IEEE SA STANDARDS ASSOCIATION

IEEE planet positive 2030

Strong Sustainability by Design

PRIORITIZING ECOSYSTEM AND HUMAN FLOURISHING WITH TECHNOLOGY-BASED SOLUTIONS

ECONOMICS/REGULATION

An initiative supported by the IEEE Standards Association

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IEEE

Strong Sustainability by Design

This Compendium has been created by committees of the IEEE Planet Positive 2030 Initiative supported by the IEEE Standards Association (IEEE SA). The IEEE Planet Positive 2030 Initiative community is composed of several hundred participants from six continents, who are thought leaders from academia, industry, civil society, policy and government in the related technical and humanistic disciplines. At least one hundred seventy members of this community from about thirty countries have contributed directly to this Compendium and have worked to identify and find consensus on timely issues.

The Compendium's purpose is to identify specific issues and recommendations regarding sustainability and climate change challenges to achieve "Planet Positivity" by 2030, defined as the process of transforming society and infrastructure by 2030 to:

- Reduce Greenhouse Gas (GHG) emissions to 50% of 2005 GHG emissions by 2030.
- Significantly increase regeneration and resilience of the Earth's ecosystems.
- Be well on the path to achieving net zero GHG emissions by 2050 and negative GHG emissions beyond 2050.
- Continue to widely deploy appropriate technology as well as design and implement new technological solutions in support of achieving technological solutions designed and deployed to achieve "Planet Positivity."

In identifying specific issues and pragmatic recommendations, the Compendium:

- Provides a scenario-based challenge (how to achieve "Planet Positivity by 2030") as a tool to inspire readers to get engaged.
- Advances a public discussion about how to build from a "Net Zero" mentality to a "Net or Planet Positive" ("do more good," that is, doing "more" than "don't harm") societal mandate for all technology and policy.
- Continues to build a diverse and inclusive community for the IEEE Planet Positive 2030 Initiative, prioritizing the voices of indigenous and marginalized members whose insights are acutely needed to help make technology and other solutions more valuable for all. Of keen interest is how to encourage more in-depth participatory design in these processes.
- Inspires the creation of technical solutions that can be developed into technical recommendations (for example IEEE SA recommended practice for addressing sustainability, environmental stewardship and climate change challenges in professional practice, IEEE P7800™) and associated certification programs.
- Facilitates the emergence of policies and recommendations that could potentially be intraoperative between different jurisdictions (e.g., countries).

By inviting the general public to read and utilize *Strong Sustainability by Design*, the IEEE Planet Positive 2030 community provides the opportunity to bring multiple voices from the related scientific and engineering communities together with the general public to identify and find broad consensus on technology to address pressing environmental and social issues and proposed recommendations regarding development, implementations and deployment of these technologies. You are invited to Join related IEEE activities, such as standards development and initiatives across the organization.

- For further information, learn more at the IEEE Planet Positive 2030 Initiative website
- Get in touch at: PlanetPositive2030@ieee.org to get connected to and engaged with the IEEE Planet Positive 2030 community.
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This Compendium is also not a position, or policy statement, or formal report of IEEE or any other organization with which IEEE is affiliated. It is intended to be a working reference tool created through an inclusive process by those in the relevant scientific and engineering communities prioritizing sustainability considerations in their work.

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Strong Sustainability by Design was created in two versions ("draft" and this current edition) that were iterated over the course of two years. The IEEE Planet Positive 2030 Initiative follows a specific consensus building process where members contributing content identify specific potential issues and proposed recommendations.

Membership

IEEE Planet Positive 2030, an initiative supported by the IEEE Standards Association as part of the Industry Connections Program, Sustainable Infrastructures and Community Development program (SICDP), currently has more than four hundred experts involved, and remains eager for new voices and perspectives to join in this work.

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ECONOMICS/REGULATION

Future Vision

The Journal of Our Sustainability News[1]
–January 1, 2030

A Caring, Inclusive, Circular, Sustainable (CICS) Economy is establishing itself globally.

The last few centuries of economic theories and practices took a long time to change. Until now, more than two billion people were not a full part of the global economy: women (The World Bank, 2022). Now in 2030, less than a decade since the Glasgow Climate Pact, the global thinking surrounding what constitutes success for a nation, for business, for society, and for individuals has completely changed. We have moved from a growth-driven, competitive, extractive, and unsustainable economy to a caring, inclusive, circular, and sustainable economy where *value* comes from very different sources compared to the economic thought of just a decade ago.

Scientists, engineers, economists, policymakers, and, of course, the public have made this happen in less than seven years. Growth and margins are no longer the only mantras of businesses; non-extractive value drivers and caring and well-being metrics are the new norm for businesses. Nations no longer pride themselves only on their growth in gross domestic product (GDP) but boast their march toward the Global Goals—Sustainable Development Goals (SDGs)—and beyond. The year 2028 saw the achievement of more than 75% of the targets set out by the United Nations. We no longer talk about an extractive economy depleting the resources of the planet but of a regenerative economy focused on the diversity of the planet and well-being of all life forms and all of humanity.

