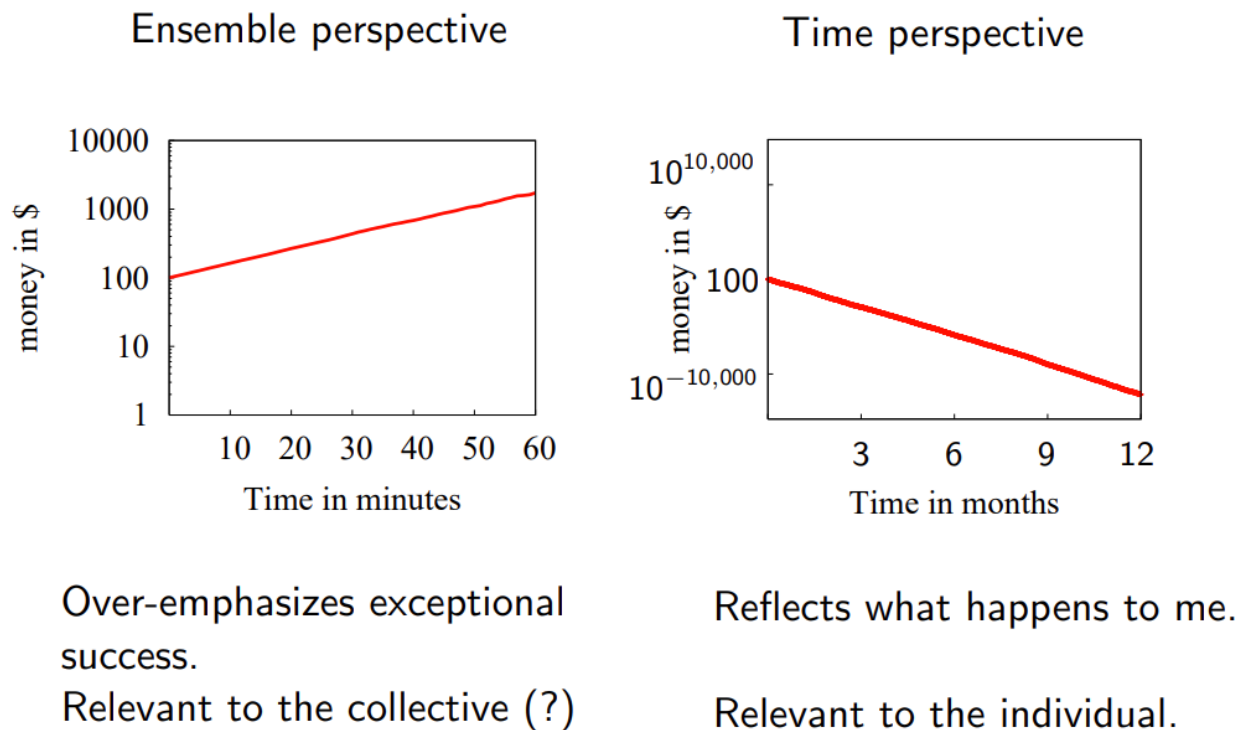


Figure 1: Slide 22 of Ole Peter's Time & Chance presentation at TEDx Goodenough College 2011. <https://sites.santafe.edu/~ole/20110318.pdf>

The field of Ergodicity Economics, led by Ole Peters, is working to correct this mathematical error in economics.⁷⁷ (It is worth noting however that the insurance industry and gamblers have been using the correct mathematics – their survival was at stake!) Their work is resulting in

⁷⁷ Peters, O., 2019. The Ergodicity Problem in Economics. *Nature Phys.* 15, 12, 1216-1221 <https://doi.org/10.1038/s41567-019-0732-0>

simple solutions to long standing mainstream (utilitarianism) economics puzzles such as why anyone cooperates⁷⁸, why is there an equity premium⁷⁹, why anyone buys insurance⁸⁰ among others. However, it seems unlikely that the ergodicity economics framework can be used to reconstruct the utilitarianism edifice – mathematically, it is fundamentally different.

IPSASB Consultation on Public Sector Sustainability Reporting

Based on an invitation by the authors of a World Bank report, *Sovereign Climate and Nature Reporting : Proposal for a Risks and Opportunities Disclosure Framework*, the IPSASB has commenced this project.⁸¹ As the report title makes clear, the concern is about sovereign reporting.