This revolution was possible because it was rooted in every single nation and with Indigenous peoples across the world and not just the advanced markets. Businesses are focused not only on the financial profit and loss (P&L) and cash-flow statements but consider the carbon-based P&L and carbon flow statements and overall environmental impact as equally important. Individuals across the globe are tracking their carbon footprint and well-being scores supported by transparent environmental, social, and corporate governance (ESG) product reporting to help each other further reduce waste, enhance air quality, and shrink their carbon footprint. Governments are leading the charge by establishing legal infrastructure and incentives to change the behaviors of businesses and their citizens. Technology is enabling this transition rather than fueling the extractive economy. Open-source data, code, and models are enabling individuals, businesses, and national governments to learn from each other and build on the successes of others.

The sovereign wealth funds, private equity, and venture capital funds of the previous decade have transformed into green funds contributing to the phenomenal investments in technologies and businesses that are building the circular economy. We have shown as a global community that we can take action—swift action—to course correct and create a better future and a better planet for the generations to come.

[1] Fictional journal title. All similarities with other publication titles are unintended.

Issue 1: Conundrum between economic growth and exacerbation of climate crisis

Background

There is a key conundrum between economic growth and the exacerbation of the climate crisis that needs to be addressed in the statistical and other models for how wealth, value, and sustainability are measured, shifting from a competitive framework to a mutually beneficial regenerative framework.

How much of the climate crisis is attributable to economic growth is the real issue for pricing in (or not pricing in) all relevant externalities (e.g., pollution, environmental degradation)[2] and how the economic system can resolve the imbalances.

The main metric in our current economic system revolves around pricing, as it lends itself as a universal tool to translate the valuation of scarce goods and services across an entire society.[3] Within this system, legislative and regulatory frameworks ideally provide balancing impetus in order to shape economic activity according to societal demands. This is common, for example, through most modern tax systems, corresponding tariffs, and governmental regulatory measures. As industrialization has progressed over the past century, frameworks to manage environmental effects, though present, have failed to keep up with the level of degradation that has led to the climate crisis. With relevant externalities not being priced in sufficiently, the environment has suffered and is still suffering, without corresponding costs being captured in economic transactions.

However, while pricing in externalities may resolve to capture environmental degradation costs, and thus ideally steering economic activities towards sustainable paths, it would also lead to an economically disadvantaged position for lower-income countries (LICs).[4] Industrial development has already taken place in higher-income countries; this may no longer be attainable by LICs, as required investment scales may multiply to prohibitive levels.

Furthermore, responsibility for the bulk of CO_2 emissions in the past century sits disproportionally with higher-income countries (Center for Global Development; Climate Watch, 2023), raising questions about equity. Some of these topics have been analyzed already and are part of the United Nations Framework Convention on Climate Change (also known as *COP agreements*).

[2] As background for pricing regarding sustainability oriented measures, the EU's Natural capital accounting tool "measures the changes in the stock and condition of natural capital (ecosystems) at a variety of scales and to integrate the flow and value of ecosystem services into accounting and reporting systems in a standard way."

[3] For a basic intro to GDP, see "Gross Domestic Product—An Economy's All" by Tim Callen.

[4] Further information on this subject: *Climate–Poverty Connections: Opportunities for Synergistic Solutions at the Intersection of Planetary and Human Well-Being* from Project Drawdown, "provides concrete evidence of how climate solutions can also be win-win opportunities for meeting development and human well-being needs while boosting prosperity for rural communities in sub-Saharan Africa and South Asia."

Recommendations

1. **Maximize the impact of incentives.** Do not reserve incentives just for companies that don't harm future environmental growth or cause human harm; instead, only give incentives to organizations/companies whose processes/products actively contribute to better futures.
2. **Transfer of technology to LICs.** Technology transfer to LICs that can help mitigate the impacts of pricing in externalities within current economic and regulatory frameworks.

Further resources

1. The White House. *National Strategy to Develop Statistics for Environmental-Economic Decisions: A U.S. System of Natural Capital Accounting and Associated Environmental-Economic Statistics*. Office of Science and Technology Policy, Office of Management and Budget, Department of Commerce. Jan. 2023.

   This U.S. System of Natural Capital Accounting and Associated Environmental-Economic Statistics" was released in the U.S. as, "a historic roadmap that will kick off a multi-year effort to put nature on the nation's balance sheet for the first time, with an emphasis on better data to understand nature's critical contributions to the U.S. economy and to guide policy and business decisions moving forward." Many are calling this a "GDP for nature," noting that the GDP was never built to measure or account for natural capital.

Issue 2: Growth as the sole indicator of progress

Background

Growth as the sole indicator of progress for economics has accelerated harms to the planet when rapid economic development is prioritized over sustainable human and environmental flourishing.

On the path to sustainability, cutting down growth/limiting consumption often raises questions of equity. No one wants to be left wanting. For example, there are countries still on the road to development who debate why they should have less claim than other countries who have gone before. In this context, sacrifice is not appreciated, nor does it scale. Solutions need to be explored to move from the era of mass consumption to the era of smart consumption.

Recommendations

1. **Use technology to help increase well-being and ecosystem health.** Artificial intelligence (AI) and many emerging technologies could/should be used to identify and increase human well-being (IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems) while prioritizing environmental sustainability (IEEE Standards Association, IEEE Std 7010™-2020). As satisfaction is a key attribute that guides humans, is it possible to use technology to provide the user with an optimal level of satisfaction while conserving resources?
2. **Employ technology to optimize resource use as appropriate.** As an example, consider a house left fully lit while only one room is occupied. The room's occupant is satisfied because it is illuminated, but he has no need to leave all the other rooms lighted. He overconsumes the resource without any real additional satisfaction. Intelligent consumption would be to have the ability to keep the room in use as it is, so its user remains satisfied, while automatically switching off the others, thus combining end-user satisfaction and resource usage optimization. This is only one example, but many such optimization scenarios can be identified.
3. **Redefine societal growth and progress.** Growth has been defined in terms of economic capital growth focused on humans. It should be redefined to also include environmental growth and benefits, and a system that is equitable versus competitive.
4. **Explore change from mass consumption to smart consumption.** Solutions should be explored to move from the era of mass consumption to the era of smart consumption.

Further resources

1. Cafaro, P. “Beyond Business as Usual: Alternative Wedges to Avoid Catastrophic Climate Change and Create Sustainable Societies.” *The Ethics of Global Climate Change* (2011): 192–215.
2. Crawford, K. The Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence. Yale University Press, 2021.
3. Dupuy, J. P. Le sacrifice et l'envie: le libéralisme aux prises avec la justice sociale. Calmann-Lévy, 2014.
4. Girard, R. *Le sacrifice*. Bibliothèque Nationale de France-BNF, 2003.
5. Leidy, N. K. “Operationalizing Maslow's Theory: Development and Testing of the Basic Need Satisfaction Inventory.” *Issues in Mental Health Nursing* 15, no. 3 (1994): 277–295.
6. MOBIUS team, combining the INSEEC Business School (for the economic model) and the ECE, engineering school (for the technical designs).
7. Olanrewaju, Temiloluwa Elijah. “Inclusion of Incentive and Punitive Measures in Multilateral Environmental Agreement: A Suggestion on How the United Nations Framework Convention on Climate Change Can be Utilised to Influence the Reduction of Gas Flaring in the Oil and Gas Exploration Fields of Nigeria.” Law diss., Pace University Elisabeth Haub School of Law, 2022.

Issue 3: Need for transparency and stricter laws that reflect ecological norms and ethics

Background

The realization of technological standards regarding environmental rights and regulatory measures calls for transparency and stricter laws that reflect ecological norms and ethics.

Humans have environmental rights.[5] But humans are also the only part of the environment that actively uses natural resources; therefore, they have duties. Human environmental rights are balanced by obligation with respect to nature and society. This obligation may be voluntary, encouraged by law or prescribed by law. Duties include not only the obligation of active regeneration but also the obligation of enhancement of nature. Also, technology can help us learn more about our environment and, in turn, guide regulatory policy and ethics.

Recommendations

1. **Support the development of innovative green technologies by appropriate law, regulation, and policy.** The current national regulatory systems are isolated from each other. It is necessary to build a unified global legal framework, which shall include ex-ante and ex-post policy measures. Social-ecological norms and ethics should be reflected in ESG (Environmental, Social, and Governance) and law (Deloitte).

   The European Union (EU) Green Deal has a framework of regulations and policies formulated by the European Commission that, in turn, become laws for EU countries. It helps us understand how (and with what initiatives) they plan to finance the transition to a greener planet and the regulation required in different areas:

   a. The private sector, out of its own interest, especially to develop its future markets, will direct considerable investments of its own into products and services that will at the same time have a direct effect on the climate, as well as on the profitability of the companies. Thus, we are talking primarily about a wide range of products and processes directly aimed at improving environmental conditions, such as alternative energy production through solar, wind, and geothermal technologies and CO_2-reducing or CO_2-storing techniques and exhaust gas treatment; creation and loss prevention of fresh water and water treatment processes such as seawater desalination; avoidance of industrial chemical substances, for example, in agricultural fertilization; and thousands of other options that are emerging as opportunities for new business.

   b. Public investment and funding in healthy and climate-improving measures. These public funds go either directly into infrastructure projects, such as greening, planting trees, and deconstructing sealed soil areas, or as premiums to promote new forms of mobility, such as tax incentives for electric vehicles. Indirectly, but also belonging to this segment, are budget funds for research and development at universities or research centers that are geared toward improving living conditions. In the overall picture of budgeting (e.g., in Europe), both

[5] In July of 2022 the United Nations General Assembly declared that everyone on the planet has a right to a healthy environment.

at the level of the European Commission and at the national levels, expenditures for research and development may occupy the second highest position—after support for agriculture.

c. Provision of financial resources. This is seen as the strongest lever in Europe for redirecting the economy toward a green economy. The first means of choice are regulations that affect the financial sector, especially rules that determine where banks and financial institutions should direct their financial resources as a matter of priority. The basic principle here is that financiers must prove that they are directing a sufficiently high proportion into genuinely green projects.