The IPSASB Consultation Paper, *Advancing Public Sector Sustainability Reporting* (the “CP”) argues that there is global public interest, major economic, environmental, social, and governance impact as well as capital markets significance for public sector sustainability reporting. The CP opens with the Brundtland Commission’s flawed definition of sustainable development. In effect, without any discussion, the CP treats sustainability as identical to sustainable development. The CP suggests the achieving the SDGs would suffice for “*attaining the ideal sustainable society by 2030*”. The CP recognizes climate change as an urgent issue. The CP argues that the public sector is of critical importance to sustainability as it is both owner/trustee of the majority of the wealth and can also set the rules of the game and enforce them as well.

While the CP recognizes that sustainable development is for the benefit of citizens, it then focuses on disclosures on sovereign bonds and argues that bond holders need standardized sustainability disclosures. The CP then quotes that World Bank report to the effect that standardized reporting is required for sovereign debt. Finally, the CP adopts the IFAC version of double materiality (Figure 2: IFAC Building Block Approach to Sustainability Reporting), indicating that the IPSASB would suggest “*general sustainability-related information and climate-related disclosures*”.⁸² In effect, this would not impact the public sector financial accounts & statements.

Unfortunately, the CP has a number of failings. The CP does not distinguish clearly between sustainability and sustainable development. The CP does not examine the Brundtland definition of sustainable development and its implications on capital maintenance. The CP does not

⁷⁸ <http://arxiv.org/abs/1506.03414>, also see farmersfable.org

⁷⁹ <http://arxiv.org/abs/1101.4548>

⁸⁰ <http://arxiv.org/abs/1507.04655>

⁸¹ [Sovereign Climate and Nature Reporting : Proposal for a Risks and Opportunities Disclosure Framework \(worldbank.org\)](http://www.worldbank.org), page VIII

⁸² [‘Double materiality’: what is it and why does it matter? - Grantham Research Institute on climate change and the environment \(lse.ac.uk\)](http://www.lse.ac.uk)

examine whether achieving the SDGs would achieve sustainability, sustainable development or the ideal sustainable society.⁸³

The CP asks a number of questions, which we will attempt to answer with the previous overview:

Preliminary View 1

The IPSASB's view is that there is a need for global public sector specific sustainability reporting guidance. Do you agree with the IPSASB's Preliminary View?

While the CP does mention “global” public sector sustainability reporting, the context seems to imply standards that would apply to all public sector institutional units globally, not a global or civilizational perspective. Further, the CP is not clear whose sustainability we are concerned about – a public sector unit, the national government as a whole, the nation, civilization, etc. Climate change raises issues of civilization survival, as well as the survival of many nations, most obviously Kiribati and Maldives, which may go under the waves with sea level rise.⁸⁴

The questions of sustainability as capital maintenance as well as sustainable development can be asked at the level of both civilization and nation states. For example, at the civilization level, re-homing the citizens of Kiribati and Maldives is a global responsibility, whose burden falls more on nations that have contributed to creating the problem and those who will benefit from a warmer climate. Similarly, plundering the global commons should be reported both by the manager of the commons as well as the nations / other entities doing the plundering. At the national level, Swiss Re estimates a fifth of countries are at risk of ecosystem collapse.⁸⁵

And while the CP does mention citizens, its focus on holders of sovereign debt as the consumers of the reports produced following standardized guidance is puzzling to say the least. Surely citizens should be the primary audience - governments are supposed to represent their interest. Any sustainability reporting should be aimed first at citizens. Holders of sovereign debt are either domestic or foreign. In cases where the sovereign does not issue overseas sovereign bonds (e.g., India), the major holders will be citizens. A 2016 study found that of 105 developing countries, only 52 had issued sovereign bonds.⁸⁶ Does this imply sustainability reporting from the other countries is immaterial?

Given that climate change is a civilizational problem, and civilization is hierarchically a higher-level system, we will assume that the first priority is public sector impacts on the survival, sustainability and well-being of civilization as a whole. At a second priority is the survival, sustainability and well-being of the nation concerned, or where appropriate, the Common

⁸³ Hickel, J., 2019. *The contradiction of the sustainable development goals: Growth versus ecology on a finite planet*. Sustainable Development. 2019;1–12.