2. **Focus environmental policy on humans and ecosystems.** Environmental policy should be focused not just on the well-being of currently living humans and future generations but also on the welfare of the natural environment (taking into account human and environmental limits) because only then are the most favorable conditions for the flourishing of humans, nature, and the planet created.

3. **Include the following policy measures:**

   a. **Environmental rights.** The environmental rights and duties should be recognized by the international community. If environmental rights are detailed in national constitutions, they can provide for access to justice. Regulation should be broadly construed so that the public's interest is the priority and constructs like "trade secrets" are the extreme exception.

   b. **Legal restrictions.** It is necessary to develop the restrictions of ecologically harmful acts at the appropriate level (e.g., penalties, ban of activities, nonmonetary sanctions).

   c. **Legal stimulus.** It is necessary to develop monetary measures (tax, loans) and nonmonetary initiatives (training, awards).

   d. **International cooperation.** It is necessary to elaborate international measures such as the following:

      i. International cooperative treaties

      ii. International standards and regulations

      iii. International sanctions

Further resources

1. Anton, Donald K., and Dinah L. Shelton. *Environmental Protection and Human Rights*. Cambridge University Press, 2011.

2. Collins, Lynda. The Ecological Constitution: Reframing Environmental Law. Routledge, 2021.

3. Ecological Law and Governance Association (ELGA). "Oslo Manifesto." Oslo Manifesto for Ecological Law and Governance. June 2016.

4. Shelton, Dinah L. Advanced Introduction to International Human Rights Law. Edward Elgar Publishing, 2020.

Issue 4: Adverse mental health fallouts not given enough attention

Background

Adverse fallouts from climate change are an existential crisis that blocks growth and has serious consequences on the public's mental health and well-being,[6] but they are not given enough attention.

Human well-being is tied with basic resources for a good life: health, security—including food security, good social relations, and freedom of choice and action. These are intertwined with direct and indirect drivers of change that can affect the individual, family, community, and environment. Direct drivers of change inlcude local land use and cover, technology adaptations, deployment and use, harvest and resource consumption, and climate change. And indirect drivers of change, which include demographic, economic, sociopolitical, science and technology, and cultural and religious. These are tied with the ecosystem, which evidence is showing has been affected due to climate change.

This change in environment can, directly and indirectly, affect all the aforementioned factors and, in particular, can affect human well-being in the context of physiological, psychological, and behavioral mechanisms. At the individual level, health is tied with income and employment, food, and water availability. Income and employment are tied with production, and some trades (e.g., agriculture) can be directly affected by climate change (e.g., changing weather patterns, increased temperatures, land degradation, etc.), which will in turn affect production, food, water availability, and so forth.

Human physiology, which is directly related to environmental conditions (e.g., temperature, humidity, air quality) and diet (e.g., caloric intake, macro- and micronutrient availability, water quality, and availability) and limitations in care, in particular in developing countries and in disadvantaged, rural, low-resource communities that already face limited or a lack of resources compared with developed countries, will only be further damaged by the effects of climate change. For example, in 2000, worldwide undernutrition accounts for nearly 10% of the global disease burden, which with decreased agricultural production and sharing resulting from extreme weather events, will only be exacerbated. As another example,

"the burden of disease from inadequate water, sanitation, and hygiene totals 1.7 million deaths and results in the loss of at least 54 million healthy life years annually. Along with sanitation, water availability and quality are well recognized as important risk factors for infectious diarrhea and other major diseases."… "Some 1.1 billion people lack access to clean drinking water, and more than 2.6 million lack access to sanitation" (UNEP, Ecosystems and Human Well-Being—Synthesis; Mudur, 2004). Related to these major diseases are vector-borne diseases. These diseases *"cause approximately 1.4 million deaths a year, mainly due to malaria in Africa. These infections are both an effect and a cause of poverty," with the "prevalence of these infectious diseases" appearing to grow, "…and environmental changes such as deforestation, dam construction, road building, agricultural conversion, and urbanization…" as "contributing factors in many cases" (UNEP, Ecosystems and Human Well-Being—Synthesis).* Climate change will only exacerbate these effects.

[6] According to a March 2023 article from The Commonwealth Fund, "more than two-thirds of U.S. adults (68%) have reported having at least some anxiety about climate change."

Psychologically there are also consequent mental health effects, with consequences

"including mild stress and distress, high-risk coping behaviors such as increased alcohol use, and, occasionally, mental disorders such as depression, anxiety, and post-traumatic stress. Climate change-related impacts can also lead to job loss, force people to move" (climate migration), "or lead to a loss of social support and community resources, all of which have mental health" (www.psychiatry.org) effects. In turn, the combined physiological and psychological effects of climate change may result in negative behavioral outcomes that will only make it more challenging and difficult for individuals, families, and communities to live healthy lives and for societies to work together in addressing the effects of climate change in both the short and long term.

Recommendations

1. **Significantly prioritize caregiving for human physical and mental health**. Human physical and mental health is a driver that will also positively impact environmental sustainability. This is a key factor for all economical metrics.
2. **Support and encourage research and identify adaptation strategies.** Support and encourage studies on how research and quantitative approaches can assess physiological and psychological adaptations resulting from climate change, which can be integrated into economic models as a population factor of productivity/output. Next, identifying strategies and factors (integrated into the economic model) to support improved productivity and output for those based on circumstance are needed.

Further resources

1. Reid, Walter, Harold A. Mooney, Angela Cropper, Doris Capistrano, Stephen R. Carpenter, Kanchan Chopra, Partha Dasgupta, et al. *Ecosystems and Human Well-Being: Synthesis: Millenium Ecosystem Assessment*. Washington, DC: Island Press, 2005.

Issue 5: Helping rural economies thrive

Background

Rural economies are often too dependent upon and/or are linked to urban economies. Also, urban issues may receive greater attention than rural challenges. There is a need to enable rural economies to also thrive and actively participate in sustainability activities.

Thriving rural areas are a condition for the growth of sustainable global communities.[7] The social and economic crisis caused by the COVID-19 pandemic has highlighted further the importance of access to services for vulnerable populations within rural regions and the importance of sustainable food supply chains to neighboring metropolitan areas.

The *green corridors*, which were piloted throughout the COVID-19 pandemic, exemplify the unshakeable connection between rural and urban. Within the EU, the expansive discussion of "smart cities" has transitioned toward "smart cities and communities," bringing forth the capacity to connect these interlinked systems. As a provider of agriculture products for the food industry, the rural region plays a significant role in the security of a country (exemplified by supply chain pressures), while it remains representative of the vulnerability and disparities in various regions (Wästfelt & Zhang, 2016; Moustier, 2017). A very early analysis of the interdependency of urban and rural communities with respect to the supply system, especially food supply, is the work of Johann H. Von Thünen (Von Thünen, 1826).

Rural areas are sparsely populated and often have an aging population (notably for Europe, where Eurostat consistently reports demographic decline and depopulation of large areas). Rural areas have higher poverty rates (25.5%) than cities and towns, 24% and 22%, respectively (Strandell & Wolff, 2017). Wage and labor retention vary significantly between urban and rural areas and between the various rural areas in the EU and globally. FAO 2019 reports that 14% of rural business owners in the EU-28 (including the UK)[8] face difficulties in access to basic digital education. The same is true globally where a significant portion of small and medium farmers face difficulties in acquiring access to digital services and solutions. At the same time, rural areas are expected to adopt a more sustainable approach to agriculture production practices and to reduce greenhouse gas (GHG) emissions for which agriculture is primarily responsible (with one-third of GHG emissions coming from agriculture produce).

Climate change impact is most significantly present within rural economies at local, regional, and global scale with lengthening seasons of droughts (recently exemplified, for example, by record heat waves in Southern Europe) and consistent need for irrigation and support of the ecosystems involved in local production and livelihoods. Ecosystem pressures continue to weigh down produce quantity and quality, affecting food security and human health. The considerable impact, which can be translated to monetizable values, is present in soil pressure and water systems, fundamental to sustain human existence, and under the pressure of sporadic seasonal changes and impact.

The challenges with which rural areas are faced can be summarized in a number of dimensions—demographics (depopulation and aging population, vulnerable groups), economic (access to basic services and economic growth challenges), climate change challenges (pressures on systems and livelihoods), and

[7] As noted by the EPA, "Smart growth strategies can help rural communities achieve their goals for growth and development while maintaining their distinctive rural character."

[8] EU-28 refers to the member states of the European Union (EU) which consists a group of 28 countries (Belgium, Bulgaria, Czech Republic, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden, and including the United Kingdom).

digital (equitable access to tools and solutions). These challenges are also quite specific and should be considered from the perspective of regional and geographic context.

Recommendations

1. **Investigate and analyze the contributions of rural ecosystems and economies to the climate change challenges AND the potentially significant role these rural economies can play towards the solution of global climate change issues and to reach the targets of sustainable development goals** (UN SDG 17). There is an interlink between the various challenges and pressures that rural economies face, making them that much more difficult to solve.
    a. Demographic considerations. The creation of jobs and provision of equitable services within rural areas is important for the growth of sparsely populated regions. Rural revitalization is an important consideration for European areas and is covered by the second pillar of the Common Agricultural Policy (CAP); in these [rural] areas growth and cohesion subside, but the demographic trends persist. Further analytics is necessary, which ought to connect policy with long-term outcomes.
    b. Economic considerations. Rural economies are significant producers of goods and services for the food industry. Ecosystems present in rural areas are the "backbone" of biodiversity and species conservation. While the significance of these systems cannot be understated, the income gap between populations in rural areas and within cities continues to grow. Additional considerations are needed for the monetization of rural ecosystem services to support the growth of rural areas and to support their demographics.
    c. Climate change impact considerations. Smart farming solutions can help resolve some of the issues with which rural areas are faced. According to the European Network for Rural Development, precision farming could be utilized to reduce the use of irrigation water by up to 18%, nitrogen fertilizers by up to 35%, and total herbicides by up to 62%, in comparison to conventional farming practice (European Network for Rural Development). But the implementation of digital solutions is still a challenge due to the need for improvement of digital literacy.