⁸⁴ [Countries at risk of disappearing due to climate change \(activesustainability.com\)](https://activesustainability.com)

⁸⁵ <https://www.swissre.com/media/press-release/nr-20200923-biodiversity-and-ecosystems-services.html>

⁸⁶ Presbitero, A.F., et. al. 2016. Sovereign bonds in developing countries: Drivers of issuance and spreads. Review of Development Finance, Vol 6, No. 1, 1-15.

Heritage of Humankind.⁸⁷ And as discussed, survival is superior to sustainability as capital maintenance which is superior to well-being. And the disclosure covers both impacts on the nation / Common Heritage of Humankind, as well as impacts of the public sector unit on all these aspects.

The CP fails to discuss whether standardization so early in the evolution of sovereign sustainability reporting is prudent. As Waymire & Basu (2007) point out, “*Accounting is an economic institution whose recordkeeping origins are at least 10,000 years old ... Accounting, which classifies, aggregates, and summarizes business performance using a firm’s comprehensive transactional history, is only a few hundred years old. Even within this relatively short time, modern corporate accounting largely took shape with little explicit direction from formal standard-setters.*”⁸⁸

There is little reflection on whether standardisation of guidance at this point may even be counterproductive. As Waymire & Basu (2011) say “*Historical evidence and contemporary economic analyses indicate that corporate financial reporting plays a minor role in precipitating economic crises but might amplify them. Economic crises likely play a role similar to major shocks in biological environments by selecting accounting practices, accounting principles, firms and regulatory institutions for survival based on how well they adapt to post-crisis environments. Conscious attempts to improve accounting in the wake of crises, whether through market or political forces, may not prove as beneficial as hoped because we currently know far too little about the causes of economic crises or the consequences of abrupt changes to complex adaptive systems such as accounting.*”⁸⁹ It may be more prudent to allow experimentation in sustainability reporting guidance negotiated between investors, investment bankers and sovereign debt issuers before attempting to codify them.

It is not apparent that there is need for additional global public sector specific sustainability reporting guidance. At the national level, we have the UN-SEEA for accounting at the national level. We note that the SDGs indirectly require implementation of the UN-SEEA as this extract shows (underline emphasis ours).⁹⁰

Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

⁸⁷ For example, the International Seabed Authority (ISA), which manages deep seabed minerals in international waters on behalf of mankind. The ISA follows IPSAS for its accounting, but doesn’t report on the key asset it manages.

⁸⁸ Waymire G., Basu, S., 2007. Accounting is an Evolved Economic Institution. *Foundations and Trends in Accounting*, 2, 1-3 (2007), 1-174

⁸⁹ Waymire, G., Basu, S., 2011. *Economic crisis and accounting evolution*. *Accounting and Business Research*, 41:3, 207-232

⁹⁰ [15.9.1 revision metadata - revision 15.9.1.pdf \(un.org\)](#)

Target 15.9: By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts

Indicator 15.9.1: Progress towards national targets established in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011-2020

Aichi Biodiversity Target 2 states “By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems”. As part of Strategic Goal A, Target 2 helps to “Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society”.

This indicator is composed of two parts:

- Part A: Number of countries that established national targets in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011-2020 in their National Biodiversity Strategy and Action Plans (NBSAP) and the progress reported towards these targets
- Part B: Integration of biodiversity values into national accounting and reporting systems, defined as implementation of the System of Environmental-Economic Accounting (SEEA).

The Global Reporting Initiative (GRI) has already produced 38 standards, which can be used by a wide range of entities. “*The GRI Standards represent global best practice for reporting publicly on a range of economic, environmental and social impacts. Sustainability reporting based on the Standards provides information about an organization’s positive or negative contributions to sustainable development.*”⁹¹

The Task Force on Climate-Related Financial Disclosures is already working specifically on climate change. And there are many other initiatives like the SDGs National Reporting Initiative.⁹²

In these cases, a lot of work has already been completed over many, many years. No doubt there are gaps – there are no accounts or disclosures at the consolidated civilization level, but it would presumably be easier for existing organisations to close the gaps rather than a new standard. With the expenditure of great effort, IPSASB can add its guidance, but like the others, it will not be binding. Eventually, sovereign bond issuers and their investment bankers will decide which sustainability accounting and reporting standards to adopt, if any. We believe there are other areas relating to public sector sustainability that IPSASB needs to prioritize.