Further resources

1. European Commission. "2050 Long-Term Strategy." Climate Action, EU Action, Climate Strategies and Targets.
2. Food and Agriculture Organization (FAO) of the United Nations. "Food Systems Account for More Than One Third of Global Greenhouse Gas Emissions." 9 Mar. 2021.
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Issue 6: The problem of landfills

Background

Landfills are sources of GHG emissions and disrupt livelihoods of people living near them (U.S. EPA, "Frequent Questions About Landfill Gas"). The core reason for products ending up in landfills is because they are deemed worthless at some point. Recycling products has not been effective for the most part.

There is a need to facilitate a universal framework for producers of goods (such as apparel) that prevents these from ending up in landfills. This requires a playbook based on principles of science, design, and technology to identify production processes and materials to make products and move us toward a circular economy.

Challenges to be addressed include:

- Sustainably made goods becoming affordable to the masses
- Lack of awareness of the negative impact producers have on the environment
- Waste from materials (e.g., synthetic fibers) that cannot be recycled (Cho, 2020)
- Attitudes regarding consumption that vary across the globe
- Brands fearing the loss of profit and resistance to "degrowth"

Recommendations

1. **Develop a framework for responsible practices for waste minimization**. Develop a framework that makes the adoption of responsible practices (i.e., keeping products and materials out of landfills and in circulation for as long as possible) attainable.
2. **Enable producers to take responsibility for the end of life/end of use of their products** using the following:
    a. **Develop best practices for responsible supply chain management on a global scale.**
    b. **Create a global framework for producers to implement responsible supply chain management where products stay out of landfills.**
    c. **Develop economic incentives for producers to adopt the new framework for responsible supply chain management.**
    d. **Incentivize local production.**
    e. **Incentivize product design for a circular economy.**
    f. **Create a fund for universal subventions tailored to producers' production costs, if these are more local, fair priced, and ethical**. Responsible brands should be compensated with subsidies so that their retail price(s) can be reduced to meet consumers' purchase restraints.

g. **Make consumers aware before purchasing how a product will remain the responsibility of the brand/supplier/producer** (or delegate—this could be a government that has levied a fee as part of the product's sale to enable the government to address the end-of-use process locally) **from which it is purchased with respect to warranty and end-of-use process**.

h. **Develop and implement a framework for alternatives to the producer's product responsibility to address issues like a producer's bankruptcy, a producer going out of business for any reason, and geographical distance between producer's location and product's end of use, such as a communal solution for collection of goods that are no longer desired by the consumer and legislated solutions.** See also the EU rules on treating waste electrical and electronic equipment to contribute towards a circular economy [European Commission, Waste from Electrical and Electronic Equipment (WEEE)].

i. **Create a fund to support circular brands whose supply chains meet the standards of these best practices for responsible supply chain management** (i.e., pre-consumer and post-consumer phase).

j. **Develop business models to stimulate degrowth, while increasing job opportunities**.

k. **Enforce the repairability and upgradability** (where appropriate) **of electronic goods for 10 years** (e.g., by making it mandatory for companies to offer free repair services for five years after product purchase (goal: increased quality and less product purchases)).

l. **Frame guidelines and, potentially, fines for dumping pre- and post-consumer goods into landfills so there are negative economic outcomes for not addressing landfills**.

Further resources

1. European Commission. "EU Strategy for Sustainable and Circular Textiles."[9]
2. Organisation for Economic Cooperation and Development (OECD). "Extended Producer Responsibility."[10]

[9] The "EU Strategy for Sustainable and Circular Textiles" addresses the production and consumption of textiles, while recognizing the importance of the textiles sector.

[10] Extended Producer Responsibility (EPR) is a policy approach under which producers are given a significant responsibility—financial and or physical—for the treatment or disposal of post-consumer products.

Issue 7: Lack of openness about data, models, predictions, assumptions, and trade-offs relating to sustainability

Background

All sustainability initiatives must be based on verifiable evidence, transparent assumptions, and economic trade-offs that need to be made at an individual country and specific ecosystem level (forests, rivers, lakes, cities, etc.). This requires organizations to open source their data, software code, and sustainability models for the benefit of all.