⁹¹ <https://www.globalreporting.org/how-to-use-the-gri-standards/gri-standards-english-language/> accessed on 5-Jul-2022

⁹² [SDG National Reporting Initiative | SDG National Reporting Initiative \(sdgreporting.org\)](https://sdgreporting.org/)

On balance, we would take the position that there is NO need for a new set of global public sector sustainability reporting guidance, though gaps do exist.

Preliminary View 2

IPSASB's experience, processes and relationships would enable it to develop global public sector sustainability reporting guidance effectively. Do you agree with the IPSASB's Preliminary View?

The authors of this comment invite IPSASB to focus its attention towards more immediate questions relating to the public sector, as set out earlier. These include:

- 1) Are the great commons, such as the deep-sea minerals in international waters, part of the public sector? Are national commons part of the public sector?
- 2) Determining the goals of the public sector (as opposed to those of the nation). Are survival, sustainability, well-being or sustainable development relevant?
- 3) Should public sector net worth decline (PIH approach), stay at least constant (capital maintenance), or increase at the growth rate (keeping the public sector proportionate vis-à-vis the rest of the economy)?
- 4) For different levels of the public sector (civilization, nation, sub-national) and for the different goals, what measures are necessary? For each measure variant, what would be included, excluded or consolidated away?
- 5) How can capital be valued for the public sector, given the significant issues with the current marginal utilitarian basis of valuation? For example, by instituting a land value tax, the government can simultaneously reduce the exchange value of land (reducing the accounting value of land) and boost output. Similarly, by reducing interest rates, governments can inflate the value of assets across the economy. In these situations, is income the residual after capital is held constant?
- 6) What is the desired output? What is productive output?
- 7) Is return on productive capital, ideally in excess of the discount rate, a useful measure for the public sector?
- 8) How many resources are being consumed either in wasteful competition at lower system levels, or in suppressing wasteful competition?

IPSASB also needs to focus on developing a comprehensive set of accounts to deal with natural resources that are either owned or managed by the public sector. Natural resources are by far the majority of the assets of the nation. At the national level, the UN-SEEA has a well-developed framework for natural resources, which are also considered in the UN-SNA as well as the IMF's GFSM. The UN-SEEA is quite an extensive body of work (and is undergoing a revision process). The IPSASB needs to create something equivalent for the public sector.

We note that the IPSASB Consultation Paper on Natural Resources says, "*The IPSASB's preliminary view is that the selection of a measurement basis for subsoil resources that achieves the qualitative characteristics and takes account of constraints on information in the GPFs may*

not be feasible due to the high level of measurement uncertainty. Based on this view, the recognition of subsoil resources as assets in GPFS will be challenging”. Subsoil resources are, in exchange value terms, probably the largest national assets, and within natural resources, probably the easiest to value. In fact, subsoil resources may even be collateral for sovereign loans.⁹³ If subsoil resources cannot be recognized in the GPFS (General Purpose Financial Statements), it is hard to see how we can measure if capital is maintained.

We note that the UN-SEEA does have a framework for recognizing and valuing subsoil resources, and this is being implemented in India, and no doubt has already been implemented elsewhere. It would lead to a peculiar situation if the national accounts recognize sub-soil assets while the public sector, which is the legal owner of these assets does not recognize them.

With this agenda before it, we believe IPSASB has much more urgent priorities than developing global public sector sustainability reporting guidance for sovereign bond issuances.

Other Preliminary Views / Specific Matters for Comment

The remaining questions in the CP assume IPSASB will be developing global public sector sustainability reporting standards. As we recommend IPSASB not squander scarce resources reinventing the wheel when many urgent public sector questions are in front it, we are not responding to the remaining questions in the CP.

⁹³ [Resource-Backed Loans: Pitfalls and Potential | Natural Resource Governance Institute](#)