Forward thinking sustainability programs aim to bring a multifaceted approach to sustainability, addressing climate change actions required as well as the sustainable use of planetary resources. This requires collecting and curating massive amounts of granular, historical data and documenting and verifying assumptions from a variety of experts. It also demands that policy makers, businesses, and individuals make future projections and trade-offs. This includes:

- Disparate data sources and assumptions
- Models specific to countries/regions or sectors that cannot be scaled easily
- Trade-offs to be made between several interacting factors that remain unclear
- Lack of systemic approach and methodology that is open and transparent

Recommendations

1. **Design and adopt a multi-phased approach from data collection to model interaction.** Sustainability-based organizations should adopt a three-phase approach: first curating existing open data and models, followed by defining best practices and interactions between different models, and finally obtaining funding to expand and integrate models focused on sustainability areas focused on reducing GHGs and increasing ecosystem regeneration.
2. **Create a global repository of data sources by focus areas and by country.**
3. **Create a global repository of government, nongovernmental organizations (NGOs) and private groups addressing similar focus areas.**
4. **Develop key economic trade-offs within each of the major ecosystems' areas.**
5. **Develop best practices for open data and open models for ecosystems and societal-based areas.**
6. **Develop business models to enable the integration and building of models in ecosystems and societal-based areas.**
7. **Create integrated multifactorial data sets that include demographic/population data, environmental/geographic distribution data, as well as weather models** (i.e., which countries are at greater risk of weather events resulting from climate change).

Further resources

1. Botev, Stéphane. "The Importance of Open Source in Tackling Climate Change." Climatiq. Last updated Apr. 2022.
2. Climate Interactive. "Simulators & Science."[11]
3. Climate Interactive. "World Climate Simulation."[12]
4. Green Software Foundation (website).[13]
5. Open Sustainable Technology (website).[14]
6. Stanford University. "Urban InVEST: Designing Resilient Cities by Nature." Natural Capital Project.[15]

[11] En-ROADS simulator models cross-sector policies for energy, transportation, land use, and new technologies to limit climate change. C-ROADS simulator models national and regional gas reductions for China, US, EU, India, and others to meet Paris Agreement targets. Both simulators are freely available.

[12] Role playing game that stimulates country-level action on the speed and level of action required to address global climate change.

[13] Trusted ecosystem of people, standards, tooling, and best practices for green software.

[14] A curated list of open technology projects to sustain a stable climate, energy supply, and natural resources.

[15] Urban Invest provides integrated valuation of ecosystem services and trade-offs.

Issue 8: The challenge of greenwashing

Background

Greenwashing, also called *green sheen*, started as a form of marketing spin in which green public relations (PR) and green marketing were deceptively used to persuade the public that an organization's products, aims, and policies were environmentally friendly. While this continues in many forms, the most recent iterations of the trend are far more insidious and involve more than marketing and PR.

Recommendations

1. **Develop and implement a multifaceted approach to identifying and combating greenwashing** to facilitate the fair and transparent interaction of both private investment and government services to ESG-minded entities.

   This requires a reimagining of the ways in which data is analyzed and shared with the public, including:

   a. Collecting and curating massive amounts of granular, historical data;

   b. Documenting and verifying assumptions from a variety of experts;

   c. Policy makers, businesses, and individuals making future projections and trade-offs; and

   d. Transferring this data into a blockchain or distributed ledger-based system that allows competing actors to reach consensus around appropriate projects.

2. **Analyze the current status of technology and technology options**. There are several steps involved in working toward a solution. First and foremost, analyze the competing technology options from the centralized versus decentralized systems. Next, analyze the following:

   a. Data verification challenges, specifically, understanding how a unified standard of acceptable environmental, social benchmarks are determined and analyzed by machine learning and AI-enabled systems

   b. Discussion concerning environmental impacts of blockchain and distributed ledger technology (DLT) solutions versus traditional methods (carbon intensive bitcoin proof of work versus carbon-negative DLTs).

   c. Use of a self-verifying distributed autonomous organization (DAO) to allow for the elimination of human verifications.

   d. Scalability and reliability of existing and future smart contracts to enable self-verifying digital assets

   e. Models specific to countries/regions or sectors that cannot be scaled easily and the need for a unified approach to data access and audit

3. **Create a global repository of DLT/blockchain-enabled data sources by focus areas and by country.**

4. **Create a global repository of government, NGO, and private groups addressing similar focus areas.**

5. **Create policy measures that de-incentivize greenwashing by imposing negative economic results on entities that indulge in greenwashing.**
6. **Develop a "neutral" measure—a label—of sustainability of a company that has to be displayed on products/company website**, for example, similar to the food traffic lights in the UK (e.g., score for CO_2, methane, water usage, recyclability, air miles), which help consumers compare without in-depth knowledge.

Further resources

1. Vieira de Freitas Netto, Sebastião, Marcos Felipe Falco Sobral, Ana Regina Bezerra Ribeiro, and Gleibson Robert da Luz Soares. "Concepts and Forms of Greenwashing: A Systematic Review." *Environmental Sciences Europe* 32, no. 19 (11 Feb. 2020).
2. Visram, Talib. "What is Greenhushing? The New Sustainability Trend Explained." *Fast Company*, 10 Mar. 2023.

Issue 9: Placing onus of protecting the climate on the consumer alone

Background

Protecting the climate should be framed as a shared responsibility between corporations and consumers. Currently, in the prominent narrative, as well as in existing regulations, the onus lies on the consumer alone.

In a capitalist society, economic success is considered a constant competition between corporations and the workforce as well as countries. Interventions that might temporarily disadvantage a party in this battle are, therefore, understood as unbearable; being slowed down is not an option.

Such framing leads to a detrimental narrative around climate protective measures: Since companies cannot be exposed to serious regulation, the onus is moved downstream to the consumer. If the user would purchase goods that are sustainable, the companies would be nudged toward producing sustainable products, completely without being disadvantaged in the battle of modern capitalism. Therefore, this is considered the most desirable (and most emphasized) way forward.

This causes problems on different levels. Firstly, are the consumers themselves. The narrative puts enormous pressure on their everyday purchase decisions. To be able to select the most sustainable option, extensive knowledge about emissions, water usage, fertilizers, and several other factors is required. Not every consumer has the time—or motivation—to acquire this form of knowledge, and many that attempt to may be feeling overwhelmed. Additionally, the most sustainable purchase decision is often more expensive (e.g., flight tickets versus train, organic food versus discounted conventional food). Moreover, it may require consumers to forgo comfortable habits or experiences, another motivational issue. Holidays on another continent, consuming animal products, or purchasing products that undergo trends are just examples of such possibly pleasurable, but potentially unsustainable choices.

Not everyone is informed, affluent, or motivated enough to undergo such waivers. Additionally, some companies may be incentivized to deceive consumers into believing that they are in line with climate protective measures; e.g., if they can sell more products, and consumers feel relieved from the impossible burden placed upon them. These dynamics produce overwhelmed consumers that are trying to navigate between their own pleasure, their consciousness, the greenwashing campaigns of marketing teams, and the feeling of helplessness in this social goods dilemma—and last but not least—anger. Rightfully, the question emerges why the onus is on them. They are asked to make hundreds of compromises every day—regarding their eating habits, mode of transport, even the number of children they feel entitled to have—many of which can severely compromise their financial and psychological well-being.

Contrasted to this, some companies may be largely untouched by regulations or only negligibly incentivized to steer their course toward sustainability. This is potentially detrimental, if we consider that 70% of the world's GHG emissions can be traced back to 100 companies (Griffin, 2017). It is not surprising that many consumers may reject their responsibility in the face of such openly unfair treatment, paired with the fact that they can only marginally impact overall sustainability through even the most significant of individual behavior changes. They may give up on this constructed battle of responsible individuals against potentially ruthless, largely unregulated companies.

Recommendations

1. **Develop regulation to address the roles and responsibilities of consumers and corporations with respect to climate protection.** The double standard applied between consumers and corporations causes frustration and resignation in this social goods dilemma. This has to be addressed through fair, equally distributed regulation. Additionally, it might be fruitful to appeal to a company's mission, for example, in dialogue with various CEOs to understand and sign their climate pledge (German Zero).

Further resources

1. EcoCart. The Role of Consumers vs Corporations in Combating Climate Change–Who's Responsible? Feb. 2023.
2. Hutcheon, Mark. "Consumers Expect Brands to Address Climate Change." *Wall Street Journal*. 20 Apr. 2021.

Issue 10: Negative impacts of tourism

Background

The tourism industry can potentially worsen the climate crisis and over time it may also negatively impact economies around the world if tourism declines due to climate change impacts, for example, in coastal cities and regions.

Overall, the travel and tourism industry generates $5.81 trillion in economic output, supporting 289 million jobs worldwide and nearly 6.1% of global GDP (World Travel & Tourism Council, "Economic Impact Research"). While the travel and tourism industry significantly contribute to global GDP, it has also contributed to the climate crisis. It is estimated that global tourism emits roughly 8% of global emissions on an annual basis (Sustainable Travel International).

Climate change is already affecting the hospitality sector. Extreme weather is increasing the cost of operations and reducing the number of tourists visiting certain destinations, while local and national environmental policies and penalties are being introduced in cities and countries around the world.

The hotel sector accounts for around 1% of global carbon emissions and this is projected to increase (UNWTO, 2008). Hospitality, like other industries, has a responsibility to manage its impact on our planet.

Research has found that the hotel industry may need to reduce its carbon emissions by 66% per room by 2030 and by 90% per room by 2050 so that the growth forecast for the industry does not lead to a corresponding increase in carbon emissions (Sustainable Hospitality Alliance, *Global Hotel Decarbonisation Report*). The industry will need to go even further to help limit warming to 1.5 ^{o}C and avoid the very worst impacts of climate change (IPCC, 2021).

Recommendations

1. **Create a more sustainable tourism industry.** The tourism industry needs to collaborate with governments to provide incentives (grants and tax credits) to create a more sustainable industry. The following suggestions can help reduce the carbon footprint of the industry:
    a. **Use sustainable fuels, that is, energy from emission-free sources (or near emission-free sources).**
    b. **Implement sustainable building design for new infrastructure builds and for retrofits**
    c. **Practice local sourcing**
    d. **Reduce waste, re-use, recycle, re-purpose, and so forth**
    e. **Increase renewable energy usage**
    f. **Conserve water, recycle water, repurpose water**

Further resources

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